JACOBS UNIVERSITY

Study Program Handbook

Chemistry

Bachelor of Science

Contents

1 The Chemistry Study Program

1.1 Concept

Chemistry relates to nearly every aspect of our lives. It lies at the heart of some of worlds most advanced industries, for example those focusing on pharmaceuticals, sustainable energy development, or even the food and beverage industry. The transdisciplinary Bachelor degree in Chemistry offers modules that include courses in nanomolecular science, organic, inorganic, analytical, and physical chemistry; where students are also taught the relevant aspects of mathematics, engineering, and industrial priorities. Over the course of the three-year study program you will take extensive laboratory courses and conduct your own research projects during your third year of study. Undergraduate students are also strongly encouraged to engage in research projects with graduate students as early as their first or second semester at Jacobs University

1.2 Specific Advantages of the Chemistry Program at Jacobs University

- Chemistry at Jacobs University combines the long tradition of a thorough education in Chemistry with the opportunity to participate in research projects already at a very early stage of the studies.

- The first year lays the foundation in chemistry, the other natural sciences, and mathematics. The second year focuses on the core education in Organic, Inorganic, and Physical Chemistry. Lectures and exercises furnish theoretical knowledge, while extensive laboratory modules put in place the required practical skills. During the third year, the students carry out their own guided research project in the laboratory of a faculty member in Chemistry.

- Chemistry at Jacobs University provides a stimulating study environment. As classes are small, there is good and supportive interaction of the Chemistry Faculty with the students, with regular contact and support in theoretical questions, research, and the development of written and oral communication skills. Undergraduate students are encouraged, at an early stage, to get involved in a research project that allows close interaction with M.Sc. and Ph.D. students.

- Chemistry at Jacobs University offers a challenging learning environment with maximum flexibility. These unique features combine to make our graduates very attractive to employers as well as graduate schools.

1.3 Program-Specific Qualification Aims

- Students will have a thorough knowledge in all core fields of chemistry (inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry) and in bioorganic and supramolecular chemistry.

- Students will receive training in searching all data banks (spectra, reactions, literature) relevant for chemistry.

- Students will be trained in oral and written communications and presentations.

- Students will, through extensive laboratory experience in courses and in research laboratories, as well as hands-on experience with all relevant analytical tools, be able to pursue careers in industry, as well as having optimal preparation for Master of Science and PhD programs.

1.4 The Jacobs University Employability and Personal Development Concept

Jacobs University's educational concept aims at fostering employability which refers to skills, capacities, and competencies which transcend disciplinary knowledge and allow graduates to quickly adapt to professional contexts. Jacobs University defines employability as encompassing not just technical skills and understanding but also personal attributes and qualities enabling students to become responsible members of their professional and academic fields as well as of the societies they live in.

Graduates of JU will be equipped with the ability to find employment and to pursue a successful professional career, which means that

- graduates possess the ability to acquire knowledge rapidly, to assess information and to evaluate new concepts critically;

- graduates have communicative competences which allow them to present themselves and their ideas and to negotiate successfully;

- graduates are familiar with business-related processes and management skills and are able to manage projects efficiently and independently.

Graduates of JU will also be equipped with a foundation to become globally responsible citizens, which includes the following attributes and qualities:

- graduates have gained intercultural competence; they are aware of intercultural differences and possess skills to deal with intercultural challenges; they are familiar with the concept of tolerance;

- graduates can apply problem-solving skills in negotiating and mediating between different points of view;

- graduates can rely on basic civic knowledge and have an understanding for ethical reasoning; students are familiar with the requirements for taking on responsibility.

1.5 Career Options

Because Chemistry is the core science relating to nearly every aspect of our lives, career opportunities are diverse and abundant. Career possibilities range from research and development in

the areas of pharmaceuticals, nanotechnology, materials and energy to environmental monitoring and forensic science. Chemists are also successful in other positions such as: production managers, business consultants, medical doctors, patent attorneys, marketers and even politicians!

1.6 More Information and Contact

For more information please contact the study program coordinator:

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Wisdom Professor of Chemistry
Email: d.gabel@jacobs-university.de
Telephone: +49 421 200-3585

or visit our program website: http://www.jacobs-university.de/chemistry-program

2 The Curricular Structure

2.1 General

The undergraduate education at Jacobs University equips students with the key qualifications necessary for a successful academic, as well as professional career. By combining disciplinary depth and transdisciplinary breadth, supplemented by skills education and extracurricular elements, students are prepared to be responsible and successful citizens within the societies they work and live in.

The curricular structure provides multiple elements enhancing employability, transdisciplinarity, and internationality. The unique Jacobs Track, offered across all study programs, provides a broad range of tailor-made courses designed to foster career competencies. These include courses which promote communication, technology, business, (German) language, and management skills. The World Track, included in the third year of study, provides extended company internships or study abroad options. Thus students gain training on the job and intercultural experiences.

All undergraduate programs at Jacobs University are based on a coherently modularized structure, which provides students with a broad and flexible choice of study plans to meet their major as well as minor study interests.
The policies and procedures regulating undergraduate study programs at Jacobs University in general can be found on the website.

2.2 The Jacobs University 3C-Model

Jacobs University offers study programs according to the regulations of the European Higher Education Area. All study programs are structured along the European Credit Transfer System (ECTS), which facilitates credit transfer between academic institutions. The three-year undergraduate program involves six semesters of study with a total of 180 ECTS credits. The curricular structure follows an innovative and student-centered modularization scheme - the 3C-Model - which groups the disciplinary content of the three study years according to overarching themes:

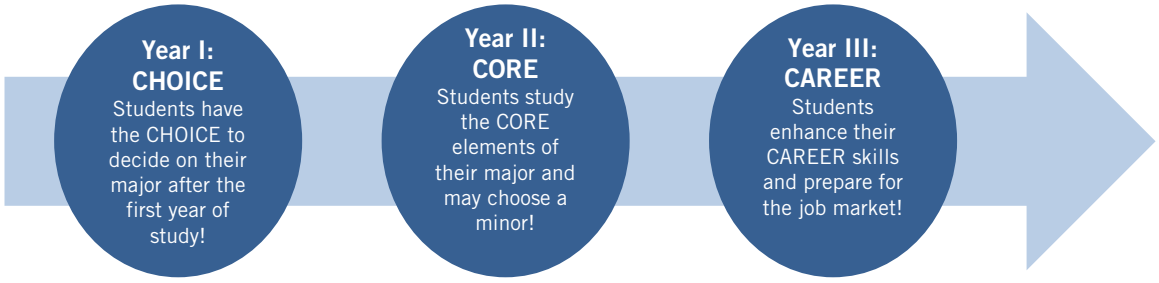


Figure 1: The Jacobs University 3C-Model

2.2.1 YEAR 1 - CHOICE

The first study year is characterized by a broad offer in disciplinary and interdisciplinary education. Students select three CHOICE modules from a variety of study programs. As a unique asset, our curricula allow students to select their study program freely from among the three selected CHOICE modules during their first year of study.

2.2.2 YEAR 2 - CORE

In the second year, students take three in-depth, discipline-specific CORE modules. One CORE module can also be taken from a second, complementary discipline, which allows students to incorporate a minor study track into their undergraduate education. Students will generally qualify for a minor if they have successfully taken at least one CHOICE module and one CORE module in a second field, and this extra qualification will be highlighted in the transcript.

2.2.3 YEAR 3 - CAREER

During their third year, students must decide on their career after graduation. In order to facilitate this decision, the fifth semester introduces two separate tracks. By default students are registered for the World Track.

1. **The World Track**
   In this track there are two mandatory elective options:
   - **Internship**
     The internship program is a core element of Jacobs University's employability approach. It includes a mandatory semester-long internship off-campus (minimum 16 weeks in full-time) which provides insight into the labor market as well as practical work experience related to the respective area of study. Successful internships may initiate career opportunities for students. For more information, please contact the Career Services Center (http://www.jacobs- university.de/career-services/contact).
   - **Study Abroad**
     Students can take the opportunity to study abroad at one of our partner universities. Courses recognized as study abroad credits need to be pre-approved according to the Jacobs University study abroad procedures and carry minimum of 20 ECTS credits in total. Several exchange programs allow you to be directly enrolled at prestigious partner institutions worldwide. Jacobs University's participation in Erasmus+, the European Unions exchange program, provides an exchange semester at a number of European universities including Erasmus study abroad funding. For more information, please contact the International Office (http://intoffice.user.jacobs-university.de/outgoing/).
2. **The Campus Track**
   Alternatively, students may also opt to follow the Campus Track by continuing their undergraduate education at Jacobs, namely by selecting an additional CORE module during their third year and redistributing the remaining courses and modules across the third year. This opportunity can be used by students to more intensively focus on their major or to fulfill the minor requirements for a second field of interest.

In the sixth semester, all students select from a range of specialization courses within their study program and concentrate on their Bachelor thesis in the context of a Project/Thesis Module. All students attend a mandatory set of career skills courses and events throughout their studies. These equip them with necessary skills for their 5th semester and their future career.

2.3 The Jacobs Track

The Jacobs Track, another stand-alone feature of Jacobs University, runs parallel to the disciplinary CHOICE, CORE, and CAREER modules across all study years and is an integral part of all study programs. It reflects our commitment to an in-depth methodological education, it fosters our transdisciplinary approach, it enhances employability, and equips students with extra skills desirable in your general field of study. Additionally, it integrates essential language courses.

Mathematics, statistics, and other methods courses are offered to all students within a comprehensive Methods Module. This module provides students with general foundations and transferable techniques which are invaluable to follow the study content not only in the study program itself but also in related fields.

The Skills Module equips students with general academic skills which are indispensable for their chosen area of study. These could be, for example, programming, data handling, presentation skills, and academic writing, scientific and experimental skills.

The transdisciplinary Triangle Module offers courses with a focus on at least one of the areas of business, technology and innovation, and societal context. The offerings comprise essential knowledge of these fields for students from other majors as well as problem-based courses that tackle global challenges from different disciplinary backgrounds. Working together with students from different disciplines and cultural backgrounds in these courses broadens the students horizon by crossing the boundaries of traditional disciplines.

Foreign languages are integrated within the Language Module. Communicative skills and foreign language competence foster students intercultural awareness and enhance their employability in a globalized and interconnected world. Jacobs University supports its students in acquiring and improving these skills by offering a variety of language courses at all proficiency levels. Emphasis is put on fostering German language skills, as they are an important prerequisite for students to learn about, explore, and eventually integrate into their host country. Hence, acquiring 10 ECTS credits in German is a requirement for all students. Students who meet the requirements of the German proficiency level (e.g. native speakers) are required to select courses in any other language program offered.

2.4 Modularization of the Chemistry Program

2.4.1 Content

Year 1
Take two mandatory modules listed below and select one further CHOICE module from a different study area.

Organic Chemistry (CH03-OrgChem)
We begin by reestablishing atomic structure, and the importance of Lewis dot structures, resonance, valence-shell electron-pair repulsion, and valence-bond theory to give meaning to a covalent bond. Hybridization is then introduced to allow an accurate and predictive accounting of molecular shape. This foundation permits the introduction of: functional groups, conformation, chirality, acidity and basicity, and the basics of equilibria, thermodynamic, and kinetic phenomena. With these concepts in hand, we develop organic reactivity by examining the mechanistic pathways (arrow pushing) and chemical principles behind substitution, elimination, and addition reactions. Common reagents and functional group transformations are then learned in the context of the importance of their order and type (retrosynthetic analysis and strategy) for brevity in synthesis.

Inorganic Chemistry and Environmental Systems (CH04-InorgChem)
The bifunctional module Chemistry and Environmental Systems provides an introduction to (inorganic) chemistry and to the anthropogenic impact on the natural (near-)surface environment of Earth. Two introductory lecture courses (Introduction to Inorganic Chemistry (focus on the elements of the PSE, molecular compounds derived from them, redox reactions) and Earth and Environmental Systems (focus on Geodynamics, Petrography, Soil Science, Oceanography, Hydrogeology, Geomorphology, and anthropogenic impact on the (near-)surface environment) are complemented by an on-campus laboratory course (Inorganic Chemistry Lab) and an off-campus field-lab (excursion) to develop fundamental practical skills.

Year 2
Take all three modules or replace one with a CORE module from a different study program.

Chemical Biotechnology (CO07-ChemBiotec)
This module provides insight into how biotechnology impacts chemical production. The replacement of both chemical catalysts by enzymes and cells and of fossil resources by renewable raw materials are two aspects which are increasingly pushed by the chemical industry in order to achieve a more sustainable production of bulk and ?ne chemicals, building blocks for chemical industry as well as food ingredients, bioplastics, and biofuels. Using a number of commercially successful examples as well as current R&D efforts of chemical industry, the students will be introduced into the advantages and practice of implementing cells or enzymes for the production of industrially relevant products. Moreover, the module describes the utilization of biomass and biomass waste streams as feedstock for production of the above mentioned compounds. The concept of biorefinery is also discussed.

Physical and Analytical Chemistry (CO08-PhysChem
Teaching physical principles and measurements to understand the properties of matter. The

course Physical Chemistry introduces fundamental themodynamical principles, intermolecular forces, electrochemistry as well as underlying physical principle of chemical kinetics. The students will apply the course content to experiments on osmotic pressure, electrochemistry and optical instrumentation. The analytical chemistry part will provide an overview over the physical principles of spectroscopic and separation methods and their application in quantitative and qualitative analysis.

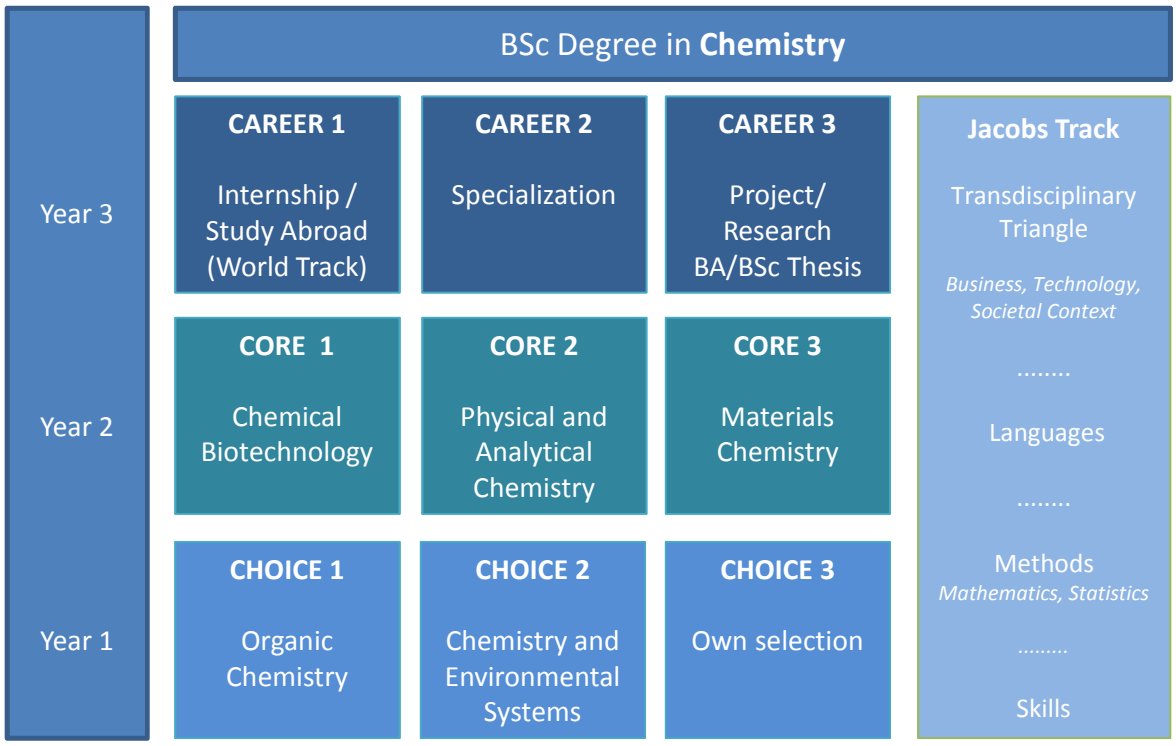
Materials Chemistry (CO09-CoChem)
The module gives information about inorganic materials and polymers, and about organic materials and polymers. Coordination compounds as basis of inorganic materials will be discussed. Methods for structure elucidation of polymeric and solid materials will be presented. Basic reactions to form these materials will be given. Industrially important materials and their preparation will be discussed. Examples of non-covalent interactions as basis for supramolecular chemistry are shown, and sensors based on the different technologies will be discussed. An introduction into surface and colloid chemistry forms part of the module.
Some CORE Modules require students to have taken a specific CHOICE Module. Please see the Module Handbook for details regarding pre-requisites.

Year 3
In the 3rd year students follow the World Track by default:

1. **World Track**
   5th Semester
   - Internship / study abroad

   6th Semester
   - Chemistry Project / Thesis Module
   - Program-specific Specialization Module
     Exemplary course offering:
     - Bioorganic Chemistry
     - Organometallic Chemistry
     - Supramolecular Chemistry
     - Structure and Mechanism
     - Organocatalysis
     - Advanced Organic Synthesis
     - Biotechnology: from Science to Business
     - Clinical Diagnosis and Management by Laboratory Methods
     - Medicinal Chemistry
     - Biophysical Chemistry
     - Structural Methods in Nanoscale Science
2. **Campus Track**
   Students who do not enter the World Track follow the Campus Track.
   5th and 6th Semester
   - Program-specific Project / Thesis Module
   - Program-specific Specialization Module
     (please see World Track for exemplary course offering)
   - Additional CORE Module

2.4.2 Structure



YEAR 1 *Take three CHOICE modules, one free selection*
YEAR 2 *Take three CORE modules, one CORE module can be substituted by a CORE module from a second study program to pursue a minor*
YEAR 3 *Alternatively Campus Track with a 4th CORE module instead of internship/study abroad module*

Figure 2: Chemistry Module Structure

3 Appendix 1a/1b: Mandatory Course Plans for World Track and Campus Track

Jacobs University Bremen reserves the right to substitute courses by replacements and/or reduce the number of mandatory/mandatory elective courses offered

Chemistry – World Track

Matriculation Fall 2015

	Program-Specific Modules	Type	Status[1]	Semester	Credits
Year 1 - CHOICE					**45**
Take the two mandatory CHOICE modules listed below, these are a requirement for the Chemistry program.					
CH03-OrgChem	**Module: Organic Chemistry**		**m**		**15**
CH03-400102	Organic Chemistry I	Lecture	m	1	5
CH03-400112	Organic Chemistry I Lab	Lab	m	1	2,5
CH03-400103	Organic Chemistry II	Lecture	m	2	5
CH03-400113	Organic Chemistry II Lab	Lab	m	2	2,5
CH04-InorgChem	**Module: Inorganic Chemistry and Environmental Systems**		**m**		**15**
CH04-210131	Introduction to Earth and Environmental Systems A	Lecture	m	1	2,5
CH04-210132	Introduction to Earth and Environmental Systems B	Lecture	m	2	2,5
CH04-210111	GeoEnvironmental Systems and their Chemistry - Field Lab	Excursion	m	2	2,5
CH04-400108	Inorganic Chemistry I A	Lecture	m	1	2,5
CH04-400109	Inorganic Chemistry I B	Lecture	m	2	2,5
CH04-400111	Inorganic Chemistry I Lab	Lab	m	1	2,5
	Module: CHOICE (own selection)		**e**	**1/2**	**15**
Students take one further CHOICE module from those offered for all other study programs. [2]					
Year 2 - CORE					**45**
Take all three modules or replace one with a CORE module from a different study program. [2]					
CO09-InorgSuMolChe	**Module: Inorganic and Supramolecular Chemistry**		**me**		**15**
CO09-420432	Supramolecular Chemistry	Lecture	m	3	5
CO09-420434	Supramolecular Chemistry Lab	Lab	m	3	2,5
CO09-400221	Inorganic Chemistry II	Lecture	m	4	5
CO09-400232	Inorganic Chemistry II Lab	Lab	m	4	2,5
CO08-PhysChem	**Module: Physical and Analytical Chemistry**		**me**		**15**
CO08-400121	Analytical Chemistry	Lecture	m	3	5
CO08-400231	Analytical Chemistry Lab	Lab	m	3	2,5
CO08-400211	Physical Chemistry	Lecture	m	4	5
CO08-400262	Physical Chemistry Lab	Lab	m	4	2,5
CO07-ChemBiotec	**Module: Chemical Biotechnology**		**me**		**15**
CO07-400104	Enzymes and Cells in Biochemical Production	Lecture	m	3	5
CO07-400114	Biochemical Production Lab	Lab	m	3	2,5
CO07-400105	Bioproducts and Biosystems Engineering	Lecture	m	4	5
CO07-400115	Bioproducts and Biosystems Engineering Lab	Lab	m	4	2,5
Year 3 - CAREER					**45**
CA02 / CA03	**Module: Internship / Study Abroad**		**m**	**5**	**20**
CA01-CarSkills	**Module: Career Skills**		**m**		
CA06-CHEM	**Module: Project/Thesis CHEM**		**m**		**15**
CA06-400303	Project CHEM		m	6	5
CA06-400304	Thesis CHEM		m	6	10
CA-S-CHEM	**Module: Specialization Area CHEM**		**m**		**10**
	Take four specialization courses (2.5 ECTS each) [2]		me	5/6	10

	Jacobs Track Modules (General Education)	Type	Status[1]	Semester	Credits
Year 1 - CHOICE					**20**
JT-ME-MethodsMath	**Module: Methods / Mathematics**		**m**		**7,5**
JT-ME 120106 / 120103	Take either Applied Calculus I or Calculus I	Lecture	m	1	2,5
JT-ME 120107 / 120104	Take either Applied Calculus II or Calculus II	Lecture	m	1	2,5
JT-ME-120101	Mathematical Concepts in the Sciences	Lecture	m	2	2,5
JT-SK-Skills	**Module: Skills**		**m**		**2,5**
JT-SK-990103	Scientific and Experimental Skills	Lecture	m	1	2,5
JT-TA-TriArea	**Module: Triangle Area**		**m**		**5**
	Take two courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	1/2	5
JT-LA-Language	**Module: Language**		**m**		**5**
	Take two German courses (2,5 ECTS each). Native German speakers take courses in another offered language	Seminar	me	1/2	5
Year 2 - CORE					**20**
JT-ME-MethodsMath	**Module: Methods / Mathematics**		**m**		**7,5**
JT-ME-120122	Foundations of Linear Algebra I	Lecture	m	4	2,5
	Take two Methods (mandatory) elective courses. (2,5 ECTS each). [2]	Lecture	me	3/4	5
JT-TA-TriArea	**Module: Triangle Area**		**m**		**7,5**
	Take three courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	3/4	7,5
JT-LA-Language	**Module: Language**		**m**		**5**
	Take two German courses (2,5 ECTS each). Native German speakers take courses in another offered language	Seminar	me	3/4	5
Year 3 - CAREER					**5**
JT-SK-Skills	**Module: Skills**		**m**		**2,5**
JT-SK-990104	Advanced Scientific and Experimental Skills	Lecture	m	6	2,5
JT-TA-TriArea	**Module: Triangle Area**		**m**		**2,5**
	Take one course from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	6	2,5

Total ECTS	**180**

[1] Status (m = mandatory, e = elective, me = mandatory elective)

[2] For a full listing of all CHOICE / CORE / CAREER / Jacobs Track modules please consult the **CampusNet online catalogue** and / or the module handbook (on our website).

[3] You are required to take six Triangle Area courses in total. Select two from each of the three triangle areas (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT).

Appendix 1b - Mandatory Course Plan for Campus Track

JACOBS UNIVERSITY

Chemistry – Campus Track

Matriculation Fall 2015

	Program-Specific Modules	Type	Status[1]	Semester	Credits		Jacobs Track Modules (General Education)	Type	Status[1]	Semester	Credits
Year 1 - CHOICE					**45**						**20**
Take the two mandatory CHOICE modules listed below, these are a requirement for the Chemistry program.											
CH03-OrgChem	**Module: Organic Chemistry**		**m**		**15**		**JT-ME-MethodsMath**	**Module: Methods / Mathematics**		**m**		**7,5**
CH03-400102	Organic Chemistry I	Lecture	m	1	5		JT-ME 120106 / 120103	Take either Applied Calculus I or Calculus I	Lecture	m	1	2,5
CH03-400112	Organic Chemistry I Lab	Lab	m	1	2,5		JT-ME 120107 / 120104	Take either Applied Calculus II or Calculus II	Lecture	m	1	2,5
CH03-400103	Organic Chemistry II	Lecture	m	2	5		JT-ME-120101	Mathematical Concepts in the Sciences	Lecture	m	2	2,5
CH03-400113	Organic Chemistry II Lab	Lab	m	2	2,5		**JT-SK-Skills**	**Module: Skills**		**m**		**2,5**
CH04-InorgChem	**Module: Inorganic Chemistry and Environmental Systems**		**m**		**15**		JT-SK-990103	Scientific and Experimental Skills	Lecture	m	1	2,5
CH04-210131	Introduction to Earth and Environmental Systems A	Lecture	m	1	2,5		**JT-TA-TriArea**	**Module: Triangle Area**		**m**		**5**
CH04-210132	Introduction to Earth and Environmental Systems B	Lecture	m	2	2,5			Take two courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	1/2	5
CH04-210111	GeoEnvironmental Systems and their Chemistry - Field Lab	Excursion	m	2	2,5		**JT-LA-Language**	**Module: Language**		**m**		**5**
CH04-400108	Inorganic Chemistry I A	Lecture	m	1	2,5			Take two German courses (2,5 ECTS each).	Seminar	me	1/2	5
CH04-400109	Inorganic Chemistry I B	Lecture	m	2	2,5			Native German speakers take courses in another offered language				
CH04-400111	Inorganic Chemistry I Lab	Lab	m	1	2,5							
	Module: CHOICE (own selection)		**e**	**1/2**	**15**							
Students take one further CHOICE module from those offered for all other study programs. [2]												
Year 2 - CORE					**45**						**20**
Take all three modules or replace one with a CORE module from a different study program. [2]											
CO09-InorgSuMolChe	**Module: Inorganic and Supramolecular Chemistry**		**me**		**15**		**JT-ME-MethodsMath**	**Module: Methods / Mathematics**		**m**		**7,5**
CO09-420432	Supramolecular Chemistry	Lecture	m	3	5		JT-ME-120122	Foundations of Linear Algebra I	Lecture	m	4	2,5
CO09-420434	Supramolecular Chemistry Lab	Lab	m	3	2,5			Take two Methods (mandatory) elective courses. (2,5 ECTS each). [2]	Lecture	me	3/4	5
CO09-400221	Inorganic Chemistry II	Lecture	m	4	5							
CO09-400232	Inorganic Chemistry II Lab	Lab	m	4	2,5							
CO08-PhysChem	**Module: Physical and Analytical Chemistry**		**me**		**15**		**JT-TA-TriArea**	**Module: Triangle Area**		**m**		**7,5**
CO08-400121	Analytical Chemistry	Lecture	m	3	5			Take three courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	3/4	7,5
CO08-400231	Analytical Chemistry Lab	Lab	m	3	2,5							
CO08-400211	Physical Chemistry	Lecture	m	4	5							
CO08-400262	Physical Chemistry Lab	Lab	m	4	2,5							
CO07-ChemBiotec	**Module: Chemical Biotechnology**		**me**		**15**		**JT-LA-Language**	**Module: Language**		**m**		**5**
CO07-400104	Enzymes and Cells in Biochemical Production	Lecture	m	3	5			Take two German courses (2,5 ECTS each).	Seminar	me	3/4	5
CO07-400114	Biochemical Production Lab	Lab	m	3	2,5			Native German speakers take courses in another offered language				
CO07-400105	Bioproducts and Biosystems Engineering	Lecture	m	4	5							
CO07-400115	Bioproducts and Biosystems Engineering Lab	Lab	m	4	2,5							
Year 3 - CAREER					**45**						**5**
COXX	**Module: Additional (4th) CORE module**		**m**	**5/6**	**15**		**JT-SK-Skills**	**Module: Skills**		**m**		**2,5**
CA01-CarSkills	**Module: Career Skills**		**m**				JT-SK-990104	Advanced Scientific and Experimental Skills	Lecture	m	6	2,5
CA06-CHEM	**Module: Project/Thesis CHEM**		**m**		**15**		**JT-TA-TriArea**	**Module: Triangle Area**		**m**		**2,5**
CA06-400303	Project CHEM		m	6	5			Take one course from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	5	2,5
CA06-400304	Thesis CHEM		m	6	10							
CA-S-CHEM	**Module: Specialization Area CHEM**		**m**		**15**							
	Take six specialization courses (2.5 ECTS each) [2]		me	5/6	15							
Total ECTS												**180**

[1] Status (m = mandatory, e = elective, me = mandatory elective)

[2] For a full listing of all CHOICE / CORE / CAREER / Jacobs Track modules please consult the **CampusNet online catalogue** and / or the module handbook (on our website).

[3] You are required to take six Triangle Area courses in total. Select two from each of the three triangle areas (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT).