



JACOBS
UNIVERSITY



Study Program Handbook

Earth and Environmental Sciences

Bachelor of Science

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1 The Earth and Environmental Sciences (EES) Study Program

1.1 Concept

The Earth and Environmental Sciences (EES) program is an interdisciplinary environmental science major and provides an understanding of the natural functioning of our planet and the consequences of human impact. It combines traditional geoscience disciplines like Geochemistry, Geophysics, and Oceanography with Environmental Sciences and Social Sciences.

EES prepares our graduates for topical challenges and research questions such as the management and sustainable exploration of natural resources, the study of Earth's climate and oceans. Participation in field and laboratory work as well as teamwork in multidisciplinary and multicultural groups are an important part of the studies.

1.2 Specific Advantages of the EES Program at Jacobs University

The study of Earth and Environmental Sciences will give you an excellent foundation for future careers in academic and applied fields ranging from geosciences and oceanography to climate and environmental research. You may work in international space agencies and NGOs, for mining and oil companies, or for media, press departments or publishing companies.

Our teaching philosophy emphasizes an interdisciplinary view of the world, focuses on a mixture of theoretical and hands-on practical work, and provides problem-solving skills that are in high demand from employers. This opens a wide variety of potential career paths.

Moreover, in the Earth and Environmental Sciences program, teaching and teamwork, helpdesks and personal training will provide you with a sound background in the natural sciences and mathematics. Mandatory courses in the social sciences and soft skills acquired in seminars, laboratory courses and field camps will prepare you for a leading role in today's world.

1.3 Program-Specific Qualification Aims

The main objective of the B.Sc. program Earth and Environmental Science is to provide a broad and thorough science-based education in geo-, ocean and environmental sciences with selected advanced topics, early exposure to research, and, in particular, the combination of theoretical and practical skills.

- The students will learn basic and advanced concepts of modern geo-, ocean and environmental sciences, that enable them to understand and explain natural phenomena and to recognize potential anthropogenic disturbances of the natural system.
- Through the combination of theoretical and practical knowledge, the students will learn a variety of approaches to address and deal with problems encountered in problem-solving in geo-, ocean and environmental sciences, both in academia and industry.
- In lab courses, field practicals and research projects the students will be trained hands-on in basic as well as advanced methods and techniques commonly applied in geo-, ocean and environmental sciences in research and industry. ?
- Through presentations, lab and field reports, term papers, and the BSc thesis, students will gain familiarity with tools and approaches to access and make use of scientific infor-

mation. They will learn the field-specific terms used in geo-, ocean and environmental sciences, and are trained to communicate using the appropriate terminology, language and discussion style of the scientific community.

- The students are educated to behave as responsible citizens who realise the impact of their research and/or work on the natural system and on society, and who behave accordingly.

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, competencies 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 will be able to:

- acquire knowledge rapidly, gather, evaluate and interpret relevant information and evaluate new concepts critically to derive scientifically funded judgements;
- apply their knowledge, understanding and methodological competences to their activity or profession to solve problems;
- present themselves and their ideas effectively and to negotiate successfully;
- demonstrate understanding and knowledge of business principles and processes and to manage projects efficiently and independently;
- take responsibility for their and their team's learning and development.

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 to negotiate and mediate between different points of view and to manage conflicts;
- graduates can rely on basic civic knowledge; they are able to analyse global issues of economic, political, scientific, social or technological nature; they are able to evaluate situations and take decisions based on ethical considerations;
- graduates are able and prepared to take on responsibility for their professional community and society.

1.5 Career Options

Career opportunities include:

- Industry - searching for and managing natural resources such as water, fossil fuels and minerals on land and in the ocean.
- Academia - research and teaching at universities and research facilities; teaching in schools and colleges; museum work.
- (Environmental) management and consulting - investigating and monitoring ground conditions associated with planning, construction, land/ocean use, reclamation of contaminated land/seafloor, and waste disposal.
- Geological surveying - collecting surface and subsurface geological information, onshore and offshore, for geological, geophysical and geochemical databases.
- Developing methods, strategies and policies for renewable energy and sustainable resource exploitation.
- Planning satellite missions for Space Agencies.
- Working as science journalists or for publishing companies.
- Pursuing an academic career in
 - Geosciences
 - Ocean sciences
 - Environmental sciences
 - Resource exploration and management
 - Applied and theoretical physics and astronomy

In the high-ranking journal *Nature*, a recent article from May 2011 pointed out the superb prospects for the future job market related to Earth sciences (*Nature* 473, 243-244): "There's good news for aspiring geoscientists. Job opportunities at all career stages are on the rise. There's room for those who love field work, and there's room for those who don't. Job prospects for geoscientists are excellent and are set to get even better. . Many of today's senior geoscientists were trained as specialists in relatively narrow disciplines, but in future, most demand will be for researchers who have been trained to appreciate the interdisciplinary nature of the Earth sciences. For those willing to get interdisciplinary training, the future looks bright. The job market is flushed with opportunities."

For more details see: <http://earth.user.jacobs-university.de/careers-jobs-earth-environmental-sciences/>

1.6 More Information and Contact

For more information please contact the study program coordinator:

Dr. Michael Bau
Professor of Geosciences
Email: m.bau@jacobs-university.de
Telephone: +49 421 200-3102

or visit our program website: <http://earth.user.jacobs-university.de/>

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:

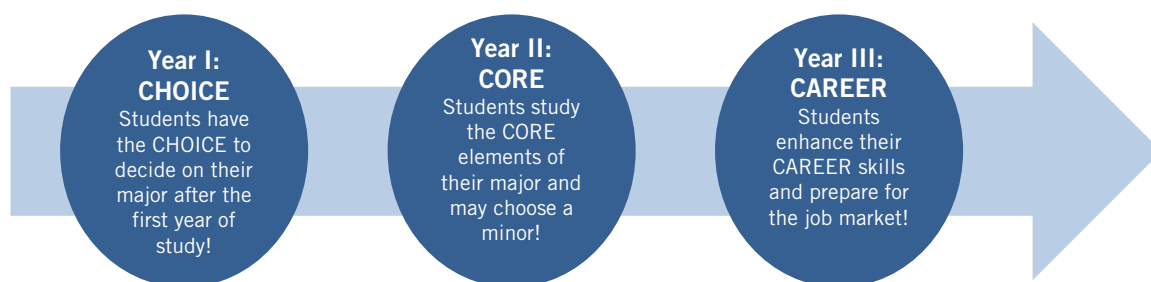


Figure 1: The Jacobs University 3C-Model

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.

As an alternative to the regular internship, a limited number of students have the opportunity to prepare in a structured manner the formation of their own start-up in the 5th semester, and can attain 20 ECTS for this study-related achievement. Jacobs University cooperates with the City Accelerator Bremen (CAB) to which students can be admitted. There are several requirements which must be fulfilled before the 5th semester in order to be admitted to the CAB, i.e. attendance of specific seminars and workshops and the successful presentation of the business idea within the framework of a competition (pitch). The module is successfully completed, when the student / team of students have submitted the business plan to CAB.

For further 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 Union's 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.

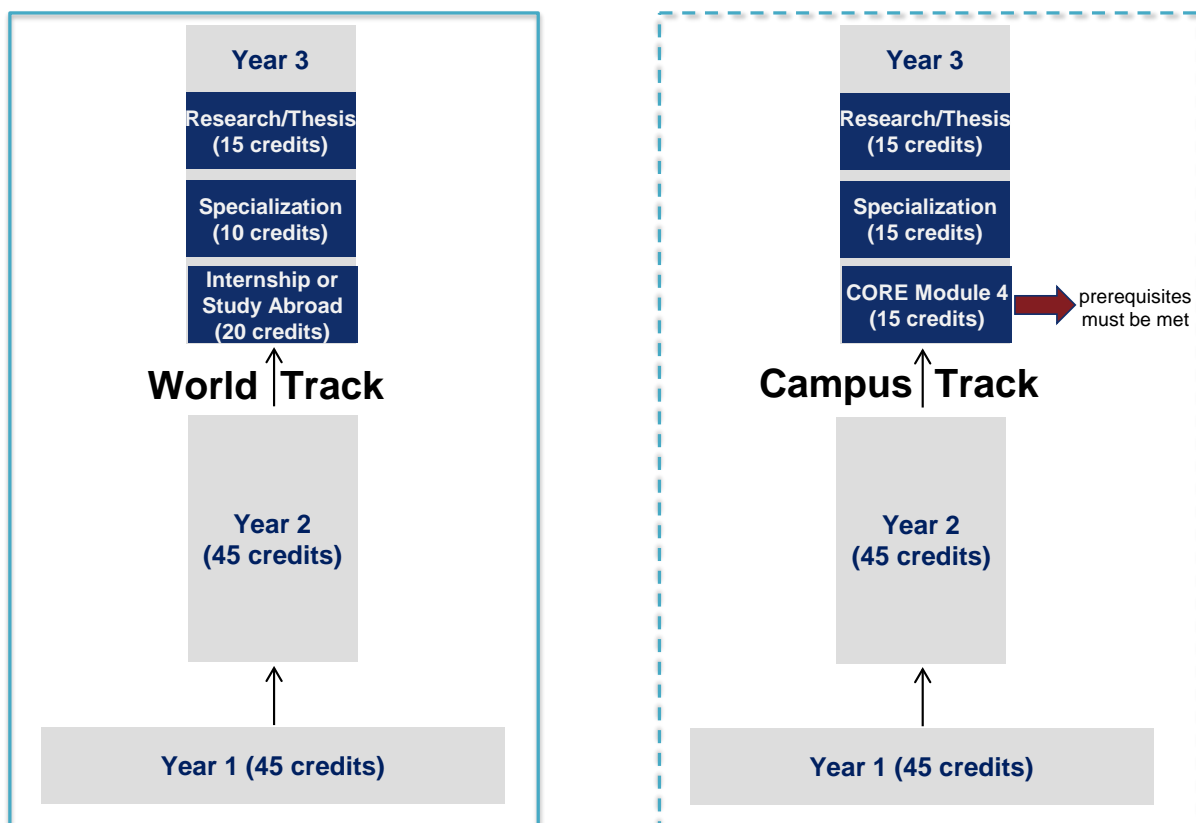


Figure 2: World Track versus Campus Track

Career Advising

Is a mandatory component of the Jacobs University's Advising and Counseling Scheme. Further components are "Academic Advising" and "Psychological Counseling and Intercultural Services". Throughout their studies all students attend a mandatory set of career skills events. The mandatory "Career Skills Advising" prepares all undergraduate students at Jacobs University for the transition from student life to working life as well as for their future career. Skills, knowledge and information which are fundamental for participation in an internship or a semester abroad will be conveyed concurrently. Essential components include information sessions, compulsory workshops on various career-relevant topics as well as participation in the annual Jacobs Career Fair.

All undergraduate students will be automatically registered for "Career Skills Advising". However, every student has to keep track of his/her individual fulfillment of requirements and has to register on CampusNet for all workshops and sessions during the official registration period at the beginning of each semester. An overview of the sequence in which events should be attended is shown in the table below.

CAREER ADVISING For Undergraduate Students matriculated Fall 2017

SEMESTER	1	2	3	4	5	6
MANDATORY BASICS	CSC-INFO Session: "CSC Services" CA01-990000		CSC-INFO Session: "World Track" CA01-990026			CSC-INFO Session "Professional Networking" CA01-990040
MANDATORY SEMINARS	Both seminars have to be attended in your first or second semester: CSC-APPLICATION TRAINING CA01-990001 CSC-SUCCESS IN STUDIES, CAREER AND LIFE CA01-990031					
MANDATORY ELECTIVE SEMINARS (seminar program subject to availability)			Attend 2 out of several career skills seminars and workshops, i.e. <ul style="list-style-type: none"> ▪ Research & Contacting Employers ▪ Business Etiquette ▪ Presentation Skills ▪ Communication Skills ▪ Grad School Application Training ▪ Self-Management ▪ Time-Management ▪ Decision Making ▪ Preparing for an Interview ▪ Introduction to Project Management 			
OTHER MANDATORY COMPONENTS				CSC-JACOBS CAREER FAIR in February, on campus CA01-990003	INTERNSHIP or STUDY ABROAD or CAMPUS TRACK	INTERNSHIP & STUDY ABROAD EVENT Online CSC-CAREER SURVEY CA01-990002

Figure 3: Career Advising

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 Earth and Environmental Sciences Program

Year 1

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

Inorganic Chemistry and Environmental Systems (CH04-InorgChem)

The bi-functional module "Inorganic Chemistry and Environmental Systems" provides an introduction to (inorganic) chemistry and to fundamental geosciences and 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, 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

Physics of Natural Systems (CH05-PhysNatSys)

Physics of Natural Systems provides an introduction to the physical description of natural phenomena and covers fundamental topics in physics and earth and environmental sciences (EES). Important concepts from mechanics, thermodynamics, fluid dynamics, electromagnetism, atoms and nuclei are introduced and applied to essential processes in Earth, marine, and planetary sciences. Structure and dynamics of natural systems are studied with moderate use of mathematics. Practical sessions will cover important experimental techniques and tools. This module provides a foundation for the higher level EES and Physics modules Earth, Ocean, and Environmental Physics, Statistical Physics and Fields, Applied Physics, Classical and Quantum Dynamics.

Year 2

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

Fundamental Earth and Environmental Sciences (CO10-FundEES)

The module Fundamental Earth and Environmental Sciences is comprised of essential geoscience courses that represent the backbone of a sound university education in the geosciences. Core courses on Sedimentology, Structural Geology, Volcanism and Metamorphism are complemented by applied courses in environmental and resource geoscience. If relevant, both marine and terrestrial systems are discussed. A key element of these courses are on-campus practicals during which the students are introduced to geological methods and techniques. These essential practical skills are further expanded upon and applied in a real-world scenario during a five day off-campus geological field camp.

Earth, Ocean and Environmental Geochemistry (CO11EOEnvChem)

The module Earth, Ocean and Environmental Geochemistry is comprised of fundamental geochemistry courses that represent the backbone of a sound university education in geochemistry and geochemistry-focussed environmental and resource science. Core courses on igneous and aqueous (trace) element geochemistry and introductory courses on stable and radiogenic iso-

tope geochemistry are complemented by a course on the biogeochemical aspects of environmental and resource science and an off-campus field camp focusing on environmental sciences. All courses address terrestrial as well as marine systems.

Earth, Ocean and Environmental Geophysics (CO12-EOEnvPhys)

The module Earth, Ocean, and Environmental Physics covers topics and methods that are essential in geophysics and physical oceanography. Emphasis will be on the quantitative assessment of physical processes and structures in terrestrial and marine systems. Important concepts are introduced and studied in lectures, and then applied and consolidated in practical courses such as field trips and computer labs on remote sensing and data analysis. The module constitutes one of the CORE pillars of the Earth and Environmental Sciences (EES) program and in general may complement the education of students interested in a physics-based presentation of fundamental EES topics.

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

- Earth and Environmental Sciences Project / Thesis Module
- Program-specific Specialization Module Exemplary course offering:
 - Resources and Environmental Behavior of Critical High-Technology Metals
 - Earth, Ocean and Environmental Sciences Field Lab
 - Current Topics in Earth and Marine Sciences
 - Current Topics in Resource and Environmental Sciences
 - Theoretical and Computational Physical Oceanography

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

2.5 The Bachelor Thesis / Project

This module is a mandatory graduation requirement for all undergraduate students. It consists of two components in the major study program guided by a Jacobs Faculty member:

1. **A Research Project** (5 ECTS)
and
2. **The Bachelor Thesis** (10 ECTS)

The workload for the project component is about 125 hours and for the thesis component about 250 hours. The title of the thesis will be shown on the transcript.

2.5.1 Aims

Within this module, students apply knowledge they have acquired about their major discipline, skills, and methods to become acquainted with actual research topics, ranging from the identification of suitable (short-term) research projects, preparatory literature searches, the realization of discipline-specific research, and the documentation, discussion, and interpretation of the results. Research results obtained from the Research Project can be embedded in the Bachelor Thesis.

2.5.2 Intended Learning Outcomes

1. Research Project

This module component consists of a guided research project in the major study program. The well-defined research task must be completed and documented according to the scientific standards in the respective discipline. It involves a high degree of independence, supported by individualized instructor feedback and guidance.

2. Bachelor Thesis

With their Bachelor Thesis students should demonstrate mastery of the contents and methods of the major specific research field. Furthermore, students should show the ability to analyze and solve a well-defined problem with scientific approaches, a critical reflection of the status quo in scientific literature, and an original development of their own ideas.

Both, the Research Project and the Bachelor Thesis, can also have an inter- or transdisciplinary nature - with the explicit permission of the supervisor.

2.5.3 Supervision

Both module components can be performed with the same Jacobs faculty member, or different ones, the latter in order to allow a broader research experience. Students are required to choose a supervisor, at the latest, by the end of the drop-add period of the semester in which the module component is taken. **The selected supervisor(s) must approve the Project topic and Bachelor Thesis topic before the student starts to work towards the module component.** The respective study program coordinators will assist in the search for prospective supervisor(s).

2.5.4 Registration

World Track students register for both components, at the earliest, in their 6th semester.

Campus Track students register for the Project component in the 5th and for the Bachelor Thesis component, at the earliest, in their 6th semester.

The registrations must be made before the end of the respective drop/add periods.

Later enrolment is possible for those students pursuing a second major or those who graduate late for other reasons. These students perform their (second) thesis earliest in the 7th semester of their studies. They have to contact the Student Records Office for individual registration.

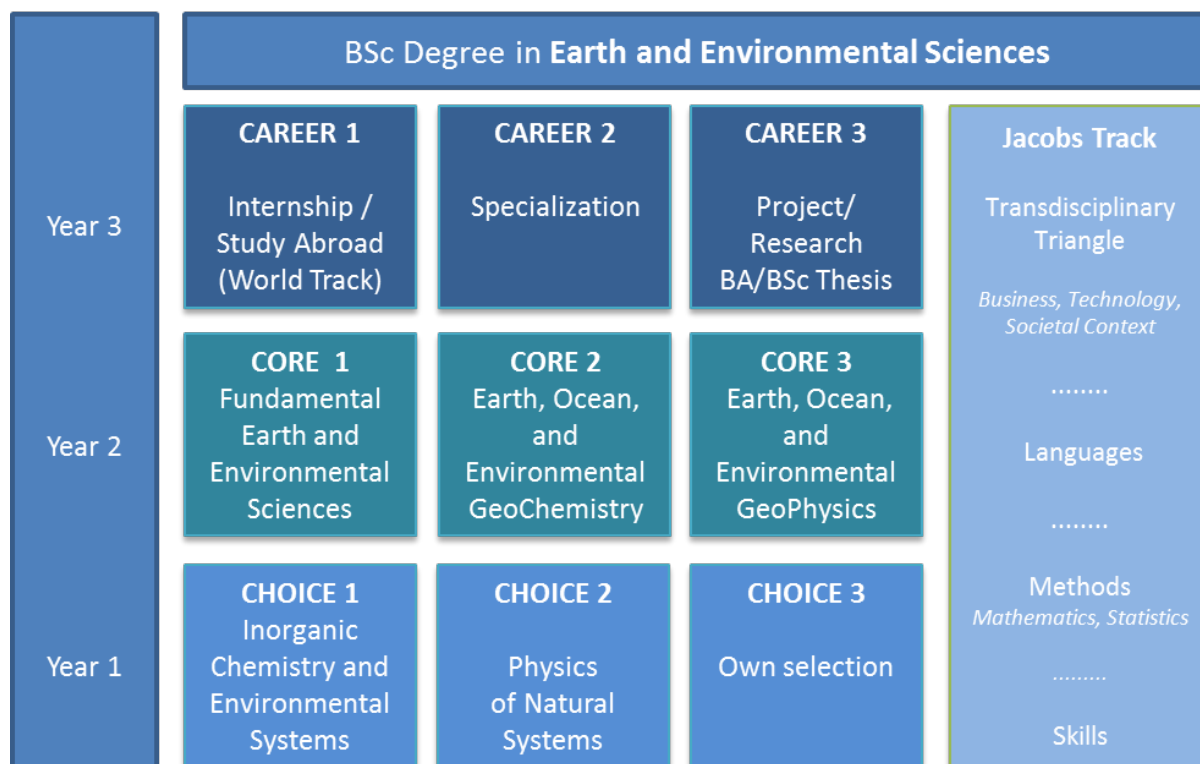
Students are allowed to extend their thesis related work into the intersession or summer break upon approval of the thesis supervisor and Student Records. Students are not allowed to register for different Bachelor Thesis courses in the same semester.

2.5.5 Formal Regulations for the Bachelor Thesis

- **Timing**
The Thesis work has to be generated within the semester of registration. The semester period has 14 weeks.
- **Extent**
The document must be between 15-25 pages in length, including references, but excluding appendices or supporting information. Deviations in length and format can be determined within individual study programs and should be communicated to all registered students by the study program coordinator.
- **Cover page**
The cover page must show the title of the Bachelor Thesis, the university's name, the month and year of submission, the name of the student and the name of the supervisor.
- **Statutory Declaration**
Each Bachelor Thesis must include a statutory declaration signed by the student confirming it is their own independent work and that it has not been submitted elsewhere. The respective form can be found on the Student Records Office website.
- **Submission**
The Bachelor Thesis must be submitted as a hard copy (pdf-file) to the supervisor and additionally to the Student Records Office via online form on the Student Records Office website.

Deadline for submission of the Bachelor Thesis is May 15 (unless specified otherwise by the Student Records Office).

2.6 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 4: Earth and Environmental Sciences Module Structure

3 Appendix 1a/1b: Mandatory Module and Examination 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.

4 Appendix 2: Course Data for Program-Specific CHOICE and CORE Courses

All course data stated in the appendix is based on the previous study year and subject to change.

Version	Valid as of	Decision	Details
Fall 2017 - V1	01.09.17	AB August 17	Masterversion
Fall 2017 - V2	01.09.17	AB August 17	2.2 revised

Appendix 1a - Mandatory Module and Examination Plan for World Track

Earth and Environmental Sciences – World Track												
Matriculation Fall 2017												
Program-Specific Modules					Jacobs Track Modules (General Education)							
Type	Status ¹	Semester	Credits		Type	Status ¹	Semester	Credits				
Year 1 - CHOICE				45						20		
Take the two mandatory CHOICE modules listed below, these are a requirement for the EES program.												
CH04-InorgChem	Module: Inorganic Chemistry and Environmental Systems			m				15				
CH04-210113	Introduction to Inorganic Chemistry and Earth & Environmental Systems	Lecture	m	1	5	JT-ME-MethodsMath	Module: Methods / Mathematics			m	7,5	
CH04-400111	Inorganic Chemistry I Lab	Lab	m	1	2,5	JT-ME-120106	Applied Calculus I	Lecture	m	1	2,5	
CH04-210114	Advanced Earth & Environmental Systems and Inorganic Chemistry	Lecture	m	2	5	JT-ME-120107	Applied Calculus II	Lecture	m	1	2,5	
CH04-210111	GeoEnvironmental Systems and their Chemistry - Field Lab	Excursion	m	2	2,5	JT-ME-120101	Mathematical Concepts in the Sciences	Lecture	m	2	2,5	
CH05-PhysNatSys	Module: Physics of Natural Systems			m		JT-SK-Skills	Module: Skills			m	2,5	
CH05-200104	Classical Physics	Lecture	m	1	5	JT-SK-990103	Scientific and Experimental Skills	Lecture	m	1	2,5	
CH05-200114	Classical Physics Lab	Lab	m	1	2,5	JT-TA-TriArea	Module: Triangle Area			m	5	
CH05-210132	Introduction to Earth and Marine Systems	Lecture	m	2	5	Take two courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS ³						
CH05-210103	Introduction to Earth System Data	Lab	m	2	2,5	JT-LA-Language	Module: Language			m	5	
	Module: CHOICE (own selection)		e	1/2	15	Take two German courses (2,5 ECTS each). Native German speakers take courses in another offered language						
Students take one further CHOICE module from those offered for all other study programs. ²												
Year 2 - CORE				45						20		
Take all three modules <u>or</u> replace one with a CORE module from a different study program. ²												
CO10-FundEES	Module: Fundamental Earth and Environmental Sciences			me					15			
CO10-210201	Volcanism and Metamorphism	Lecture	m	3	2,5	JT-ME-MethodsMath	Module: Methods / Mathematics			m	7,5	
CO10-210203	Sedimentology	Lecture	m	3	2,5	Take three Methods (mandatory) elective courses (2,5 ECTS each). ²						
CO10-210206	Structural Geology	Lecture	m	3	2,5	Lecture	me	3/4	7,5			
CO10-210204	Marine Environments	Lecture	m	4	2,5	JT-TA-TriArea	Module: Triangle Area			m	7,5	
CO10-210133	Introduction to Mineralogy	Lecture	m	4	2,5	Take three courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS ³						
CO10-041202	Fieldtrip Environmental Changes and Challenges in Northwestern Germany	Excursion	m	4	2,5	JT-LA-Language	Module: Language			m	5	
CO11-EOEnvChem	Module: Earth, Ocean, and Environmental Geochemistry			me		Take two German courses (2,5 ECTS each). Native German speakers take courses in another offered language						
CO11-210241	Geochemistry of Igneous and Aqueous Systems	Lecture	m	3	2,5	CA01-CarAdv	Career Advising⁴					
CO11-210302	Environmental Geochemistry	Lecture	m	3	2,5							
CO11-210362	Applied Geochemistry	Lecture	m	4	2,5							
CO11-210301	Isotope Geochemistry	Lecture	m	4	2,5							
CO11-210373	Mineral Resources	Lecture	m	4	2,5							
CO11-210202	Fieldtrip Volcanism and Hydrochemistry in the Eifel, Germany	Excursion	m	4	2,5							
CO12-EOEnvPhys	Module: Earth, Ocean, and Environmental Geophysics			me								
CO12-210223	Marine and Applied Geophysics	Lecture	m	3	2,5							
CO12-210225	Physics of System Earth	Lecture	m	3	5							
CO12-210214	Physical Oceanography	Lecture	m	3	2,5							
CO12-210213	Earth System Monitoring and Remote Sensing	Lecture	m	4	2,5							
CO12-210251	Oceanographic Excursion / Research Cruise North Sea	Excursion	m	4	2,5							
Year 3 - CAREER				45						5		
CA02 / CA03	Module: Internship / Study Abroad			m	5	20						
CA07-EES	Module: Project / Thesis EES			m		15						
CA07-210304	Project EES		m	6	5	JT-SK-Skills	Module: Skills			m	2,5	
CA07-210305	Thesis EES		m	6	10	JT-SK-990104	Advanced Scientific and Experimental Skills	Lecture	m	6	2,5	
CAS-WT-EES	Module: Specialization Area EES			m		10	JT-TA-TriArea	Module: Triangle Area			m	2,5
Take four specialization courses (2.5 ECTS each) ²				me	5/6	10	Take one course from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS ³					
Total ECTS							CA01-CarAdv			Career Advising⁴		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).

⁴ Mandatory component of the Jacobs University's Counseling and Advising Scheme.

Appendix 1b - Mandatory Module and Examination Plan for Campus Track

Earth and Environmental Sciences – Campus Track											
Matriculation Fall 2017											
Program-Specific Modules					Jacobs Track Modules (General Education)						
Type	Status ¹	Semester	Credits		Type	Status ¹	Semester	Credits			
Year 1 - CHOICE				45						20	
<i>Take the two mandatory CHOICE modules listed below, these are a requirement for the EES program.</i>											
CH04-InorgChem	Module: Inorganic Chemistry and Environmental Systems			m	15	JT-ME-MethodsMath	Module: Methods / Mathematics			m	7,5
CH04-210113	Introduction to Inorganic Chemistry and Earth & Environmental Systems	Lecture	m	1	5	JT-ME-120106	Applied Calculus I	Lecture	m	1	2,5
CH04-400111	Inorganic Chemistry I Lab	Lab	m	1	2,5	JT-ME-120107	Applied Calculus II	Lecture	m	1	2,5
CH04-210114	Advanced Earth & Environmental Systems and Inorganic Chemistry	Lecture	m	2	5	JT-ME-120101	Mathematical Concepts in the Sciences	Lecture	m	2	2,5
CH04-210111	GeoEnvironmental Systems and their Chemistry - Field Lab	Excursion	m	2	2,5	JT-SK-Skills	Module: Skills			m	2,5
CH05-PhysNatSys	Module: Physics of Natural Systems			m	15	JT-SK-990103	Scientific and Experimental Skills	Lecture	m	1	2,5
CH05-200104	Classical Physics	Lecture	m	1	5	JT-TA-TriArea	Module: Triangle Area			m	5
CH05-200114	Classical Physics Lab	Lab	m	1	2,5	Take two courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS ³					
CH05-210132	Introduction to Earth and Marine Systems	Lecture	m	2	5				me	1/2	5
CH05-210103	Introduction to Earth System Data	Lab	m	2	2,5	JT-LA-Language	Module: Language			m	5
	Module: CHOICE (own selection)			e	1/2	15	Take two German courses (2,5 ECTS each). Native German speakers take courses in another offered language				
<i>Students take one further CHOICE module from those offered for all other study programs. ²</i>											
Year 2 - CORE				45						20	
<i>Take all three modules <u>or</u> replace one with a CORE module from a different study program. ²</i>											
CO10-FundEES	Module: Fundamental Earth and Environmental Sciences			me	15	JT-ME-MethodsMath	Module: Methods / Mathematics			m	7,5
CO10-210201	Volcanism and Metamorphism	Lecture	m	3	2,5	Take three Methods (mandatory) elective courses (2,5 ECTS each). ²					
CO10-210203	Sedimentology	Lecture	m	3	2,5	Lecture	me	3/4	7,5		
CO10-210206	Structural Geology	Lecture	m	3	2,5						
CO10-210204	Marine Environments	Lecture	m	4	2,5	JT-TA-TriArea	Module: Triangle Area			m	7,5
CO10-210133	Introduction to Mineralogy	Lecture	m	4	2,5	Take three courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS ³					
CO10-041202	Fieldtrip Environmental Changes and Challenges in Northwestern Germany	Excursion	m	4	2,5						
CO11-EOEnvChem	Module: Earth, Ocean, and Environmental GeoChemistry			me	15	JT-LA-Language	Module: Language			m	5
CO11-210241	Geochemistry of Igneous and Aqueous Systems	Lecture	m	3	2,5	Take two German courses (2,5 ECTS each). Native German speakers take courses in another offered language					
CO11-210302	Environmental Geochemistry	Lecture	m	3	2,5				me	3/4	7,5
CO11-210362	Applied Geochemistry	Lecture	m	4	2,5	CA01-CarAdv	Career Advising⁴				
CO11-210301	Isotope Geochemistry	Lecture	m	4	2,5						
CO11-210373	Mineral Resources	Lecture	m	4	2,5						
CO11-210202	Fieldtrip Volcanism and Hydrochemistry in the Eifel, Germany	Excursion	m	4	2,5						
CO12-EOEnvPhys	Module: Earth, Ocean, and Environmental GeoPhysics			me	15					5	
CO12-210223	Marine and Applied Geophysics	Lecture	m	3	2,5						
CO12-210225	Physics of System Earth	Lecture	m	3	5						
CO12-210214	Physical Oceanography	Lecture	m	3	2,5						
CO12-210213	Earth System Monitoring and Remote Sensing	Lecture	m	4	2,5						
CO12-210251	Oceanographic Excursion / Research Cruise North Sea	Excursion	m	4	2,5						
Year 3 - CAREER				45						5	
COXX	Module: Additional (4th) CORE module			m	5/6	15					
CA07-EES	Module: Project / Thesis EES			m	15	JT-SK-Skills	Module: Skills			m	2,5
CA07-210304	Project EES		m	5	5	JT-SK-990104	Advanced Scientific and Experimental Skills	Lecture	m	6	2,5
CA07-210305	Thesis EES		m	6	10	JT-TA-TriArea	Module: Triangle Area			m	2,5
CAS-CT-EES	Module: Specialization Area EES			m	15	Take one course from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS ³					
Take six specialization courses (2,5 ECTS each) ²				me	5/6	15	CA01-CarAdv	Career Advising⁴			
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).

⁴ Mandatory component of the Jacobs University's Counseling and Advising Scheme.

Appendix 2 - Course Data



Course Name GeoEnvironmental Systems and their Chemistry-Field Lab	Course No CH04-210111	ECTS 2,5
Module Affiliation CH04-InorgChem Inorganic Chemistry and Environmental Systems	Workload (hrs / sem) Contact Time: 25,50 Private Study: 37,00	Level Bachelor 1st Year CHOICE
Course Description / Content / Aims Introduction to the fundamental techniques of field geology and field geochemistry including using geology, water chemistry and environmental problems in the old mining district of the Harz Mountains, Germany, as examples. The students participate in a three-day field trip that includes introductory lunchtime lectures prior to the field trip, the three-day field trip itself, and two evening lectures during the field trip.		
Course Name Introduction to Inorganic Chemistry and Earth and Environmental Sciences	Course No CH04-210113	ECTS 5
Module Affiliation CH04-InorgChem Inorganic Chemistry and Environmental Systems	Workload (hrs / sem) Contact Time: 35,00 Private Study: 90,00	Level Bachelor 1st Year CHOICE
Course Description / Content / Aims Inorganic Chemistry An introduction to fundamental concepts of general/inorganic chemistry including the following areas: matter, measurements and moles, elements, compounds, units, chemical reactions, stoichiometry, equations, equilibrium, acids and bases, properties of gases. Earth & Environmental Sciences Students are introduced to the fundamental principles and concepts in the geosciences, with special emphasis on the Earth's internal structure and on plate tectonics. The focus then shifts towards the "Critical Zone", i.e. on the complex near-surface environment in which interactions between rock, soil, water, air and living organisms define the natural habitat and control the availability of live-sustaining resources. Students will be introduced in a qualitative way to the basic components of and fundamental processes operating in the critical zone.		

Appendix 2 - Course Data

Course Name Advanced Earth and Environmental Sciences and Inorganic Chemistry	Course No CH04-210114	ECTS 5
Module Affiliation CH04-InorgChem Inorganic Chemistry and Environmental Systems	Workload (hrs / sem) Contact Time: 35,00 Private Study: 90,00	Level Bachelor 1st Year CHOICE
Course Description / Content / Aims Earth & Environmental Sciences: Following a continuation of a discussion of the fundamentals of geology, it will be demonstrated how physical, chemical and biological processes interact in the Earth System and drive the functions of ecosystems, and how human activities interfere with natural processes. Anthropogenic changes at local and global scales will be discussed, with emphasis on the degradation of the atmosphere, freshwater systems, soils, forests, grassland and cropland and on the changes of polar and coastal regions. Inorg. Chemistry: Continuation of the introduction to chemistry that comprises the following parts: Atoms and atomic structure, the hydrogen atom, many electron atoms, periodic properties of elements. The chemical bond, ionic vs covalent bond, hydrogen bond. Molecular structure (VSEPR).		
Course Name Inorganic Chemistry I Lab	Course No CH04-400111	ECTS 2,5
Module Affiliation CH04-InorgChem Inorganic Chemistry and Environmental Systems	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 1st Year CHOICE
Course Description / Content / Aims Foundation principles of chemistry, including basic laboratory techniques, qualitative analysis of anions and cations, strong/weak acids and bases, titrations, solubility of salts, crystallization, redox reactions, gravimetric analysis, volumetric analysis, complex formation, synthesis of nanoparticles.		

Appendix 2 - Course Data

Course Name Classical Physics	Course No CH05-200104	ECTS 5
Module Affiliation CH05-PhysNatSys Physics of Natural Systems	Workload (hrs / sem) Contact Time: 35,00 Private Study: 90,00	Level Bachelor 1st Year CHOICE
Course Description / Content / Aims <p>Physics is the most fundamental of all natural sciences. A thorough background and understanding of physics is important for any description of natural systems. This course introduces to the basic principles of mechanics, thermodynamics, and optics. Emphasis is laid on general principles and fundamental concepts for the understanding of natural phenomena, not on an extensive mathematical description. Nevertheless, some basic calculus will be necessary to develop a scientific sound description of physical phenomena. Experiments and demonstrations are included in the lecture, and a tutorial is offered to discuss homework and topics of interest in more details.</p> <p>The course consists of three main sections: The section on mechanics introduces the description of motion and the concepts of force and energy, including collisions, rotations, gravitation, and oscillations. The section on thermodynamics adds the concepts of heat and temperature to the description of natural systems including heat capacity, ideal gases, internal energy and the first law of thermodynamics. The section on optics introduces the concepts of light rays and waves to discuss optical instruments and the phenomena of interference and diffraction.</p>		
Methods of Assessment		
Name	Weighting	
Final Exam	50%	
Home Work	20%	
Midterm Exam	30%	
Course Name Classical Physics Lab		
Course No CH05-200114		
ECTS 2,5		
Module Affiliation CH05-PhysNatSys Physics of Natural Systems	Workload (hrs / sem) Contact Time: 25,50 Private Study: 37,00	Level Bachelor 1st Year CHOICE
Course Description / Content / Aims <p>Physics is an experimental science and the ultimate test for any theory or description of nature is the experiment. This lab course complements the Classical Physics lecture with experiments in the fields of mechanics, thermodynamics and optics. It deepens the understanding and extends the topics covered in the lecture, which is a corequisite for this course. Prior to the course, students need to attend the relevant safety instructions and will get an introduction into error analysis and calculation. The lab offers six different experiments and runs over six afternoons. The aim of the lab sessions is hands-on experience on how to investigate physical phenomena and topics presented in the lecture; to plan, carry out, and analyse experiments in physics; to describe, summarize and present experimental results adequately. Examples of experiments include the mathematical pendulum, ideal gas law and optical instruments.</p>		
Methods of Assessment		
Name	Weighting	
Final Exam	34%	
Lab Reports	66%	

Appendix 2 - Course Data

Course Name Introduction to Earth System Data	Course No CH05-210103	ECTS 2,5
Module Affiliation CH05-PhysNatSys Physics of Natural Systems	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 1st Year CHOICE
Course Description / Content / Aims The course provides an early exposure to Earth data and their handling. The wide range of remotely or in-situ collected datasets will be introduced and examples provided, as well as their relevance for Earth science disciplines. Three main components of the course are included: a) an overview of the range of data types, standards, and formats commonly use in Earth science and exemplary data sources and data search, discovery, retrieval and inspecting options, b) exemplary Earth science data collection activities, and c) data handling and analysis basics, covering either archive or field-collected data. Geospatial and temporal data of interest and relevance for Earth and Marine sciences will be described, collected, inspected and analyzed with available open source tools.		
Course Name Introduction to Earth and Marine Systems	Course No CH05-210132	ECTS 5
Module Affiliation CH05-PhysNatSys Physics of Natural Systems	Workload (hrs / sem) Contact Time: 35,00 Private Study: 90,00	Level Bachelor 1st Year CHOICE
Course Description / Content / Aims Planet Earth is a natural system comprising a number of compartments such as the interior, the continents, the oceans, and the atmosphere. In this course you are introduced to the complex interplay of earth and marine processes on a wide range of spatial and temporal scales. Earth's history and planetary evolution define our place in space and time. Plate tectonics and surface structures are closely linked to the composition and the dynamics of the planetary interior. We discuss the physical forces and hydrodynamical principles on our rotating planet that govern ocean currents and also atmospheric dynamics on large spatial scales.		

Appendix 2 - Course Data

Course Name Fieldtrip Environmental Changes and Challenges in Northwestern Germany	Course No CO10-041202	ECTS 2,5
Module Affiliation CO10-FundEES Fundamental Earth and Environmental Sciences	Workload (hrs / sem) Contact Time: 25,50 Private Study: 37,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims The excursion to areas in NW Germany is comprised of several days with visits to sites such as an East Frisian Island, the UNESCO world heritage region Wadden Sea, the marsh polder land, the moraine "Geest" and the peat bogs. The differences in the geology, pedology and ecology will be studied to understand the historic and present development of this dynamic landscape and the consequences of the climate change for these unique ecosystems and the society. Also contamination of water and soils from industrial or agricultural activities will be studied. Additionally the opportunities as well as consequences of development in renewable energy and the effects of the political decisions on the land use and landscape will be explored.		
Course Name Introduction to Mineralogy	Course No CO10-210133	ECTS 2,5
Module Affiliation CO10-FundEES Fundamental Earth and Environmental Sciences	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims This course provides an introduction to mineral sciences. Key concepts of crystallography are reviewed to show how the three-dimensional nature of crystals is related to their physical and chemical properties. An introduction to modern analytical techniques like e.g. XRD is given. Further topics include nucleation and growth of crystals from aqueous solutions, and their thermodynamic properties.		

Appendix 2 - Course Data

Course Name Volcanism and Metamorphism	Course No CO10-210201	ECTS 2,5
Module Affiliation CO10-FundEES Fundamental Earth and Environmental Sciences	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims Introduction to the fundamentals of (physical) geology. Part I starts with a discussion on how magma forms in the Earth's mantle and what igneous rocks crystallize from it. Plutonic, volcanic and pyroclastic rocks, volcanoes and their different eruption styles will be introduced. We will also discuss the reaction of rocks to increasing pressure and temperature, touch upon metamorphism and introduce the concept of metamorphic facies and the mineral assemblages typical of them. In addition to the lectures, the course also includes practicals in rock and mineral description and recognition.		
Course Name Sedimentology	Course No CO10-210203	ECTS 2,5
Module Affiliation CO10-FundEES Fundamental Earth and Environmental Sciences	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims In this course the students will be made familiar with the basics concepts of sedimentary geology and stratigraphy. Focus will also be on the identification and recognition of sedimentary features and on an understanding of modern and ancient depositional processes and environments.		

Appendix 2 - Course Data



Course Name Marine Environments	Course No CO10-210204	ECTS 2,5
Module Affiliation CO10-FundEES Fundamental Earth and Environmental Sciences	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims This course covers aspects of the physical, chemical and biological environments of the sea. It demonstrates human impacts on the marine environments and how science is used to predict and to solve the problems created by human activities. Attention is given to aspects of marine productivity, hydrocarbon industries, fisheries and mariculture and to the effects of the industrial developments on the marine environment. Case studies are presented to show how science can contribute to providing solutions to these problems.		
Course Name Structural Geology	Course No CO10-210206	ECTS 2,5
Module Affiliation CO10-FundEES Fundamental Earth and Environmental Sciences	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims In this course the students will be made familiar with the basics concepts of structural geology. Topics such as folding and faulting will be covered and a basic introduction to geological field mapping will be provided.		

Appendix 2 - Course Data

Course Name Fieldtrip Volcanism and Hydrochemistry in the Eifel, Germany	Course No CO11-210202	ECTS 2,5
Module Affiliation CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Workload (hrs / sem) Contact Time: 25,50 Private Study: 37,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims During this fieldlab techniques commonly performed in the geosciences will be practised and “textbook geology” will be compared to “real world geology”. During a four day excursion to the Eifel area of western Germany, which is famous for its mantle xenoliths, its Tertiary and Quaternary volcanism, and its large variety of mineral springs, the focus will be on volcanology, sedimentology and water chemistry. Fieldwork during the day will be complemented by evening seminars.		
Course Name Geochemistry of Igneous and Aqueous Systems	Course No CO11-210241	ECTS 2,5
Module Affiliation CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims This course addresses principal chemical concepts in geosystems. It will be demonstrated how chemical reactions and equilibria drive changes in the Earth's endogenic and exogenic systems. This includes an introduction to the thermodynamics and kinetics relevant for an understanding of natural systems and to the concept of geochemical modeling of igneous systems (magmas) and aqueous systems (waters). Furthermore, it covers compartments, components, and chemical processes including interactions with the biosphere in aqueous systems.		

Appendix 2 - Course Data

Course Name Isotope Geochemistry	Course No CO11-210301	ECTS 2,5
Module Affiliation CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims <p>The first part of the course focuses on the use of stable isotopes as a means of studying biogeochemical cycles in the ocean, specifically carbon, nitrogen and sulfur cycles. It considers isotopic effects during photosynthesis, respiration, organic matter degradation, CaCO₃ dissolution, methanogenesis, nitrification&#47;denitrification and sulfate reduction. This course starts with an introduction into the fundamentals of stable isotope geochemistry and moves on into more complex isotope system. Topics include: Theoretical and experimental principles; isotope fractionation mechanisms of selected elements; variations of stable isotope ratios in nature; application of stable isotope proxies in paleoceanography and -climatology.</p> <p>In the second part of the course the students are introduced to the basic concepts of radiogenic isotope geochemistry. The radiogenic isotope systems important in geochemistry will be explained together with applications such as radiometric age dating and characterisation of source rocks or environmental conditions.</p>		
Course Name Environmental Geochemistry	Course No CO11-210302	ECTS 2,5
Module Affiliation CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims <p>In this course, human interactions with natural systems will be discussed in both qualitative and quantitative ways. The focus will be placed upon anthropogenic contamination of the environment and global consequences for the atmosphere, pedosphere and hydrosphere. The physical, chemical and biological principles of contaminant transports, transformation and uptake by organisms will be introduced. Cycling of heavy metal and radioactive compounds in terrestrial and marine environments, and behavior, transport and degradation of organic and metal-organic pollutants (examples: TBT, PCBs, DDT, etc.), will be some of the topics. Further subjects include acid mine drainage and acid rain.</p>		

Appendix 2 - Course Data

Course Name Applied Geochemistry	Course No CO11-210362	ECTS 2,5
Module Affiliation CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims The first part describes the geochemical characteristics of various igneous rocks, and the controls of plate tectonic setting and geochemical processes, such as assimilation of country rock, hydrothermal alteration and weathering, on rock chemistry. The chemical characteristics of clastic and chemical sediments will be briefly addressed, with emphasis on the former. In the second part, following an introduction to the basic concepts of aquatic chemistry, the geochemical and physical characterization of aquatic environments will be presented. This includes the composition of freshwater (rain, lake, river and ground water) systems and seawater (including hydrothermal fluids and their role for the composition of the ocean) and the formation of marine precipitates. Processes along steep physico-chemical gradients such as oxic-anoxic layers, sediment-bottom water boundaries and seawater - hydrothermal fluid mixing zones will be another focus. The interface between the aqueous compartments and the biosphere will also be addressed.		
Course Name Mineral Resources	Course No CO11-210373	ECTS 2,5
Module Affiliation CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims This course is an introduction to the genesis, occurrence, characteristics, economic significance, and resource assessment of metallic and non-metallic ore deposits. After an introduction to the principles of ore formation, magmatic, sedimentary and metamorphic ore-forming environments are presented. Different metal ore deposits, including base metal, precious metal, iron and alloy ore deposits will be addressed. Also rare metals of interest for new high-tech industries will be a topic of the course. Deposits of industrial minerals and uranium as an energy resource will finalize the course curriculum. The lectures will be supplemented by practical exercises and student presentations on selected topics.		

Appendix 2 - Course Data

Course Name Earth System Monitoring and Remote Sensing	Course No CO12-210213	ECTS 2,5
Module Affiliation CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims The course provides an introduction to the use of remote sensing measurements and spatial information technologies for observing, monitoring, modeling and analyzing Earth and environmental data, with particular relevance for natural resource management. Remote sensing allows the study of Earth processes on a range of spatial, temporal, and spectral scales. The growing multidimensional body of data collected by Earth observation platforms is integrated in digital mapping environments. Earth is monitored as a system with interactions between geosphere, atmosphere and biosphere. The course combines traditional lecture elements with hands-on computer training using case studies to expose students to the latest developments of Earth observation remote sensing principles and practice.		
Course Name Physical Oceanography	Course No CO12-210214	ECTS 2,5
Module Affiliation CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Workload (hrs / sem) Contact Time: 17,50 Private Study: 45,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims This class extends and builds on the first year courses on physical oceanography and marine sciences in general. The course focuses on the large-scale circulation of the oceans and includes temperature-salinity analysis, water mass identification, water, salt, and heat budgets. The distribution of chemical tracers, advection and diffusion will be discussed. The sources, reactions, and fates of organic molecules in the marine environment along with the stable isotope geochemistry of marine organic substances will be presented. In addition, various aspects of marine exploration and science will be touched upon.		

Appendix 2 - Course Data

Course Name Physics of System Earth	Course No CO12-210225	ECTS 5
Module Affiliation CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Workload (hrs / sem) Contact Time: 35,00 Private Study: 90,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims The system approach to planet Earth introduced in the first-year courses is developed further and made more quantitative. We begin with a review of mathematical tools and physical concepts that are relevant for Earth and environmental sciences, and include an introduction to numerical software. Earth's internal structure and dynamics is intimately linked to surface processes and plate tectonics, and also to the geomagnetic field and the Earth's gravity field. Structure and dynamics of the oceans and the atmosphere are of key importance for global challenges such as global warming and climate change. The lecture part of the course is supplemented by Earth science data analysis and visualization.		
Course Name Oceanographic Excursion: Research Cruise North Sea	Course No CO12-210251	ECTS 2,5
Module Affiliation CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Workload (hrs / sem) Contact Time: 25,50 Private Study: 37,00	Level Bachelor 2nd Year CORE
Course Description / Content / Aims Oceanographic and marine geosciences excursion to practice and train field techniques in the geosciences. The excursion to Helgoland will take place on FS Heincke. The course provides students an excellent opportunity to gain some practical hands-on experience. They will be able to put to test various theories they have learned during their lectures over the past two years. It will also support and foster team work as they will have to process and interpret the acquired data as a group and write a cruise report. For cruise preparation and providing theoretical background an evening seminar prior to the cruise is mandatory.		