JACOBS
UNIVERSITY

Study Program Handbook

Earth and Environmental Sciences

Bachelor of Science

Subject-specific Examination Regulations for Earth and Environmental Sciences (Fachspezifische Prüfungsordnung)

The subject-specific examination regulations for Earth and Environmental Sciences are defined by this program handbook and are valid only in combination with the General Examination Regulations for Undergraduate degree programs (General Examination Regulations = Rahmenprüfungsordnung). This handbook also contains the program-specific Mandatory Module and Examination Plans (Appendix 1a / 1b).

Upon graduation, students in this program will receive a Bachelor of Science (BSc) degree with a scope of 180 ECTS (for specifics see chapter 3 of this handbook).

Version	Valid as of	Decision	Details
Fall 2018 - V1	01.09.18	Academic Senate August 29, 2018	Master Version

Contents

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 Earths 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 a 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

By the end of this B.Sc. degree program, students will be able to:

Theory

- explain basic concepts and key processes within the fields of: geology, oceanography, environmental sciences, geochemistry, geophysics, data analysis and modeling.
- describe and discuss terrestrial as well as marine systems, identify and examine relevant mechanisms and interactions.
- identify and differentiate sedimentary, igneous and metamorphic rocks and minerals.
- classify and analyze major anthropogenic disturbances of the natural (near-)surface system.
- understand and describe the interdependencies of resource economy and environmental protection.
- discuss and criticize currently debated topics in geology, oceanography, geophysics, and geochemistry.

Practical Work

- investigate natural phenomena using basic experimental and observational geoscientific techniques.
- understand and apply fundamental practical skills and concepts in geological, geochemical, and geophysical field work.
- demonstrate key techniques of data analysis, interpretation, and presentation of geoscientific observations and samples.
- select and apply basic and advanced data analysis techniques in applied and environmental geosciences.
- perform quantitative analyses of geoscientific processes and systems, and construct models of their dynamics.
- apply chemical and physical concepts and methods to real-world problems in terrestrial and marine Earth and Environmental Sciences.

Transferable Skills

- design, test, and revise hypotheses and models for processes and systems in Earth and Environmental Sciences.
- analyze scientific and technical questions, put them into relationship to what is known in the literature, suggest avenues to solve the questions at hand, and communicate these solutions effectively.
- present their own results, and those of others, concisely and professionally in front of an audience.
- understand the relationship between experiments, and the data and trends therefrom, for scientific hypotheses.
- demonstrate a general set of scientific methods and skills used in Earth, Environmental, and Marine Sciences.
- understand the value of reproducible results and ethical standards within science.

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 chair:

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Telephone: +49 421 200-3102

or visit our program website: https://www.jacobs-university.de/study/undergraduate/programs/earth-and-environmental-sciences

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:

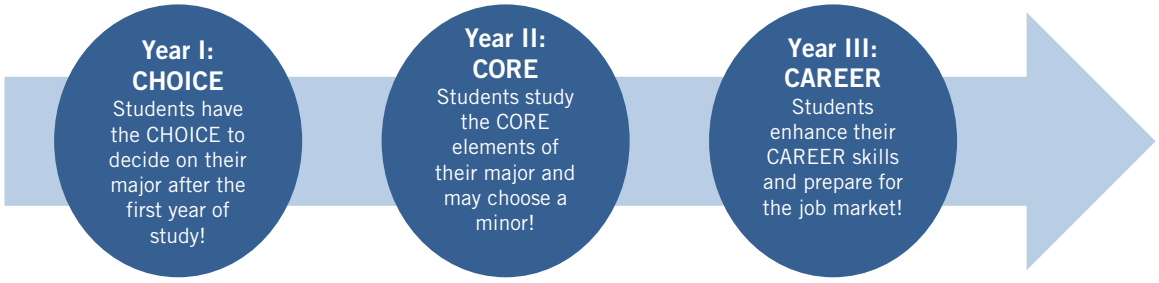


Figure 1: The Jacobs University 3C-Model

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 Universitys 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 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.

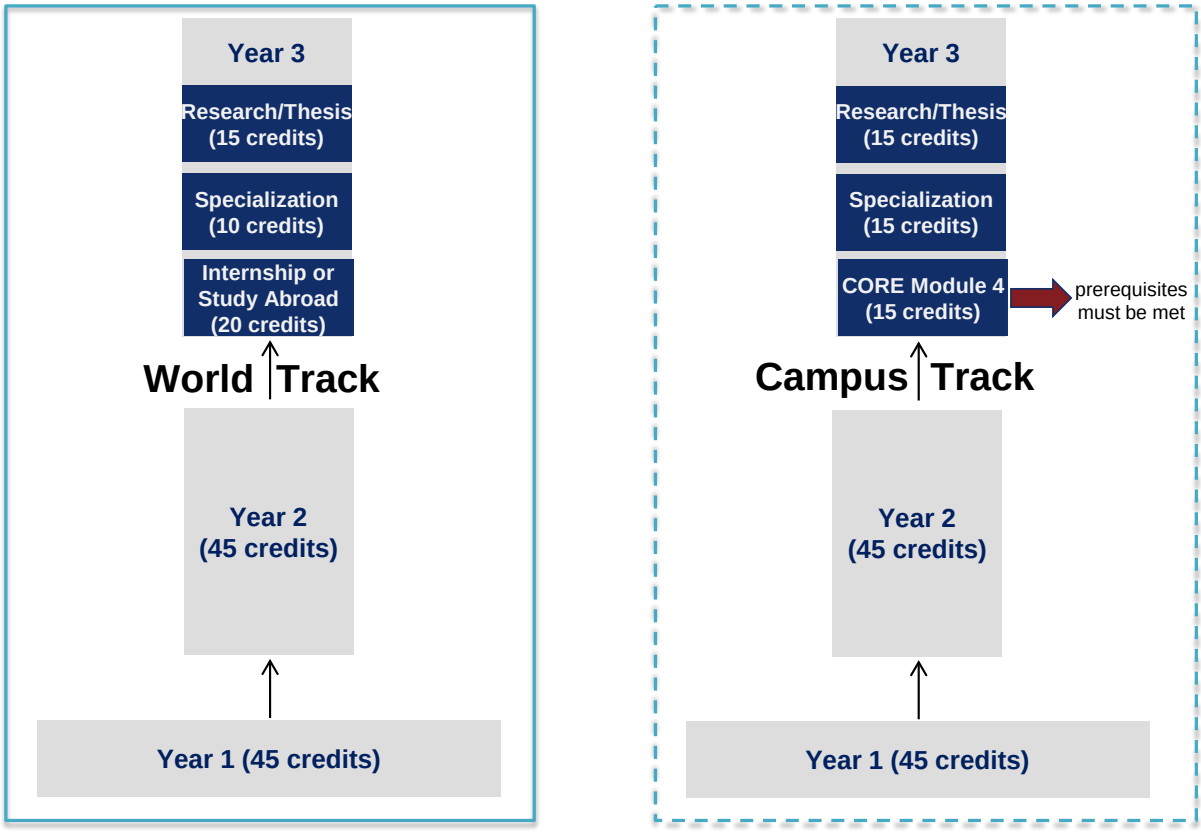


Figure 2: World Track versus Campus Track

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 2018

SEMESTER	1	2	3	4	5	6
MANDATORY BASICS	CSC-INFO Session: "CSC Services" CA01-990000		CSC-INFO Session: "World Track" CA01-990026			
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 in your third or forth semester, i.e. ▪ 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 ▪ Career Orientation ▪ Working in Germany ▪ Stress Management			
OTHER MANDATORY COMPONENTS				CSC-JACOBS CAREER FAIR in February, on campus CA01-990003		
CAREER RELATED STUDY PROGRAM COMPONENTS					INTERNSHIP (World Track) or STUDY ABROAD (World Track) or CAMPUS TRACK (exceptional)	INTERNSHIP & STUDY ABROAD EVENT

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 the mandatory module listed below and select two further CHOICE module from a different study area.

General Earth and Environmental Sciences (CH04-GenEES)
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

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 isotope 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 gen-

eral 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 chairs 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.

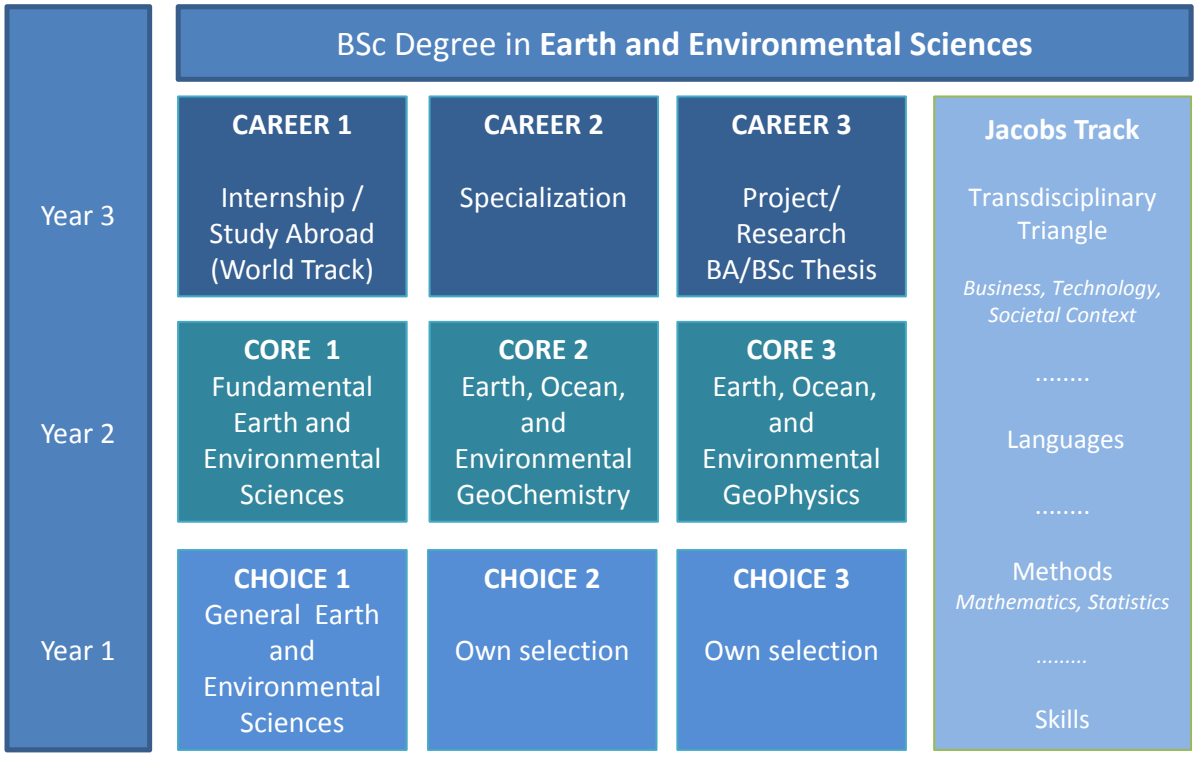
Students are allowed to extend their thesis related work into the intersession or summer break upon approval of the thesis supervisor and Student Records. Students are not allowed to register for different Bachelor Thesis courses in the same semester.

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 chair.
- 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, two 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.

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

Earth and Environmental Sciences – World Track

Matriculation Fall 2018

	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 mandatory CHOICE module listed below, this is a requirement for the EES program.											
CH04-GenEES	**Module: General Earth and Environmental Sciences**		**m**		**15**		**JT-ME-MethodsMath**	**Module: Methods / Mathematics**		**m**		**7,5**
CH04-210121	Introduction to Earth and Environmental Science	Lecture	m	1	5		JT-ME-120106	Applied Calculus I	Lecture	m	1	2,5
CH04-210103	DataLab: Introduction to Earth System Data	Lecture	m	1	2,5		JT-ME-120107	Applied Calculus II	Lecture	m	1	2,5
CH04-210123	The Earth-Ocean System and its Evolution	Lecture	m	2	5		JT-ME-120101	Mathematical Concepts in the Sciences	Lecture	m	2	2,5
CH04-210111	FieldLab: Earth and Environmental Systems and their Chemistry	Lab	m	2	2,5		**JT-SK-Skills**	**Module: Skills**		**m**		**2,5**
							JT-SK-990103	Scientific and Experimental Skills	Lecture	m	1	2,5
	Module: CHOICE (own selection)		**e**	**1/2**	**30**		**JT-TA-TriArea**	**Module: Triangle Area**		**m**		**5**
Students take two further CHOICE modules from those offered for all other study programs. [2]								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
							CA01-CarAdv	**Career Advising[4]**				
Year 2 - CORE					**45**							**20**
Take all three modules or replace one with a CORE module from a different study program. [2]												
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							
CO10-210203	Sedimentology	Lecture	m	3	2,5			Take three Methods (mandatory) elective courses (2,5 ECTS each). [2]	Lecture	me	3/4	7,5
CO10-210206	Structural Geology	Lecture	m	3	2,5							
CO10-210204	Marine Environments	Lecture	m	4	2,5							
CO10-210133	Introduction to Mineralogy	Lecture	m	4	2,5							
CO10-041202	Fieldtrip Environmental Changes and Challenges in Northwestern German	Excursion	m	4	2,5							
CO11-EOEnvChem	**Module: Earth, Ocean, and Environmental GeoChemistry**		**me**		**15**		**JT-TA-TriArea**	**Module: Triangle Area**		**m**		**7,5**
CO11-210241	Geochemistry of Igneous and Aqueous Systems	Lecture	m	3	2,5							
CO11-210302	Environmental Geochemistry	Lecture	m	3	2,5			Take three courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	3/4	7,5
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**		**15**		**JT-LA-Language**	**Module: Language**		**m**		**5**
CO12-210223	Marine and Applied Geophysics	Lecture	m	3	2,5							
CO12-210225	Physics of System Earth	Lecture	m	3	5			Take two German courses (2,5 ECTS each). Native German speakers take courses in another offered language	Seminar	me	3/4	5
CO12-210214	Physical Oceanography	Lecture	m	3	2,5							
CO12-210213	Earth System Monitoring and Remote Sensing	Lecture	m	4	2,5		**CA01-CarAdv**	**Career Advising[4]**				
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**		**JT-SK-Skills**	**Module: Skills**		**m**		**2,5**
CA07-EES	**Module: Project / Thesis EES**		**m**		**15**		JT-SK-990104	Advanced Scientific and Experimental Skills	Lecture	m	6	2,5
CA07-210304	Project EES		m	6	5		**JT-TA-TriArea**	**Module: Triangle Area**		**m**		**2,5**
CA07-210305	Thesis EES		m	6	10			Take one course from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	6	2,5
CAS-WT-EES	**Module: Specialization Area EES**		**m**		**10**							
	Take 10 ECTS of specialization courses [2]		me	5/6	10		**CA01-CarAdv**	**Career Advising[4]**				
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 1b - Mandatory Module and Examination Plan for Campus Track

Earth and Environmental Sciences – Campus Track

Matriculation Fall 2018

	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 mandatory CHOICE module listed below, this is a requirement for the EES program.											
CH04-GenEES	**Module: General Earth and Environmental Sciences**		**m**		**15**		**JT-ME-MethodsMath**	**Module: Methods / Mathematics**		**m**		**7,5**
CH04-210121	Introduction to Earth and Environmental Science	Lecture	m	1	5		JT-ME-120106	Applied Calculus I	Lecture	m	1	2,5
CH04-210103	DataLab: Introduction to Earth System Data	Lecture	m	1	2,5		JT-ME-120107	Applied Calculus II	Lecture	m	1	2,5
CH04-210123	The Earth-Ocean System and its Evolution	Lecture	m	2	5		JT-ME-120101	Mathematical Concepts in the Sciences	Lecture	m	2	2,5
CH04-210111	FieldLab: Earth and Environmental Systems and their Chemistry	Lab	m	2	2,5		**JT-SK-Skills**	**Module: Skills**		**m**		**2,5**
							JT-SK-990103	Scientific and Experimental Skills	Lecture	m	1	2,5
	Module: CHOICE (own selection)		**e**	**1/2**	**30**		**JT-TA-TriArea**	**Module: Triangle Area**		**m**		**5**
Students take two further CHOICE modules from those offered for all other study programs. [2]								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
							CA01-CarAdv	**Career Advising**[4]				
Year 2 - CORE					**45**							**20**
Take all three modules or replace one with a CORE module from a different study program. [2]												
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]	Lecture	me	3/4	7,5
CO10-210203	Sedimentology	Lecture	m	3	2,5							
CO10-210206	Structural Geology	Lecture	m	3	2,5							
CO10-210204	Marine Environments	Lecture	m	4	2,5							
CO10-210133	Introduction to Mineralogy	Lecture	m	4	2,5							
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-TA-TriArea**	**Module: Triangle Area**		**m**		**7,5**
CO11-210241	Geochemistry of Igneous and Aqueous Systems	Lecture	m	3	2,5							
CO11-210302	Environmental Geochemistry	Lecture	m	3	2,5			Take three courses from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	3/4	7,5
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**		**15**		**JT-LA-Language**	**Module: Language**		**m**		**5**
CO12-210223	Marine and Applied Geophysics	Lecture	m	3	2,5							
CO12-210225	Physics of System Earth	Lecture	m	3	5			Take two German courses (2,5 ECTS each). Native German speakers take courses in another offered language	Seminar	me	3/4	5
CO12-210214	Physical Oceanography	Lecture	m	3	2,5							
CO12-210213	Earth System Monitoring and Remote Sensing	Lecture	m	4	2,5		**CA01-CarAdv**	**Career Advising**[4]				
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**		**JT-SK-Skills**	**Module: Skills**		**m**		**2,5**
							JT-SK-990104	Advanced Scientific and Experimental Skills	Lecture	m	6	2,5
CA07-EES	**Module: Project / Thesis EES**		**m**		**15**		**JT-TA-TriArea**	**Module: Triangle Area**		**m**		**2,5**
CA07-210304	Project EES		m	5	5			Take one course from the triangle (BUSINESS, TECHNOLOGY & INNOVATION, SOCIETAL CONTEXT) area. Each counts 2,5 ECTS [3]		me	5	2,5
CA07-210305	Thesis EES		m	6	10							
CAS-CT-EES	**Module: Specialization Area EES**		**m**		**15**		**CA01-CarAdv**	**Career Advising**[4]				
	Take 15 ECTS of specialization courses [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).

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

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
DataLab: Introduction to Earth System Data	CH04-210103	2,5
Module Affiliation CH04-GenEES General Earth and Environmental Sciences	***Workload (hrs / sem)*** Contact Time: 25,50 Private Study: 37,00	***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 and Environmental Science sub-disciplines. Three main components of the course are included: a) an overview of the range of data types, standards, and formats commonly used in Earth and Environmental Science and exemplary data sources and data search, discovery, retrieval and inspection options, b) exemplary Earth and Environmental 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 Environmental Sciences will be described, collected, inspected and analyzed with available open source tools.

Methods of Assessment

Name	Weighting
Active Participation	10%
Final Exam	30%
Individual Report	40%
Tasks/exercises	20%

Course Name	***Course No***	***ECTS***
FieldLab: Earth and Environmental Systems and their Chemistry	CH04-210111	2,5
Module Affiliation CH04-GenEES General Earth and Environmental Sciences	***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 applied and exemplified to the geology, water chemistry and environmental problems in the old mining district of the Harz Mountains, Germany. The students participate in a three-day field laboratory that includes introductory lunchtime lectures prior to the field lab, the three-day (Sat – Mon) off-campus field lab in the Harz Mts. itself, and two evening lectures/practicals during the field lab.

Methods of Assessment

Name	Weighting
Field book notes and active participation	50%
Introductory report based on preparatory lectures	50%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Introduction to Earth and Environmental Science	CH04-210121	5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CH04-GenEES General Earth and Environmental Sciences	Contact Time: 35,00 Private Study: 90,00	Bachelor 1st Year CHOICE

Course Description / Content / Aims

Students are introduced to the fundamental principles and concepts in Earth and Environmental Sciences to gain better understanding of the System Earth and how our natural environment is affected by anthropogenic impact.
In the course unit Planet Earth we introduce Earth as a planet in our solar system, discuss planetary formation and evolution, explain how planetary rotation and orbital revolution give rise to seasonal, tidal, and climate cycles, and highlight the physical structure of Earth's interior. The course unit Plate Tectonics explores further the Earth's internal structure, discusses the minerals and the chemical composition of the Earth's mantle and the fundamental processes related to plate tectonics, that produce magma and volcanoes, and ultimately form the planet's solid surface. The course unit The Oceans is concerned with physical aspects of the Earth's oceans such as the vertical structure in coastal waters and the open ocean, ocean basin circulation, gyres, eddies, upwelling, and air-sea interactions. The course unit Seawater and Sediments covers a spectrum of topics ranging from the chemical composition of seawater and the marine carbon cycle to marine sediments and resources and the anthropogenic impact on marine ecosystems.

Methods of Assessment

Name	Weighting
Final Exam "Seawater and Sediments"	25%
Final Exam "The Oceans"	25%
Midterm Exam "Planet Earth"	25%
Midterm Exam "Tectonics"	25%

Course Name	***Course No***	***ECTS***
The Earth-Ocean System and its Evolution	CH04-210123	5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CH04-GenEES General Earth and Environmental Sciences	Contact Time: 35,00 Private Study: 90,00	Bachelor 1st Year CHOICE

Course Description / Content / Aims

The course provides an advanced introduction to the Earth-Ocean System and its anthropogenic disturbances. The biosphere is shielded from the hostile space environment by the Earth's atmosphere. The course starts with a discussion of atmospheric formation and stability, the role of solar radiation, vertical structure and composition of the Earth's atmosphere, clouds and precipitation, air pressure, wind, and atmospheric dynamics. Following a discussion of the fundamentals of geology which in the course of Earth history produced the different environments that have been the habitats for the evolution of life, 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. The final chapter of the course will focus on the effects of climate change and anthropogenic impact on the marine organic carbon cycle.

Methods of Assessment

Name	Weighting
Final Exam (The Anthropocene I)	25%
Final Exam (The Anthropocene II)	25%
Midterm Exam (Earth Evolution)	25%
Midterm Exam (The Atmosphere)	25%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Fieldtrip Environmental Changes and Challenges in Northwestern Germany	CO10-041202	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/or 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.

Methods of Assessment

Name	Weighting
Active Participation	20%
Field Trip Report	30%
Presentation	50%

Course Name	***Course No***	***ECTS***
Introduction to Mineralogy	CO10-210133	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.

Methods of Assessment

Name	Weighting
Final Exam	60%
Quizz(es)	40%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Volcanism and Metamorphism	CO10-210201	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO10-FundEES Fundamental Earth and Environmental Sciences	Contact Time: 17,50 Private Study: 45,00	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	***Course No***	***ECTS***
Sedimentology	CO10-210203	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO10-FundEES Fundamental Earth and Environmental Sciences	Contact Time: 17,50 Private Study: 45,00	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.

Methods of Assessment

Name	Weighting
Active Participation	10%
Assignments	45%
Final Exam	45%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Marine Environments	CO10-210204	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO10-FundEES Fundamental Earth and Environmental Sciences	Contact Time: 17,50 Private Study: 45,00	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.

Methods of Assessment

Name	Weighting
Final Exam	50%
Final Exam 2	50%

Course Name	***Course No***	***ECTS***
Structural Geology	CO10-210206	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO10-FundEES Fundamental Earth and Environmental Sciences	Contact Time: 17,50 Private Study: 45,00	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.

Methods of Assessment

Name	Weighting
Active Participation	20%
Assignments	40%
Final Exam	40%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Fieldtrip Volcanism and Hydrochemistry in the Eifel, Germany	CO11-210202	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Contact Time: 25,50 Private Study: 37,00	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.

Methods of Assessment

Name	Weighting
Active Participation	50%
Final Report	50%

Course Name	***Course No***	***ECTS***
Geochemistry of Igneous and Aqueous Systems	CO11-210241	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Contact Time: 17,50 Private Study: 45,00	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.

Methods of Assessment

Name	Weighting
Exam Bau	50%
Exam Koschinsky	50%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Isotope Geochemistry	CO11-210301	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Contact Time: 17,50 Private Study: 45,00	Bachelor 2nd Year CORE

Course Description / Content / Aims

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/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 paleooceanography and -climatology.
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.

Methods of Assessment

Name	Weighting
Final Exam	100%

Course Name	***Course No***	***ECTS***
Environmental Geochemistry	CO11-210302	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Contact Time: 17,50 Private Study: 45,00	Bachelor 2nd Year CORE

Course Description / Content / Aims

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.

Methods of Assessment

Name	Weighting
Final Exam	50%
Midterm Exam	50%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Applied Geochemistry	CO11-210362	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Contact Time: 17,50 Private Study: 45,00	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.

Methods of Assessment

Name	Weighting
Final Exam 1 (Bau/Krämer)	50%
Final Exam 2 (Koschinsky)	50%

Course Name	***Course No***	***ECTS***
Mineral Resources	CO11-210373	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO11-EOEnvChem Earth, Ocean and Environmental GeoChemistry	Contact Time: 17,50 Private Study: 45,00	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.

Methods of Assessment

Name	Weighting
Abstract	40%
Course Assignment	30%
Presentation	30%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Earth System Monitoring and Remote Sensing	CO12-210213	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Contact Time: 17,50 Private Study: 45,00	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.

Methods of Assessment

Name	Weighting
Attendance	10%
Final Exam	45%
Practical	30%
Quizz(es)	15%

Course Name	***Course No***	***ECTS***
Physical Oceanography	CO12-210214	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Contact Time: 17,50 Private Study: 45,00	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.

Methods of Assessment

Name	Weighting
Final Exam	50%
Midterm Exam	50%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Marine and Applied Geophysics	CO12-210223	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Contact Time: 17,50 Private Study: 45,00	Bachelor 2nd Year CORE

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 the students are introduced to the complex interplay of earth and marine processes on a wide range of spatial and temporal scales. Emphasizing general scientific concepts and important observation techniques, we discuss a range of topics including Earth as a planet on space and time, radiation and energy, atmospheric structure, air-sea interactions, global wind regimes, ocean circulation, El Nino, and climate change.

Methods of Assessment

Name	Weighting
Course Assignment	75%
Participation, attendance	25%

Course Name	***Course No***	***ECTS***
Physics of System Earth	CO12-210225	5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Contact Time: 35,00 Private Study: 90,00	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.

Methods of Assessment

Name	Weighting
Final Exam	40%
Home Work	20%
Midterm Exam	20%
Midterm Exam 2	20%

Appendix 2 - Course Data

Course Name	***Course No***	***ECTS***
Oceanographic Excursion: Research Cruise North Sea	CO12-210251	2,5
Module Affiliation	***Workload (hrs / sem)***	***Level***
CO12-EOEnvPhys Earth, Ocean, and Environmental Physics	Contact Time: 25,50 Private Study: 37,00	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.

Methods of Assessment

Name	Weighting
Attendance	20%
Cruise Report	50%
Work onboard	30%