

## **Course catalogue**

# **Master's programme**

## **Water Science and Management**

**2017-2018**

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## Preface

Welcome to the Master's programme Water Science and Management!

The Master's programme Water Science and Management is part of the Graduate School of Geosciences and is jointly organised by the Teaching Institute of Innovation, Environmental and Energy Sciences and the Teaching Institute of Earth Sciences. The programme aims to teach you the specialised knowledge and professional attitudes and skills needed to become a first class professional in the field of water science and management. The international setting of the Master's programme, combined with the small scale of the groups, strong involvement of organisations of the professional water field throughout the whole degree and the pleasant working atmosphere will contribute to this aim.

We hope this course catalogue will help you to find easily the relevant information you need as a student in the Master's programme. First a general description of the programme, the structure, the components and some organisational matters are presented. This is followed by a description of all courses of the two year programme. Information about procedures and the UU-time table are also included in the catalogue. The Teaching and Examination Regulations 2017-2018 (OER) can be found in Appendix II and the Regulations of the Board of Examiners will be published separately on the UU website.

At any time during your studies you will need two course catalogues: one of the year you started your Master's programme in Water Science and Management (this shows the examprogramme that you need to follow) and one of the most recent academic year, which shows the current Rules & Regulations.

You can find more information on the website at: <http://students.uu.nl/en/geo/wsm>. Still, if you have some (personal) questions, you can contact the Student Advisor of the programme.

On behalf of the staff we wish you an inspiring, pleasant and successful new academic year!

Dr. Paul Schot, Programme Leader Master Water Science and Management  
(Environmental Sciences),

Prof. Dr. Marc Bierkens, Programme Leader Master Water Science and Management  
(Earth Sciences),

Dr. Martin Hendriks, Director of Education Earth Sciences  
and

Dr. Jacco Farla, Director of Education Innovation, Environmental and Energy Sciences

## **1 Profile of the programme**

### **1.1 Profile of Water Science and Management**

Water Science and Management is an academic Master's programme that integrates knowledge from the natural and the social sciences as a response to (emerging) needs in the professional field. The trend of more holistic approaches, stemming from the pursuit for sustainable development, participation of stakeholders and economic accountability, increasingly complicate the tasks of water managers. This has given rise to a need for water managers with a broad societal focus on water management issues, operating next to and in cooperation with more traditional and technical water managers.

The Master's programme Water Science and Management focuses on students from the natural sciences with an interest in water management. These students are both interested in the scientific analysis of the water system, but also in the application of water science in integrated and complex societal problems that occur in contemporary water management.

This 2-year Master trains students to become water professionals with both the knowledge of the technical aspects of water management and the ability to implement this knowledge with an eye for societal needs. They view water management in light of sustainable development, taking into account the functions water fulfils for mankind and nature, and consider technical innovations in view of societal costs and benefits. Graduates have a solid basis in water science in conjunction with the ability to apply their knowledge in policy formulation.

Eligible for admission to the programme Water Science and Management is the holder of a Dutch or foreign degree who has knowledge, insight and competences on university bachelor level and who can prove to have the following specific knowledge, insight and competences:

- a) Knowledge in the area of Earth Sciences, Environmental Sciences or Natural Sciences at or equal to the advanced level of the major Earth Sciences, Environmental Sciences or Natural Sciences of Utrecht University.
- b) Insight in Earth Sciences, Environmental Sciences or Natural Sciences at or equal to the advanced level of the major Earth Sciences, Environmental Sciences or Natural Sciences of Utrecht University.
- c) Academic skills and research skills at or equal to the major Earth Sciences, Environmental Sciences or Natural Sciences of Utrecht University.

Selection of students will be based on judgment of the following core competences of the applicant:

- a) Motivation and talent (also based on GPA and study progress);
- b) Level of relevant knowledge and command of methods and techniques of the relevant study area;
- c) General academic level of thinking and working;
- d) Command of the language(s) used in the programme.

### **1.2 Mission**

The mission of the Master's programme Water Science and Management is to educate academic water professionals that are able to make a substantial contribution to sustainable development, through their scientific water knowledge and their ability to apply this knowledge in water management policies.

### **1.3 Degree requirements**

The following general qualifications apply to the programme Water Science and Management as a whole. The graduates are able to:

- analyse technical and societal issues, and the relations between them, relevant to contemporary and future water management aimed at sustainable development;
- understand, and perform basic calculations on, natural and technical processes related to water quantity and water quality issues;
- design, carry out and report on scientific research on the issue of water management in a creative and independent way;
- engage in a scientific, social and administrative debate on the issue of water management;
- communicate on the issue of water management verbally and in writing to a wide audience of water specialists and non-specialists alike.

### **1.4 Competence profile**

The Master's programme trains students to become academic professionals in the field of water management aimed at sustainable development. They are complementary to more traditionally educated water specialists with a natural sciences focus, thus filling the demand in the professional field for more holistic water managers characterised by:

- insight in the full breadth of contemporary water management, and notably in the relations between different scientific and professional perspectives;
- ability to work with specialists from different backgrounds on complex, integrated water management projects and planning.

Graduates are characterised by:

- overview of natural and technical processes related to water quantity and water quality;
- overview of relevant aspects of integrated water resources management;
- insight in the approach of more specialised technical water managers;
- technical competences in a limited number of quantitative water management skills (e.g. modelling);
- insight in the approach of social scientists (policy makers, legal advisors);
- insight in relevant legislation, policy frameworks and institutions for water policy and management in The Netherlands, in Europe and globally;
- insight in contemporary trends in water management and the ability to integrate this knowledge in policy documents for water management, physical planning and sustainable development;
- ability to work with specialists from different backgrounds on complex, integrated water management projects and planning.

### **1.5 Career prospects**

The professional field consists of a wide variety of organisations in The Netherlands and abroad:

- Consultancy firms;
- Water boards;
- Governmental organisations;
- Utility companies;
- Water research institutes;
- NGOs;
- International development organisations.

The graduates have a number of technical skills which enable them to acquire junior positions at the start of their career. Based on their broad knowledge of contemporary water management they are expected to move relatively fast to more senior and strategic planning, policy and management positions, dealing with issues involving specialists from different backgrounds and/or societal stakeholders. Some graduates may also develop themselves further into more technical specialists while on the job.

## 2. Structure and content of the programme

### 2.1 Programme structure

The Master Water Science and Management is a two year (academic) Master. Students have to earn 120 European Credit Transfer System (EC) points.

The Master's programme may be followed along two, only slightly different, pathways:

- enrolling as Earth Sciences Master student with an accent on Water Science;
- enrolling as Environmental Sciences Master student with an accent on Sustainable Development.

The formal difference is that you will either get a Master's degree in Earth Sciences or Environmental Sciences respectively. Both degrees will indicate you followed the Water Science and Management Master's programme.

The substantial difference in the programme is limited to one course (period 2, year 1):

- Earth Sciences students acquire extra training in Water Systems by choosing one elective out of two relevant Water Science courses;
- Environmental Sciences students acquire extra training in methods of Sustainability Science.

The programme of the two different pathways is presented below. The course descriptions can be found in chapter 5.

	Earth Sciences student		Environmental Sciences student	
period 1	<b>Principles of Groundwater Flow</b>	<b>Perspectives on SD</b>	<b>Principles of Groundwater Flow</b>	<b>Perspectives on SD</b>
period 2	<b>Unsaturated Zone Hydrology or Hydrogeological Transport Phenomena</b>	<b>Quantitative Water Management</b>	<b>Sustainability Modelling and Indicators</b>	<b>Quantitative Water Management</b>
period 3	<b>Research Design</b>	<b>Managing Future Deltas</b>	<b>Research Design</b>	<b>Managing Future Deltas</b>
period 4	<b>Water, Governance and Law</b>	<b>Drinking water and Sanitation</b>	<b>Water, Governance and Law</b>	<b>Drinking water and Sanitation</b>
period 5	<b>Land Surface Hydrology</b>	<b>Transdisciplinary Case Study</b>	<b>Land Surface Hydrology</b>	<b>Transdisciplinary Case Study</b>
period 6	<b>Master's thesis (Internship) or Elective</b>	<b>Master's thesis (Internship) or Elective</b>	<b>Master's thesis (Internship) or Elective</b>	<b>Master's thesis (Internship) or Elective</b>
period 7	<b>Master's thesis (Internship)</b>	<b>Master's thesis (Internship)</b>	<b>Master's thesis (Internship)</b>	<b>Master's thesis (Internship)</b>
period 8	<b>Master's thesis (Internship) or Elective</b>	<b>Master's thesis (Internship) or Elective</b>	<b>Master's thesis (Internship) or Elective</b>	<b>Master's thesis (Internship) or Elective</b>

The programme schedule consists of two semesters and each semester consists of two blocks. In each block 2 courses of 7,5 EC are followed, each running half-time over about 10 weeks. Please note that due to the combination of Earth Science courses and Environmental Science courses in the WSM programme, your courses in each period may not start and end in the same weeks. Therefore, *always check the course manual for each course carefully to see when your classes, exams and resits are!*

The first year is dedicated to basic knowledge and skills which are acquired in 8 courses. In the second year the emphasis is on application of the acquired knowledge and skills in real world situations in the professional field outside the university. This application emphasis is realised in two main ways:

- the Transdisciplinary Case Study (GEO4-2302). In this course students work on a multidisciplinary assignment for a real world client. They work in groups with students from different scientific backgrounds in order to acquire skills to effectively communicate and design solutions in a multidisciplinary setting for societal clients and stakeholders.
- the Master's thesis (internship) (GEO4-6004). This course consists of a research assignment performed at a relevant external organisation or at a university. Further details are described in paragraph 2.2.

## **2.2 Master's thesis (internship)**

The Master's thesis (internship) (GEO4-6004) may be followed for 30 or 45 EC. The amount of EC has to be motivated by the student in relation to the work needed; e.g. gathering new empirical data from the field may require more time than analysing an existing database. No other amount than 30 or 45 EC is possible. It is not possible to change the number of EC after the research proposal has been approved by the Board of Examiners.

The Master's thesis (internship) represents the culmination of the study, and provides the proof of the capability of the student to formulate and carry out (semi) independent research. The Master's thesis (internship) may be executed by on-site training during an Internship. This allows the student to obtain insight into the demands and constraints of doing research within the day-to-day practice of the professional water manager. In that case the academic report of the Internship is the student's Master's thesis. The Master's thesis (internship) may also be executed at a university.

Internships provided by organisations in the professional field, as well as water research opportunities at universities, will be posted on a designated website within the e-learning environment on Blackboard. The Faculty of Geosciences also has its own digital internships database: <http://internships.geo.uu.nl>. However, students are also encouraged to arrange their own internship, especially if they want to do an internship at a specific organisation or abroad. This process must be started at an early stage (preferably at the end of the first year) as it usually takes some time before all arrangements have been finalised. Consult the programme leader at an early stage if you have plans to arrange your own internship, to determine whether your idea is likely to be approved. He may also have useful contacts or ideas on possible internships. Every Master's thesis research or internship has to be approved by the Board of Examiners, based on a proposal (including time schedule) submitted by the student and supported by a proposed supervisor from the academic staff.

To start the Master's thesis (internship) the minimum requirement in terms of EC obtained in the programme is 60 EC. Note that this is only the minimum requirement. Usually, the student is expected to have completed more course modules.

For information on procedures regarding the Master's thesis (internship), see the course manual Master's thesis (internship) WSM, which can be found on the Blackboard Community Water Science and Management.

For any other information contact the programme leader:

- for Earth Sciences students: Prof. dr. Marc Bierkens ([M.F.P.Bierkens@uu.nl](mailto:M.F.P.Bierkens@uu.nl));
- for Environmental Sciences students: Dr. Paul Schot ([P.P.Schot@uu.nl](mailto:P.P.Schot@uu.nl)).

## **2.3 Tailor-made course and other electives**

In the Water Science and Management programme, there is room to choose other Master's courses as electives in the programme. Students may also opt for a Tailor Made Course in which they develop their own project. This project must contribute to the competences of the students as specified in the degree requirements of the Master's programme in Water Science and Management. Moreover the contents of the project must be additional to the courses already followed. Examples of projects include research projects, literature reviews, participation in summer schools, etc.

The student takes the initiative to formulate a proposal for a Tailor-made course (GEO4-6005) and must find a staff member willing to provide guidance and grading during the course. Note that staff members are not obliged to supervise a Tailor Made Course.

The proposal must be approved by the Board of Examiners and should contain at least the following elements:

1. start with "*Proposal for a Tailor-made course within the master programme Water Science and Management*";
2. Name and studentnumber;
3. Date;
4. Supervisor (staff member);
5. Title for your course;
6. Requested EC (7,5 or 15);
7. Intended learning outcomes;
8. Relation of learning outcomes to Master's programme degree requirements;
9. Short description of activities;
10. End products;
11. Mode of assessment (like the Master's thesis' assessment form);
12. Time planning for the intended EC, including feedback sessions with the supervisor.

After the proposal has been written, it must be approved and signed by the staff member who is supervising and grading the course, and then be sent to the Board of Examiners. Please note that these procedures take time, so *start with organising your Tailor-made course well ahead of the start date*. The course will not start until the Board of Examiners has approved your proposal. The Board of Examiners may take a maximum of 6 weeks to assess your proposal. If you have any questions regarding the possible content of your Tailor-made course please contact your track coordinator.

### *Other electives*

The Tailor-made course is not the only option to fill 15 EC of elective courses in the programme. With your electives you can specialise in a field of your interest, possibly related to your graduation topic. The only restriction on the choice of elective courses is that their relevance for the field of WSM has been made clear, and that they are part of a Master's programme or of a comparable level. The procedure for choosing electives is described in Appendix I.

Elective courses can also be followed at other universities. Please note that students with non-EEA nationalities may have to pay a steep fee in order to take elective courses at another Dutch university. This fee cannot be paid for or reimbursed by Utrecht University.

The Babel Talen Institute offers a short course in English for Academic Purposes. This course aims to practice the writing and presenting skills students need in their Master's

programme. It does not offer any credits but you can take the course outside your WSM programme, at your own expense. Please see <http://wwwbabel.nl/language-courses/open-courses/english/course-english-for-academic-purposes/?lang=en> for more details.

## **2.4 Young Innovators Programme**

Utrecht University offers the Young Innovators Programme to high-achievers with leadership potential. Young Innovators Programme is a selective 15 EC honours course at graduate level, to be taken on top of any master's programme.

The Young Innovators programme embodies a community of learning, where the focus is on creating positive impact through social innovation and personal leadership. As such, the programme focuses on learning to research, design and deliver innovative and sustainable solutions to real-life societal challenges. Supported by leading researchers from the University's strategic theme Institutions for Open Societies, the programme allows you to immerse yourself in both theory and practice of innovation across corporate, public and community sectors.

During this program you will be stimulated to collaborate, produce and learn in multidisciplinary teams. In this, you are challenged to take ownership of both your own and collective learning processes and thereby invited to co-create the program design.

Young Innovators is an honours programme designed for students who have the will and ability to stretch themselves beyond the confines of their regular Master's programme. Young Innovators is about learning and working differently: experientially, through ownership, through challenging teamwork, on the borderlines of academia and practice, and at the interface of research and intervention.

Being part of this learning community, you:

- are part of an inspiring and experiential learning environment that may further enhance the basis for your professional network;
- work in an interdisciplinary team on a real-life societal challenge;
- present your team's work-in-progress at several plenary conferences;
- attend supportive meetings to acquire the knowledge, skills and inspiration needed for social innovation;
- learn to take ownership of your own learning processes and the program design.

Interested in this programme? Learn more about the admission requirements?  
<http://wwwuu.nl/masters/en/general-information/international-students/about-utrecht-university/young-innovators>.

## **2.5 Entrance requirements and other restrictions WSM courses**

Some courses in the WSM programme require prior knowledge, to be gained by passing or at least attending certain previous WSM-courses. In the table on the next pages and in the course descriptions (chapter 5) you will find which courses carry which entrance requirements or recommended prerequisites or may have other entrance restrictions.

In case of a discrepancy between the entrance requirements and/or recommended pre-requisites and/or other restrictions mentioned in this course catalogue and the ones mentioned in the electronic UU course offerings database 'Osiris', the entrance requirements and/or recommended pre-requisites and/or other restrictions mentioned in the tables below are leading.

## **Entrance requirements**

<b>Course</b>	<b>Entrance requirement</b>
Hydrogeological Transport Phenomena (GEO4-1433)	<ul style="list-style-type: none"> <li>- BSc or equivalent degree in Earth Sciences or related field;</li> <li>- having followed Principles of Groundwater Flow (GEO4-1434) or an equivalent Masters-level course.</li> </ul> <p>Recommended prerequisites:</p> <ul style="list-style-type: none"> <li>- basic knowledge of hydrology, geology and geochemistry.</li> </ul>
Principles of Ground Water Flow (GEO4-1434)	<ul style="list-style-type: none"> <li>- Letter of acceptance MSc Earth Sciences or MSc Water Science and Management.</li> <li>- BSc or equivalent in Earth Sciences, Applied Sciences, or related fields.</li> <li>- basic knowledge of physics, calculus, ordinary and partial differential equations.</li> </ul> <p>Recommended prerequisites:</p> <ul style="list-style-type: none"> <li>- basic knowledge of hydrology, introductory geology and/or environmental sciences.</li> </ul>
Perspectives on Sustainable Development (GEO4-2301)	Letter of acceptance MSc Sustainable Development or MSc Water Science & Management
Transdisciplinary Case Study (GEO4-2302)	<ul style="list-style-type: none"> <li>- Letter of acceptance MSc Sustainable Development or MSc Water Science &amp; Management.</li> <li>- At least 30 EC gained in the master SUSD or WSM, including Perspectives on Sustainable Development (GEO4-2301).</li> </ul>
Research Design (GEO4-2314)	Letter of acceptance MSc Sustainable Development or MSc Water Science and Management.
Sustainability Modelling & Indicators (GEO4-2331)	<p>Letter of acceptance MSc Sustainable Development or MSc Water Science and Management.</p> <p>Recommended prerequisite: Perspectives on Sustainable Development (GEO4-2301)</p>
Managing Future Deltas (GEO4-4403)	General principles of coastal and river geomorphology. Students have to appreciate the role of interdisciplinary science and the role of (applied) sciences in societal issues and coastal zone and river basin management problems and challenges. In-depth lectures concerning these subjects will not be given but relevant literature will be provided.
Land Surface Hydrology (GEO4-4404)	<p>Letter of acceptance MSc Earth Sciences or MSc Water Science and Management.</p> <p>Recommended prerequisites: Basic</p>

	knowledge of quantitative analysis, including statistics, mathematics (differentiation, integration) and physics (mechanics).
Unsaturated Zone Hydrology (GEO4-4417)	<p>Letter of acceptance MSc Earth Sciences or MSc Water Science and Management.</p> <p>Recommended prerequisites:</p> <ul style="list-style-type: none"> <li>- Knowledge of groundwater hydrology: GEO2-4203 Physical hydrology or GEO4-1434 Principles of groundwater flow (or equivalent);</li> <li>- basic physics/mathematics skills.</li> </ul>
Quantitative Water Management (GEO4-6001)	<p>Letter of acceptance of a Master's programme.</p> <p>Recommended prerequisites:</p> <ul style="list-style-type: none"> <li>- A bachelor level natural sciences background.</li> <li>- One or more of the following courses: GEO2-4203 Physical Hydrology; GEO3-4307: Fluid mechanics 1; GEO4-1434 Principles of groundwater flow; GEO4-4404: Land surface hydrology.</li> </ul> <p>Students without a natural science Bachelor's degree should contact the course coordinator <i>before</i> registering for the course.</p>
Water, Governance and Law (GEO4-6002)	Letter of acceptance of a Master's programme.
Drinking Water and Sanitation (GEO4-6003)	<p>Letter of acceptance of a Master's programme.</p> <p>Recommended pre-requisite: A bachelor level natural sciences background.</p> <p>Students without a natural science Bachelor's degree should contact the course coordinator <i>before</i> registering for the course.</p>
Master's thesis (Internship) (GEO4-6004; GEO4-6006)	<p>Letter of acceptance MSc Water Science and Management. At least 60 EC passed within the programme.</p> <p>Students that started the WSM programme in February 2016 and who do not fulfill this entrance requirement need to file a request with the Board of Examiners for an exemption of the entrance requirement.</p>
Tailor made course WSM (GEO4-6005)	Letter of acceptance MSc Water Science and Management. At least 45 EC passed within the WSM programme.

## **Other restrictions**

<b>Course</b>	<b>Max. participants</b>	<b>Other restrictions</b>
GEO4-1433: Hydrogeological Transport Phenomena	-	Open access
GEO4-1434: Principles of Ground Water Flow	-	Only open for Earth Sciences and WSM
GEO4-2301: Perspectives on Sustainable Development	-	Only open for SUSD and WSM
GEO4-2302: TCS	-	Only open for SUSD and WSM
GEO4-2314: Research Design	-	Only open for SUSD and WSM
GEO4-2331: Sustainability Modelling and Indicators	-	Only open for SUSD and WSM
GEO4-4403: Managing Future Deltas	-	Only open for Earth Sciences and WSM
GEO4-4404: Land Surface Hydrology	-	Only open for Earth Sciences and WSM
GEO4-4417: Unsaturated Zone Hydrology	-	Only open for Earth Sciences and WSM
GEO4-6001: Quantitative Water Management	-	Open access (ba natural science background)
GEO4-6002: Water, Governance and Law	-	Open access
GEO4-6003: Drinking Water and Sanitation	40	Open access (ba natural science background); WSM students have priority.
GEO4-6004 + GEO4-6006: Master's thesis (internship)	-	Only open for WSM
GEO4-6005: Tailor-made course WSM	-	Only open for WSM

## **Exclusions:**

<b>Students that passed the course:</b>	<b>... are not allowed to take the course:</b>
GEO4-1441/1517A/1425/1437	GEO4-2325
GEO4-4423	GEO4-2327
GEO4-2327	GEO4-4423
GEO4-2325	GEO4-1441/1517A/1425/1437

## **2.6 Conversion of former courses**

Please notice that some of the courses from the programme 2016-2017 and before have been replaced or renamed. The following courses from 2016-2017 and earlier are replaced or renamed as follows:

<b>Old course</b>	<b>New course 2017-2018</b>
Environmental Systems Analysis (GEO4-2303)	Research Design (GEO4-2314)

### **3. Didactics, study management and practical matters**

#### **3.1 Educational format**

##### *Activating education*

The educational philosophy of the Master's programme is problem-orientated, which calls for a proactive teaching format. Problem-orientated education takes a concrete problem as the point of departure for the learning process. The acquisition of knowledge and skills is related to the analysis and/or solution of the problem in question. "Activating education" is a form of teaching whereby the students themselves are largely in control of the learning process. They take their education into their own hands by doing individual or group assignments, taking part in debates or simulation games, and applying the methods they have learned. A proactive educational format calls for intensive back-up on the part of the instructor in the form of study guidelines, instructions, manuals, and feedback on the students' performance. During contact hours, the students mainly work in small groups.

##### *Active input of instructors and students*

The objective of the Master's programme is to offer an inspiring and high-quality environment for study. The goal is to work together with the student to maximise the transfer of knowledge. All of the instructors and support staff involved in the programme operate on the assumption that if the student is fully dedicated to the study, they can offer the greatest possible guarantee that the student will pass all of the individual courses.

##### *Required attendance*

For various parts of the study, attendance is mandatory. This applies to working groups, field trips, simulation games, etc. The course manual for each course stipulates exactly which sessions the student is required to attend. As stated in article 4.4 of the Education and Examination regulations, exceptions to mandatory attendance can only be made if the student can prove that his absence is due to reasons beyond his control (special circumstances due to e.g. illness or family circumstances).

##### *Report ill in time*

If you cannot attend a preliminary or other exam, lecture or working group, please phone the department's secretariat *prior* to the meeting, and by 9.30 a.m. at the latest. Environmental Sciences students have to notify the IEES secretary's office: 030-253 1625 or 030-253 2359. Earth Sciences students have to contact the Earth Sciences secretary's office: 030-253 5050.

Absence or illness does not relieve you of your obligation to perform to the best of your ability. In other words, if you have not been able to complete a paper or give a presentation, contact the Course Coordinator to find out if it can be rescheduled for another date.

If the quality or quantity of your attendance has been insufficient, the Course Coordinator may exclude you from the remainder or part of the course.

##### *Testing*

There are multiple points during a course in which the student is tested. Thus, the final evaluation for a course does not depend solely on a final exam. As a rule, there are opportunities for feedback and improvement, depending on how the course is designed. These opportunities are set forth in the course manual. If during the course the student satisfies all the effort requirements and does not receive a satisfactory grade but does receive a final grade of at least 4.00 before rounding, he or she will be given one opportunity to take a supplementary test. The specifics can be found in the Teaching and Examination Regulations and the course manuals.

### *Plagiarism, Code of Originality*

Since science is about developing new knowledge, in all phases of the Master's programme, much attention is paid to the originality of the students' achievements, for instance with the aid of advanced software. All scientific research, including that of a student, builds on the results of the work of other researchers, either in positive or in negative sense. Those other researchers deserve the credits for their work, in the form of a correct acknowledgement.

This implies: referring to or quoting other work is allowed (and even necessary), but copying other researchers' work and presenting it as if it were one's own, is plagiarism. This is considered a huge sin in science. Therefore students have to sign a Statement of Originality when they submit the Master's thesis. Students, who plagiarise, run severe risks: in the worst case they are expelled from the programme for a year. The Teaching and Examination Regulations of the programme lists the sanctions with which a student who is caught plagiarising will be confronted.

## **3.2 Study management and supervision**

### **3.2.1 Introduction for new students**

There will be an introduction for Master novices in the first week of their first semester, organised by WSM and its study associations UAV and Storm. Both social issues and general information will be presented during this introduction. Its objective is to help new students feel at home at the Master's programme WSM and the faculty, as soon as possible. Focus will be on meeting your fellow students, getting to know the WSM-programme itself, its professors, mutual rights and obligations, information desks and the buildings where you will spend much of your time in the next couple of years.

### **3.2.2 Study planning and advice**

During your studies, you will be guided and supervised by the programme leaders and the Study Advisors of the programme.

The programme leaders (dr. Paul Schot for Environmental Sciences and prof. Marc Bierkens for Earth Sciences) advise their students on the choices that can be made within the Master's programme. These choices pertain to elective courses and options for internships and thesis research, for instance.

During your entire programme, you can go to the Study Advisors, Jana Scheuer for Environmental Sciences and dr. Almar de Ronde for Earth Sciences, for neutral and confidential advice on everything that is related to your studies. This can be on issues that are directly study-related, for example study delay, electives, dissatisfaction with the programme, or a potential conflict with a teacher or supervisor. But you can also discuss more personal issues that might be of influence on your progress, such as illness, disability, pregnancy, family circumstances, top-class sports, motivation issues, et cetera. When necessary, the Study Advisor can refer you to a Student Counsellor, Student Psychologist, or for example a study skills class.

In the unfortunate situation that you expect to suffer study delay due to personal circumstances, it is important to contact the Study Advisor as early as possible. Together you can discuss how you could deal with these circumstances and perhaps the programme could offer you a concession (e.g. extra time for an exam or paper).

You can contact Jana Scheuer through [j.scheuer@uu.nl](mailto:j.scheuer@uu.nl) and Almar de Ronde through [studieadviseur.aw@uu.nl](mailto:studieadviseur.aw@uu.nl). They are located in the Koningsberger building, rooms 1.20D and 1.20F respectively.

The Study Advisors are members of the Dutch National Society of Study Advisors and work according to the code of conduct of this professional society, see [www.lvsa.nl](http://www.lvsa.nl) for details.

The Study Advisors are in regular contact with other Study Advisors of the Faculty and University, which makes peer feedback and cooperation possible. If the Study Advisor is not available due to illness or holiday and you urgently need a confidential consult, please feel free to contact any of the other Study Advisors of the Faculty of Geosciences. You can find their contact details via the Student Affairs office Geosciences: [studentaffairs.geo@uu.nl](mailto:studentaffairs.geo@uu.nl).

### **3.3 Course registration and automatic graduation**

#### **3.3.1 Semesters and blocks**

Classes take place during two semesters, each of which can be divided into two blocks, or periods of 9 or 10 weeks. In Appendix III and IV you will find the start and end dates of each block for this academic year. Please note that due to the combination of Earth Science courses and Environmental Science courses in the Water Science and Management programme, your courses in each period may not start and end in the same weeks. Therefore, *always check the course manual for each course carefully to see when your classes, exams and resits are!*

#### **3.3.2 Timeslots**

At Utrecht University a so-called timeslotmodel is used to schedule courses to fit into fixed parts of the week. Using this model prevents overlap in a schedule. In this way it is easy to see if two courses can be taken in the same period.

The Utrecht University timeslotmodel consists of five slots (A, B, C, D, E).

Timeslot A = Monday morning and Wednesday morning

Timeslot B = Tuesday morning and Thursday afternoon

Timeslot C = Monday afternoon and Thursday morning

Timeslot D = Wednesday afternoon and Friday

Timeslot E = Monday evening until Friday evening

Morning = 09.00-12.45 hours, afternoon = 13.15-19.00 hours, evening = 18.00-21.45 hours.

Periods and timeslots have been put into the course schedule (5.1). Changes to the course schedule are still possible. The final scheduling (time and lecture room) of each courses will be made public via <http://students.uu.nl/en/geo/wsm/academics/schedules>. Also check the Blackboard e-learning environment of your course for latest changes in the course programme.

#### **3.3.3 Course registration**

In order to participate in a course, you need to be registered for it: if you are not, you will not have access to the course and its supporting facilities such as Blackboard; neither will results be registered. No registration = no participation = no result.

As a student, **course registration is your own responsibility!** You decide which courses (elective and mandatory) you want to take in each block. Keep in mind possible entrance requirements to a course; students that do not adhere to entrance requirements cannot register for the course and/or will be removed from the course.

Course registration is **only possible via internet**, [www.uu.nl/Osirisstudent](http://www.uu.nl/Osirisstudent) and **only within the official registration periods**, which usually fall in the beginning of the previous block (for the dates of the Faculty of Geosciences, please see Appendix IV). You can register for no more than 2 courses (15 EC) of the Faculty of Geosciences per period (code GEO\*-\*). Students that register on time are generally secured of a place in the course; however, courses that have a limited capacity have certain placement rules. Just before the start of the block, there are 2 days for late registration, in case you want to switch courses. Please note: this is only possible for courses that are not full yet; participation is therefore not guaranteed.

If you want to register for a course outside the Faculty of Geosciences, there could be different registration dates; at some Faculties, students register only once per semester.

Each period (or block) you can register for a maximum of two courses (15 EC) of the Faculty of Geosciences via Osiris (code GEO4-\*). Any student that wants to take a third course, needs permission of the programme. If the 3<sup>rd</sup> course is a course of one of the Master's programmes of the department of Innovation, Environmental and Energy Sciences or the department of Earth Sciences, you can fill out a digital form on: <https://fd8.formdesk.com/universiteitutrecht/additionalcourseGEO>.

Please note:

- This registration form needs to be submitted during the regular registration period. During the late registration ('na-inschrijving') it is no longer possible to apply for an additional course.
- You have to be enrolled for your other courses in Osiris before submitting your request for an additional course.
- The additional course should be a course from your own major programme/department.
- Students are not allowed to participate in more than one course in the same timeslot.
- Enrolment in an additional course may be declined by the Director of Education in case of insufficient study progress and/or insufficient capacity for a course.

**After the regular registration period** and during late registration periods, no requests for taking a 3<sup>rd</sup> course will be dealt with and therefore they will always be denied. If the course is full, the request for a 3<sup>rd</sup> course will also be denied. Only as an exception and based on sufficiently important reasons will the programme allow a student to take three courses in one period.

A request for taking a 3<sup>rd</sup> course will need to address the criteria mentioned below and these will be checked:

- Motivation: what is the student's motivation?
- Circumstances: are there any special, personal circumstances?
- Urgency: is it, at this point in time, necessary that the student takes three courses at once?
- Feasibility: can the student handle taking three courses at the same time? The following issues will be looked at in order to check this criterion:
  - o Study progress.
  - o Study results so far.
  - o Has the student taken three courses before and if so, were they all completed successfully?
- Is the Master's thesis one of the three courses the student wishes to take? If this is the case, the request will not be granted.
- Timeslot: if the 3<sup>rd</sup> course falls in the same timeslot as any of the other courses you will be taking, the request for a 3<sup>rd</sup> course will never be granted.

Students that do not adhere to the registration periods can only under very special circumstances be placed in a course after permission from the Board of Examiners, which can be reached via [examencommissie.geo@uu.nl](mailto:examencommissie.geo@uu.nl). Always give our student number when communicating with the Board of Examiners. The Board of Examiners (NOT the lecturer of the course) decides whether you have a valid reason for not registering during the registration periods. If the Board of Examiners decides you do not have a valid reason, you cannot attend a course and no course results will be registered.

In other words: register early, as early as possible, for the courses that you want to take in the next block! *This also applies to the obligatory courses!*

### **3.3.4 Automatic graduation**

When you are due to finish your programme, you will receive a message from the student administration about your graduation. After it has been verified that you have fulfilled all requirements of your programme, the Board of Examiners will be asked to judge your file. Please note: in order to graduate, you need to have fulfilled all requirements: all grades are known and registered in Osiris, you have paid all tuition fees, hard copies of any earlier decisions taken by the Board of Examiners have been handed in to the Student Affairs office Geosciences (if applicable) and you have uploaded your thesis to Scripties Online: <https://osiris.library.uu.nl/scrol2/index.html?ou=GEO>.

Under certain conditions, it is possible to postpone your graduation, see article 6.1.6 of the Teaching and Examination Regulations 2017-2018.

In order to actually receive your degree certificate or to pick it up at the Student Affairs office Geosciences, you need to fill out an exam-registration form. If you want to attend a graduation ceremony, strict deadlines regarding registration and handing in of any documents will be maintained.

Automatic graduation does not mean you will be de-registered automatically from the programme. You will need to take care of this yourself and this cannot be done until you have received formal confirmation of your graduation from the Board of Examiners.

## **3.4 Study abroad**

Studying abroad means broadening your horizon, meeting new people, exploring different cultures, and expanding your field of study. If you are interested in going abroad there are many possibilities. You can follow courses, do an internship or conduct research. Make use of what the university in general, but the Faculty of Geosciences in particular, has to offer you.

### A lot to organise?!

Don't worry, just make sure to start planning your period abroad in time. Do you want to study abroad? Start via the International Office Online:

<http://students.uu.nl/en/academics/study-abroad>.

Answer these questions:

- Where would you like to go to?
- What do you want to do?
- Does this university have an agreement with UU?
- Which courses would you like to attend?
- When would you like to go?

Once you have found an answer to these questions, contact your Study Advisor to connect your period abroad to your study plan in Utrecht.

After you have consulted with your Study Advisor, The International Office of Geosciences is there to guide you through the process. For all your practical questions, please contact [international.geo@uu.nl](mailto:international.geo@uu.nl) or visit Student Affairs / International Office on the 1<sup>st</sup> floor of the Victor J. Koningsberger building. Open daily apart from Wednesdays from 10.30-11.30 and 12.30-14.30 hrs or by appointment.

Besides, please visit our study association EGEA (Ruppert Building), or visit <http://www.egea.eu/entity/utrecht>. EGEA members generally have a lot of experience with studying abroad. They can help you out with a lot of practical matters (such as housing, experiences and tips & tricks).

In October and November several orientation meetings take place organised by the International Office. For more information, look for more information or dates at this website: <https://students.uu.nl/en/academics/study-abroad/faculty-information/geosciences>.

#### Practical matters

Once you've decided to study abroad, you can apply through the regular procedure. Please do keep in mind the deadlines for application! More information about how to apply and which deadline to bear in mind can be found on the website: <https://students.uu.nl/en/academics/study-abroad>. For faculty destinations, go to destinations and select Geosciences. For the Faculty International Office website, please look here: <https://students.uu.nl/en/academics/study-abroad/faculty-information/geosciences>.

#### Good to know

- Eligible for studying abroad during their master are all students with formal permission from their programme coordinator. To obtain permission please use the 'study plan for studying abroad' (available via: <http://students.uu.nl/en/academics/study-abroad/step-2-application-at-uu>).
- After your programme coordinator has signed the study plan, upload it in Osiris
- Credits obtained at partner universities can quite often easily be transferred to your academic record in Utrecht: study abroad doesn't necessarily cause delay in your programme!
- If your destination is within Europe, either for courses (exchange) or an internship, you are eligible for an ERASMUS grant. Monthly financial support to make your study abroad easier than it already is.
- If your destination is outside Europe, please have a look at [www.beursopener.nl](http://www.beursopener.nl) and find out if you are eligible for the options mentioned.
- If you're going abroad, you'd better put your public transport (OV) student chip-card on hold (public transport card for Dutch students). By doing this, you can apply for a monthly travel allowance. Forms for this allowance are to be signed by the Student Affairs office/International Office.

## **4. Organisation**

### **4.1 Organisation at programme level**

For the day-to-day management of the Master's programme the following contact details may be useful.

Contact for Earth Sciences students:

- Education information desk: Student Affairs (Faculty of Geosciences) ([studentaffairs.geo@uu.nl](mailto:studentaffairs.geo@uu.nl), phone: +31 30 253 9559)
- Study Advisor: dr. Almar de Ronde ([studieadviseur.aw@uu.nl](mailto:studieadviseur.aw@uu.nl), phone +31 30 253 5152)
- Programme leader: Prof. Marc Bierkens ([M.F.P.Bierkens@uu.nl](mailto:M.F.P.Bierkens@uu.nl), phone +31 30 253 2777)

Contact for Environmental Sciences students:

- Education information desk: Student Affairs (Faculty of Geosciences) ([studentaffairs.geo@uu.nl](mailto:studentaffairs.geo@uu.nl), phone: +31 30 253 9559)
- Study Advisor: Jana Scheuer, MSc ([J.Scheuer@uu.nl](mailto:J.Scheuer@uu.nl), phone +31 30 253 2359)
- Programme leader: Dr. Paul Schot ([P.P.Schot@uu.nl](mailto:P.P.Schot@uu.nl), phone +31 30 253 2318)

### **4.2 Organisation at faculty level**

Utrecht University is managed at three levels: the University, the faculties and the departments. Each level involves the participation of the scientific, technical and administrative staff as well as the students. For the Faculty of Geosciences the following organisational units are of interest:

#### **Faculty of Geosciences Board**

Dean: prof. dr. P. Hoekstra

Vice-dean education: dr. H. de Bresser

Vice-dean research: prof. dr. P. Driessens

Faculty director: dr.ir. C.L.M. Marcelis

Student member: Jeffrey Peters

Faculty office: room 723, W.C. van Unnik building, Heidelberglaan 2, Tel: 030 - 253 2044

E-mail: [faculteitsbureau.geo@uu.nl](mailto:faculteitsbureau.geo@uu.nl)

#### **Faculty council**

The faculty council has fourteen members: 50% are students and 50% is staff.

Secretary: dr. L.E.G. Rietveld, Tel: 030 - 253 2044

E-mail: [L.e.g.rietveld@uu.nl](mailto:L.e.g.rietveld@uu.nl)

#### **Teaching Institute**

The Teaching Institute is responsible for the organisation, coordination and quality management of the educational elements of the various courses offered by the Geosciences departments.

Teaching Institute Earth Sciences:

Chairperson: dr. M.R. Hendriks, Tel: 030 – 253 2054

Clerk: I. Beekman, Tel: 030 – 253 5010

Member: dr. T. Behrends, Tel: 030 – 253 5008

Member: dr. P.Th. Meijer, Tel: 030 – 253 5091

Student member: vacancy

Student member: vacancy

### Teaching Institute Environmental Sciences:

Chairperson: dr. J.C.M. Farla, Tel: 030 – 253 7850  
Clerk: drs. E.B. Dijksma, Tel: 030 – 253 8462  
Member: dr. F. van Rijnsoever, Tel: 030 – 253 7484  
Member: dr. P.P. Schot, Tel: 030 – 253 2318  
Member: dr. E. Nieuwlaar, Tel: 030 – 253 7607  
Member: dr. M. Chappin, Tel: 030 – 253 6773

### **Board of Studies**

Within the Utrecht Graduate Division (UGD) the Master's programme Water Science and Management is part of the Graduate School of Geosciences, to which all Master's students and PhD-students of the Faculty of Geosciences belong. The School supervises the quality of the programme and the admission of its students. All Directors of Education and Directors of Research of the Faculty of Geosciences are members of the Graduate Board of Studies, as well as a PhD student and a student from one of the MSc programmes of the Faculty. Chairman is the dean of the Faculty, prof. dr. Piet Hoekstra; the Board's secretary is mr. Diederik Gussekloo ([d.gussekloo@uu.nl](mailto:d.gussekloo@uu.nl)).

### **Board of Examiners**

The Board of Examiners is responsible for the examination of students. The Board of Examiners will determine the examination results as soon as the student has submitted sufficient proof of the tests taken. This Board also decides about deviations (e.g. exemptions) in the programme, internships and the approval of elective courses (see Appendix I of this catalogue). Requests about exemptions, elective courses or other issues for the Board of Examiners, can be addressed to [examencommissie.geo@uu.nl](mailto:examencommissie.geo@uu.nl). Always include your student number and your specialisation track (Environmental Sciences or Earth Sciences) when contacting the Board of Examiners.

## **4.3 Evaluation and quality assurance**

The Faculty of Geosciences values the high quality of its programmes and has therefore set up a quality assurance system. Quality assurance provides information about the quality of individual courses and the programme as a whole, study climate and students' progress and performance. Its most important goals are improving education and organisation, and making the quality of the programme more visible.

One part of quality assurance which you as a student will be dealing with regularly is evaluations. Every course is evaluated afterwards and the results of this *course evaluation* are discussed in the Education committee and the Management team of the programme. It provides important information for the lecturer to improve his/her course. All Geosciences students may view the evaluation results of the Faculty of Geosciences on Blackboard. You can use this if e.g. you need to make a choice about electives.

During the running of the course, we also work on improving quality. *Course feedback groups* may be active in each course in order to mend any problems early on. For each course, such a group consists of 4-5 students that meet up with the lecturer in the break and talk about the course so far.

Its purpose is to find out what is being appreciated, what is going well and what practical issues can be improved. This does not concern aspects which are already fixed, such as the choice of literature, set up of tutorials or class times. It's all about fine-tuning, e.g. are the lecture slides readable, can everyone hear the lecturer, has information been put on Blackboard on time, etc. In the study guide of the course you can find further information about the course feedback group in your course.

Finally, at the end of each academic year (May/June) a written *year evaluation* is carried out among the students. The year evaluation it is not about an individual course but about issues that transcend the course, such as coherence/set-up of the programme,

electives, workload and effort, level, thesis supervision, challenge, atmosphere and lecturers.

The results of the year evaluation will be discussed in panel meetings with the education director, programme leaders and a student delegation.

#### **4.4 Career Services**

The start of your Master's programme will also be the start of your career. Let us help you to prepare for the job-market right from the beginning of your Master. With the activities of Career Services you will be prepared for the future after your graduation. Within your Master's programme job-market orientation will have a much attention in the way of company visits, guest lectures and meeting alumni. An internship will let you familiarise yourself with a company or organisation and will give you the experience of your first step on the labour market.

During your Master you can do more to discover your talents, interests and motivation by following workshops and special training programmes of Career Services. You can also have a meeting with a career officer and attend career days organised by Career Services.

Check the website of your Master's programme under Career Services. The career officer of the faculty of Geosciences is mrs. Franca Geerdes ([f.geerdes@uu.nl](mailto:f.geerdes@uu.nl)).

#### **4.5 Student facilities**

##### **Student Affairs Office Geosciences**

The Student Affairs Office Geosciences is the primary point of contact for students in the faculty of Geosciences. It provides students with general information and answers questions about registration for courses, course timetables, examinations, grades and credits, etc.

Student Affairs Office Geosciences is situated at the Victor J. Koningsberger building, Budapestlaan 4a-b, Tel: +31-30-253 9559.

Opening hours: Monday – Friday: 10.30-11.30h and 12.30-14.30h.

During academic holidays opening hours may be limited.

Internet: <http://students.uu.nl/en/geo>

E-mail: [studentaffairs.geo@uu.nl](mailto:studentaffairs.geo@uu.nl)

##### **Student Services**

You can contact Student Services for information on a wide range of issues relating to studying and student life. This includes admission, application and enrolment, tuition fees, financial assistance, working alongside your studies, insurance, schemes and facilities for outstanding student athletes, student housing and student organisations and information about studying with a disability or chronic illness.

If you have questions about your study programme, schedules, student progress review, examinations, exemptions, study abroad and your graduation: please contact the Student Affairs office Geosciences.

Contact details Student Services:

E-mail: [studentservices@uu.nl](mailto:studentservices@uu.nl) (please mention your student number!)

Tel: + 31 30 253 7000 (Monday to Friday 10-12 am and 1-3 pm)

Fax: + 31 30 253 2627

Visitors' address: Heidelberglaan 6, De Uithof (Monday to Friday 10 am - 4 pm)

Postal address:

Student Services  
Postbus 80125  
3508 TC Utrecht  
The Netherlands

For questions about ICT you can send an email to [servicedesk@uu.nl](mailto:servicedesk@uu.nl).

### **The Faculty's student organisations**

The Faculty of Geosciences has a long-standing tradition of hosting student organisations. These organisations arrange extra-curricular activities that encourage the social networking of their members and act as a special-interest group in the interaction between the educational and faculty boards. All student organisations offer books and other literature at discounted prices. As these discounts are more than the organisations' joining fees, membership is almost a hundred percent. A substantial number of the members are active in organising and participating in activities including conferences, seminars, study tours, theatre, music, sports and parties.

Increasingly, the student organisations cooperate in arranging joint activities. They also play a major role in the introduction of new students, helping them to find their way around the faculty and the university.

The student organisations are linked to the different academic programmes within the faculty. Further information can be found on each organisation's website.

#### Earth Sciences / Physical Geography:

- Utrechtse Aardwetenschappen Vereniging (UAV)  
Address: Princetonplein 5, room 277, 030-253 2019  
E-mail: [uav@uu.nl](mailto:uav@uu.nl), Internet: <http://uavonline.nl/>

#### Environmental Sciences:

- STORM  
Address: Ruppert building, room 002 (open on Mon-Fri from 10.30-15.00 hours), 030-253 2164  
E-mail: [storm@uu.nl](mailto:storm@uu.nl), Internet: <http://storm.geo.uu.nl>

#### International:

- European Geography Association (EGEA), Address: Marinus Ruppertbuilding Room 2 (left) , tel. 030 - 253 9708, E-mail: [Egea@uu.nl](mailto:Egea@uu.nl), Internet: <http://www.egea.nl/Utrecht>  
- Association des Etats Généraux des Etudiants de l'Europe (AEGEE) (<http://www.aegee-utrecht.nl>)  
- Utrecht Erasmus Student Network (ESN) (<http://www.esn-utrecht.nl>)  
- Studentenvereniging voor Internationale Betrekkingen Utrecht (SIB) (<http://www.sib-utrecht.nl>)

## **4.6 Computer facilities**

### **Osiris**

Osiris ([https://www.osiris.universiteitutrecht.nl/osistu\\_ospr/StartPagina.do](https://www.osiris.universiteitutrecht.nl/osistu_ospr/StartPagina.do)) is the student registration system for Utrecht University. You can log into the system using the internet and register for both courses and examinations. You can also check the results of your examinations and update your personal information (telephone numbers, postal address, etc.). Your data is confidential. You will be provided with a username and password to gain access to the system.

## **Student Email**

Utrecht University provides each student with an e-mail address. The faculty uses this address to communicate information. Students are thus required to check their inbox regularly. Upon registration students receive a letter or an e-mail at their postal address with operating instructions and a password.

## **MyTimetable and MyUU app**

Utrecht University has two main channels that allow you to look into the schedule of your course. The schedules are published on those channels two weeks before the start of the course. Along with viewing the complete schedule of your courses it is also possible to check the schedule of your own group, as soon as the lecturer informed you on the division of the groups. You can log in with your Solis-ID and password.

You can make use of **MyTimetable** (<https://mytimetable.uu.nl>) on your browser. Along with a more clear representation of the schedule, it is also possible to synchronise your own schedule with your diary.

On your smartphone you can use the **MyUU-app**. Download this application and always have your schedules and grades from Osiris at hand. The MyUU-app is available for Android and iOS.

## 5. Course information

### 5.1 Course schedule Water Science and Management 2017-2018

Slot A = Monday morning and/or Wednesday morning

Slot B = Tuesday morning and/or Thursday afternoon

Slot C = Monday afternoon and/or Thursday morning

Slot D = Wednesday afternoon, Friday morning and/or Friday afternoon

Slot E = Monday evening, Tuesday evening, Wednesday evening, Thursday evening and/or Friday evening

#### **Earth Sciences:**

Year 1 (intake 2017)

Period 1	(A+B) Perspectives on Sustainable Development, GEO4-2301	(D) Principles of Groundwater Flow, GEO4-1434
Period 2	Choice 1 of 2: (C) Unsaturated Zone Hydrology, GEO4-4417 or (D) Hydrogeological Transport Phenomena, GEO4-1433	(A) Quantitative Water Management, GEO4-6001
Period 3	(C) Research Design, GEO4-2314	(B) Managing Future Deltas, GEO4-4403
Period 4	(A) Water, Governance and Law, GEO4-6002	(B) Drinking Water and Sanitation, GEO4-6003

Year 2 (intake 2016)

Period 1	(D) Transdisciplinary Case Study, GEO4-2302	(B) Land Surface Hydrology, GEO4-4404
Period 2	Master's thesis (Internship) (30 EC or 45 EC), GEO4-6004	
Period 3	Electives (15 EC in case of 30 EC thesis)	
Period 4		

#### **Environmental Sciences:**

Year 1 (intake 2017)

Period 1	(A+B) Perspectives on Sustainable Development, GEO4-2301	(D) Principles of Groundwater Flow, GEO4-1434
Period 2	(C+D) Sustainability Modelling & Indicators, GEO4-2331	(A) Quantitative Water Management, GEO4-6001
Period 3	(C) Research Design, GEO4-2314	(B) Managing Future Deltas, GEO4-4403
Period 4	(A) Water, Governance and Law, GEO4-6002	(B) Drinking Water and Sanitation, GEO4-6003

Year 2 (intake 2016)

Period 1	(D) Transdisciplinary Case Study, GEO4-2302	(B) Land Surface Hydrology, GEO4-4404
Period 2	Master's thesis (Internship) (30 EC or 45 EC), GEO4-6004	
Period 3	Electives (15 EC in case of 30 EC thesis)	
Period 4		

Recommended electives: <http://students.uu.nl/en/geo/wsm/academics/study-programme/electives>.

Recommended electives do not need to be approved by the programmeleader but must still be approved *before starting* by the Board of Examiners.

## 5.2 Course descriptions

**Note: in case of a discrepancy between the entrance requirements and/or recommended pre-requisites and/or other restrictions mentioned in this course catalogue and the ones mentioned in the electronic UU course offerings database 'Osiris', the entrance requirements and/or recommended pre-requisites mentioned and/or other restrictions in the tables in § 2.5 are leading.**

<b>AW-Hydrogeological Transport Phenomena</b>		
<b>Code:</b> GEO4-1433	<b>Credits:</b> 7,5 EC	<b>Level:</b> M
<b>Period/Timeslot</b>	2 D	
<b>Language</b>	English	
<b>Coordinator</b>	prof. dr. ir. S.M. Hassanizadeh	
<b>Instructor(s)</b>	prof. dr. ir. S.M. Hassanizadeh, dr. A. Raoof	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students must be registered for a Master's programme	
<b>Assumed previous knowledge</b>	Essential: - BSc or equivalent degree in Earth Sciences or related field; - having followed Principles of groundwater flow (GEO4-1435) or an equivalent Masters-level course. Useful background: - basic knowledge of hydrology, geology and geochemistry. Remarks: Students without a natural science Bachelor's degree should contact the course coordinator before registering for the course.	
<b>Previous knowledge can be gained by</b>	Following the course Principles of Groundwater Flow (GEO4-1434)	
<b>Course content</b>		
<b>Objectives</b>	This course aims at exposing the student to basic concepts and principles related to the movement of solutes in porous media, in general, and in soil and groundwater, in particular. Processes affecting the spreading of solutes in porous media will be described and corresponding governing equations will be introduced. The students will develop the ability to set up mathematical models for quantitative description of subsurface transport phenomena including initial and boundary conditions. Simple analytical solutions will be discussed. Also, students will become familiar with the well-known modeling package PMWIN.	
<b>Content</b>	The subsurface environment plays an important role in many human activities as well as in natural systems. Both soil and groundwater are valuable natural resources for human beings. Moreover, the subsurface is frequently used for storage of mass (toxic and otherwise) and energy, and construction of certain facilities and infrastructure. For a sustainable use of the subsurface and its resources, it is extremely important to understand and predict various processes that occur in the subsurface. In particular, knowledge of the flow of water and the movement of dissolved components is essential for the design of various activities occurring in the subsurface. This course relates to the understanding and	

	<p>description of processes affecting the fate of dissolved components of groundwater. The knowledge obtained in this course will be also relevant to the study of transport of solutes in general porous media (e.g. human tissues, plants, ceramics, concrete and other construction materials, food, paper).</p> <p>Transport of solutes by advection and diffusion;</p> <ul style="list-style-type: none"> <li>• Various ways of classification of pollutants</li> <li>• Determination of flow velocity and dispersion coefficients</li> <li>• Description of adsorption: linear and nonlinear isotherms, kinetic adsorption</li> <li>• Determination of adsorption coefficients</li> <li>• Degradation processes</li> <li>• Discussion of initial and boundary conditions</li> <li>• Solute transport in double-porosity media</li> <li>• Transport in unsaturated zone</li> </ul>
<b>Entry requirement for</b>	This course is an entry requirement for: Environmental Hydrogeology (GEO4-1432)
<b>Instructional modes</b>	
<b>Instructional modes</b>	lectures (required) tutorials (required)
<b>Assessment</b>	
<b>Explanation</b>	<i>What will be assessed?</i> Homeworks (25%); Take-home exam (25%); Final Exam (50%)
<b>Study materials</b>	
<b>Literature</b>	<p>Required: Literature reader: Lecture notes by S.M. Hassanzadeh. ISBN:</p> <p>Recommended: Book: Mayer, A.S. and S.M. Hassanzadeh, Soil and Groundwater Contamination: Nonaqueous Phase Liquids, American Geophysical Union, 224 pages, June 2005 (ISBN 0-87590-321-7). Book: Fetter, C.W., Contaminant hydrogeology, Macmillan, New York, (2nd ed.). 1999.</p>

<b>AW-Principles of Groundwater Flow</b>		
<b>Code: GEO4-1434</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	1 D	
<b>Language</b>	English	
<b>Coordinator</b>	prof. dr. R.J. Schotting	
<b>Instructor(s)</b>	prof. dr. R.J. Schotting (r.j.schotting@uu.nl)	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	<ul style="list-style-type: none"> <li>- Letter of acceptance MSc Earth Sciences or MSc Water Science and Management.</li> <li>- BSc or equivalent in Earth Sciences, Applied Sciences, or related fields.</li> <li>- basic knowledge of physics, calculus, ordinary and partial differential equations</li> </ul>	
<b>Recommended pre-requisites</b>	Basic knowledge of hydrology, introductory geology and/or environmental sciences.	
<b>Course content</b>		
<b>Objectives</b>	<p>This course introduces the basic principles and methods necessary to quantify flow of water and transport of solutes through saturated porous media. In addition, students will be introduced to basic numerical methods and (professional) software for simulating groundwater flow.</p>	
<b>Content</b>	<p>The importance of groundwater as a resource and as a critical component in many environmental issues is widely recognized. Groundwater hydrology is a rapidly evolving science and plays a key role in understanding a variety of subsurface processes.</p> <ul style="list-style-type: none"> <li>A. Porous media properties such as porosity and intrinsic permeability, hydraulic conductivity, erosion, fractures, continuum approach, Representative Elementary Volume REV- concept, up-scaling from pore-to continuum scale, basic fluid mechanical concepts.</li> <li>B. Groundwater flow: Darcy's Law, hydraulic head, hydraulic conductivity, pore pressure, anisotropy, Dupuit assumptions, mapping of flow, flow in fractured media.</li> <li>C. Flow equations in confined and unconfined aquifers: combining the mass balance equation and Darcy's Law, boundary conditions, storage properties of porous media: compressibility of groundwater and compressibility of the solid phase, Boussinesq approximation, initial and boundary conditions, flow nets, dimensional analysis, analytical solutions of simple hydrogeological problems.</li> <li>D. Density-dependent flow, coastal aquifers.</li> <li>E. Super position principle, method of images, Analytical Element Method.</li> <li>F. Transient flow of groundwater, pumping tests, slug tests, constant head and falling head tests.</li> <li>G. Groundwater flow modeling, modeling approaches (schematization), simulation, evaluation model results, model verification and validation, finite differences, grids, integration in time, initial and boundary conditions, computer models, introduction to ModFlow, modeling exercises with ModFlow.</li> <li>H. Particle tracking in groundwater modeling.</li> <li>I. Two excursions are an integral part of this course. In general a visit to a bank-infiltration water supply pumping station (De Steeg of Oasen) and a trip to a groundwater remediation site.</li> </ul>	

<b>Entry requirement for</b>	This course is an entry requirement for: - Hydrogeological Transport Phenomena (GEO4-1433) - Master's thesis Internship (GEO4-6004; GEO4-6006)
<b>Instructional modes</b>	
<b>Instructional modes</b>	Lectures and tutorials
<b>Assessment</b>	
<b>Explanation</b>	<p>During the course a variety of home works is presented to the students. Each home work contributes to the final grade. The idea of the home works is 'continuous assessment' of the students. In the final weeks of the course, the students are confronted with old exams, either as a graded homework or as an additional example to get acquainted with the examination style.</p> <p>The home works, including the computer homework(s) contribute to 25 % of the final grade. The written exam contributes 75%.</p> <p>Grades between 5.50 and 5.99 are rounded up to 6.0. Grades between 5.0 and 5.49 are rounded down to 5.0. The right to a repair examination is granted if the final grade lies between 4.0 and 5.0. The result of the repair exam will be expressed as a pass (grade = 6.0) or a fail. Failure in the repair stage implies redoing the course in the following academic year.</p>
<b>Study materials</b>	
<b>Literature</b>	<p>Required:</p> <p>Charles R. Fitts, Groundwater science. Academic press, June 2002. ISBN 0-12-257855-4.</p>

<b>IS-Technology Related Venturing</b>		
<b>Code:</b> GEO4-2268	<b>Credits:</b> 7,5 EC	<b>Level:</b> M
<b>Programme</b>	IS	
<b>Status</b>	Obligatory for IS; Elective for other programmes	
<b>Period/Timeslot</b>	1 C	
<b>Language</b>	English	
<b>Coordinator</b>	Lorenz, A. MSc	
<b>Instructor(s)</b>	Lorenz, A. MSc	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	None	
<b>Course content</b>		
<b>Objectives</b>	<p>The objectives of this course are to make students aware of the opportunities and threats of developing innovations within established and entrepreneurial companies, to make them acquainted with theoretical concepts and models relevant for these subjects and to train their academic skills necessary for recognizing, analysing and managing innovation problems that emerge in practice from a theoretical perspective.</p> <p>After completion of the course, the student:</p> <ul style="list-style-type: none"> <li>• has advanced knowledge and understanding of the dynamics and challenges of Innovation Sciences in the context of both organizations and society at large,</li> <li>• has insight into the complex interactions between science, innovative technology and society and is able to reflect critically upon the roles of science and technology in society;</li> <li>• is able to communicate conclusions, as well as the knowledge, reasons and considerations underlying these conclusions, to an audience of specialists and non-specialists.</li> </ul>	
<b>Content</b>	<p>Technology related venturing comprises activities of organizational entities (within established firms or as new enterprises), which are focused on developing and launching new, better and/or cheaper products, services or processes based on new technological insights into and knowledge of emerging technologies like biotechnology, clean technology (including sustainable energy and transportation technologies) and information technology. Ventures engaged in innovation will, however, face many problems arising in practice, which they have to deal with: lacking resources and complementary assets; lacking dynamic capabilities; the prevailing appropriation regime; the emergence of a dominant design and standardization; assessment of user needs and customer value; and competition. In this course, these problems are studied in further details with respect to their causes, possible solutions and management. Additionally, empirical cases from technological fields like biotechnology, clean technology and information technology will be analysed in order to provide students with the academic skills to apply theoretical knowledge for the solution of innovation problems encountered in practice by established as well as entrepreneurial firms.</p> <p><b>Note</b></p> <p>The course is required for the university wide Annotation Sustainable Entrepreneurship &amp; Innovation.</p>	

	Academic and professional skills: <i>Concise writing, valuing literature, argumentation and reasoning, and reflection on science and society &amp; Giving feedback and learning to work independently</i>
<b>Entry requirement for</b>	<p>This course is an entry requirement for:</p> <ul style="list-style-type: none"> <li>• Master's Thesis IS (GEO4-2239X)</li> <li>• Consultancy Project IS (GEO4-2252)</li> <li>• Master's Thesis SBI (GEO4-2606)</li> </ul>
<b>Instructional modes</b>	
<b>Instructional modes</b>	Lectures (required) Group meetings (required)
<b>Class session preparation</b>	See course manual
<b>Contribution to group work</b>	See course manual
<b>Assessment</b>	
<b>Explanation</b>	<p><i>What will be assessed?</i></p> <p>Written exam, paper on the group assignment and participation in group meetings</p>
<b>Study materials</b>	
<b>Literature</b>	Literature: List of scientific articles (see course manual)

<b>SUSD-Perspectives on Sustainable Development</b>		
<b>Code: GEO4-2301</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	SD/WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	1 A+B	
<b>Language</b>	English	
<b>Coordinator</b>	dr. B. Wicke	
<b>Instructor(s)</b>	Various lecturers	
<b>Open to other students</b>	No	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students must be registered for one of the following degree programmes: <ul style="list-style-type: none"> <li>- Water Science and Management,</li> <li>- Sustainable Development</li> </ul>	
<b>Course content</b>		
<b>Objectives</b>	After completion of the course, the student is able to: <ul style="list-style-type: none"> <li>• give a good overview of the concept of sustainable development and its history, and of various ways to operationalise it;</li> <li>• understand the contributions from relevant scientific disciplines and has the ability to integrate these;</li> <li>• recognize key sustainable development issues and make an integral and critical assessment of available approaches and policy options;</li> <li>• look at real-world problems from multiple perspectives and understand that achieving sustainability needs contributions from different worldviews.</li> <li>• articulate his/her own ambitions in contributing to sustainable development and define his/her study path accordingly</li> </ul>	
<b>Content</b>	<p>This course aims at providing insights into different perspectives on sustainable development. Students are introduced to the major threats and the main scientific concepts and methods needed to understand and respond to them. The emphasis is on seeing the larger picture.</p> <p>The course starts by elaborating on the concepts and various definitions of sustainable development, including the recently defined sustainable development goals. Next we discuss sustainable development from historical, ethical, personal and value perspectives. We move on to examine sustainability concerns related to population and consumption, resource use, and impacts to illustrate different relevant scientific disciplines such as ecology, demography, energy and environmental science, agro-ecology, economy, and social and political science.</p> <p>Throughout the course, sustainable development is approached from a wide range of perspectives in order to illustrate that the perception of both problems and solutions depends on ones point of view and the frame of reference. That is why dealing with sustainability problems is a matter of combining scientific data about the world with value orientations and institutional realities.</p> <p>Academic skills: <i>academic writing, effective presentations, team work</i></p>	
<b>Entry requirement for</b>	This course is an entry requirement for : <ul style="list-style-type: none"> <li>• Transdisciplinary Case Study (GEO4-2302)</li> <li>• Master's Thesis SD (GEO4-2321)</li> </ul>	

<b>Instructional modes</b>	
<b>Instructional modes</b>	Lectures (required) Simulation game (required) Tutorials (required)
<b>General remarks</b>	Lectures, tutorials in groups, two assignments in groups of 3-4 students, one individual ambition paper
<b>Class session preparation</b>	In order to successfully participate in class, assigned literature should be read before lectures and tutorials.
<b>Contribution to group work</b>	Two of the assignments are conducted in small groups (3-4 students). Each member of a group is expected to equally contribute to the assignment; free-riding is not permitted. If free-riding occurs anyways, this will have implications for the individual grade.
<b>Assessment</b>	
<b>Explanation</b>	<i>What will be assessed?</i> Group assignments (2 x 20%), group presentation (10%) and final exam (50%); personal ambition paper is not graded, but handing it in before the deadline is required to pass this course.
<b>Study materials</b>	
<b>Literature</b>	<p>Required:</p> <p>Literature: De Vries, B.J.M., 2012, Sustainability Science, Cambridge University Press</p> <p>Literature: The World Commission on Environment and Development, Our Common future, 1987, Oxford University Press. Available online at <a href="http://www.un-documents.net/our-common-future.pdf">http://www.un-documents.net/our-common-future.pdf</a></p> <p>Items: Articles, Reports, Extra materials (available on Blackboard)</p>

<b>SUSD-Transdisciplinary Case Study</b>		
<b>Code: GEO4-2302</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	SD/WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	1 D	
<b>Language</b>	English	
<b>Coordinator</b>	dr. P.P. Schot	
<b>Instructor(s)</b>	dr. P.P. Schot	
<b>Open to other students</b>	No	
<b>Entry requirements</b>		
<b>Entry requirements</b>	<p>Students must be registered for one of the following degree programmes:</p> <ul style="list-style-type: none"> <li>- Water Science and Management</li> <li>- Sustainable Development</li> </ul> <p>Students must not be exclusively registered for one of the following degree programmes:</p> <p>Guest Student Geosciences.</p> <p>Number of credits achieved: 30EC of the Master's programme.</p> <p>The following course must be completed:</p> <ul style="list-style-type: none"> <li>- SUSD-Perspectives on Sustainable Development (GEO4-2301)</li> </ul>	
<b>Course content</b>		
<b>Objectives</b>	<p>After completion of the course the student is able to:</p> <ul style="list-style-type: none"> <li>• Perform an Integrated Problem Analysis of a sustainable development issue from a multidisciplinary perspective;</li> <li>• Formulate Integrated Interventions for a multidisciplinary sustainable development problem, in the form of integrated actions to be taken by the client, and/or remaining knowledge gaps, and recommendations for further research;</li> <li>• Take responsibility for, and reflect on, the personal role, as well as that of other students, in the group process;</li> <li>• Show a professional attitude towards the client and stakeholders involved.</li> </ul>	
<b>Content</b>	<p>This course focuses on the integration of insights from different knowledge domains which are necessary to realise sustainable development.</p> <p>Sustainable development issues are characterised by their multidisciplinary character, and the fact they are not merely an academic exercise but pertain to real-world problems. They show large complexity as a result of mutual interactions between social and biophysical systems. Regular or normal scientific approaches tend to focus on more or less disciplinary aspects of the problem in isolation, using an objective analytical perspective. On the contrary, it has been argued that sustainable development issues are in need of a Post-Normal Science in which there are multiple legitimate perspectives, related to values and world views of individuals or groups, and the full complexity including its uncertainty should be part of the scientific analysis (Functowitz and Ravetz, 1993). The multiplicity of world views also allows for non-scientific stakeholders to enter into the problem analysis and problem solving arena, enabling the addition of tacit knowledge to the</p>	

	<p>formal scientific knowledge. The resulting networks involving public-private partnerships and the collaboration with community organisations have given rise to new forms of governance. Such participation of multiple stakeholders and scientific specialists involved in sustainability research and problem solving, necessitates forms of integration of the multidisciplinary knowledge being produced. Such research is often termed transdisciplinary. Tress et al. (2005) provide an overview of definitions of integrative research concepts (disciplinary, multidisciplinary, participatory, interdisciplinary, transdisciplinary).</p> <p>The notions on integration of the basic disciplines of ecology, economy and sociology, as well as the influence of different world views, have been subject of the first two common Sustainable Development master courses Perspectives on Sustainable Development (GEO4-2301) and Sustainability Modelling and indicators (GEO4-2331).</p> <p>In this course students will enter the transdisciplinary arena. They will be confronted with a real-world problem of a real-world client. The students will work in multidisciplinary groups to analyse the clients problem. They will analyse the multidisciplinary problem from their own specific background, and integrate their scientific knowledge with that of other students, and with the tacit knowledge of stakeholders. Information on the case study and client will be provided during the introductory lectures of the course.</p>
<b>Entry requirement for</b>	This course is an entry requirement for: N/A
<b>Instructional modes</b>	
<b>Instructional modes</b>	Lecture (required) Tutorial (required)
<b>General remarks</b>	<p>Lecture:</p> <p>There are a few lectures as an introduction to the course and the assignment. The main activities are by the students themselves and consist of group work and individual work. At the end of the course all groups present their results.</p>
<b>Assessment</b>	
<b>Explanation</b>	<p><i>What will be assessed? (evt. %)</i></p> <p>The course grade is determined based on the Final Group paper as follows (% of final grade):</p> <ul style="list-style-type: none"> <li>• specific aspects of the case: 50%</li> <li>• the mutual multidisciplinary parts of the group paper: 50%</li> </ul>
<b>Study materials</b>	
<b>Literature</b>	Required: Course guide

<b>SUSD-Research Design</b>		
<b>Code:</b> GEO4-2314	<b>Credits:</b> 7,5 EC	<b>Level:</b> M
<b>Programme</b>	SD/WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	3 C	
<b>Language</b>	English	
<b>Coordinator</b>	Prof. dr. P.P.J. Driessen	
<b>Instructor(s)</b>	Prof. dr. P.P.J. Driessen, dr. C. Uittenbroek, prof. dr. M. Rietkerk, dr. G. van Westen, dr. W. Crijns-Graus	
<b>Open to other students</b>	No	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students must be registered for one of the following degree programmes: MSc Sustainable Development MSc Water Science and Management  Students must not be exclusively registered for the following degree programme: Guest Student Geosciences	
<b>Course content</b>		
<b>Objectives</b>	After completion of this course, the student: <ul style="list-style-type: none"> <li>• Is able to apply and integrate theoretical and methodological knowledge about how to develop a research proposal.</li> <li>• Is able to delineate a research proposal to manageable proportions and present the proposal in a well-structured and clear way.</li> <li>• Is able to give a critical review on the research design.</li> <li>• Is able to explain how his/her research proposal will contribute to transforming our society in a more sustainable way.</li> </ul>	
<b>Content</b>	This course provides insights, guiding principles and methodology for developing a conceptual and technical research design. Attention will be paid to the formulation of a feasible and effective research objective, to the development of a clear research framework and to the determination of relevant research issues. The course takes place in a multidisciplinary setting. After some introductory lectures about developing a research design, students review work from former MSc students and develop their own research design from their own track perspective. At the end of the course, students make a poster based on their research design and present this to fellow students. <i>Academic skills: designing a research project</i>	
<b>Entry requirement for</b>	This course is an entry requirement for: <ul style="list-style-type: none"> <li>• Master's Thesis SD (GEO4-2321)</li> <li>• Research Project ECE (GEO4-2335) (actively participated in GEO4-2314 in order to register for GEO4-2335)</li> </ul>	
<b>Instructional modes</b>		
<b>Instructional modes</b>	Lectures (required) Presentations (required) Tutorials (required)	

<b>Class session preparation</b>	To prepare the first three lectures, students have to read the text book.
<b>Contribution to group work</b>	This part of the course focuses on a critical analysis of a finalized MSc thesis. Students work in pairs (one with a social science background, one with a natural science background) and analyse two MSc theses: one from a social science track and one from a natural science track. The analyses are presented to peers in a tutorial.
<b>Assessment</b>	
<b>Explanation</b>	<p><i>What will be assessed?</i></p> <ul style="list-style-type: none"> <li>• Analysis MSc thesis and presentation (in pairs): 20%</li> <li>• DIY individual research design: 70%</li> <li>• Poster presentation: 10%</li> </ul>
<b>Study materials</b>	
<b>Literature</b>	<p>Required:</p> <p>Reader: Course manual</p> <p>Book: P. Verschuren &amp; H. Doorewaard (2010). Designing a Research Project, Publisher Lemma, Utrecht, 2nd edition</p>

<b>SUSD- Environmental Ethics and Sustainable Development</b>		
<b>Code: GEO4-2323</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	SD/IS/WSM/ES/SBI	
<b>Status</b>	Elective	
<b>Period/Timeslot</b>	1 A	
<b>Language</b>	English	
<b>Coordinator</b>	dr. F. van den Berg	
<b>Instructor(s)</b>	dr. F. van den Berg	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	None	
<b>Course content</b>		
<b>Objectives</b>	<p>After completion of the course, the student is able to:</p> <ul style="list-style-type: none"> <li>• describe the philosophical dimensions of sustainable development;</li> <li>• perform an in-depth analysis of the concepts 'sustainability' and 'development';</li> <li>• give an overview of contemporary environmental ethics;</li> <li>• perform an integral and critical assessment of moral stances on environmental problems and sustainable development;</li> <li>• write an article for a general audience on environmental issues, using philosophical tools &amp; knowledge.</li> </ul>	
<b>Content</b>	<p>The present-day political and economic systems are not sustainable and we are heading for global environmental disasters (ecocide). The notions sustainability, development and sustainable development have gradually entered political and social debates, and scientific and philosophical investigations. It is rooted in concern about environmental degradation of our planet. Philosophical reflection about sustainable development and the human-nature relationship starts with clarifying key concepts of environmental science. Sustainable development should at least encompass three dimensions: (1) the environment (conservation and preservation), (2) economy (growth vs. steady state), and (3) the social structure (equity, welfare). These dimensions form the pillars of sustainable development and will be studied from a philosophical viewpoint.</p> <p>This course aims at providing philosophical reflection on sustainable development-related issues as part of environmental philosophy. We start with reflection on three kinds of relationships from the perspective of sustainability: humans-humans, humans-animals, and humans-nature. During the course key concepts and methods of environmental philosophy are dealt with. We will explore concepts such as biodiversity and vulnerability, demographic transition and inter- and intragenerational (environmental) justice.</p> <p>The emphasis of the course is normative deliberation on the environmental crises and sustainable development. What insights can science and environmental philosophy give to sustain life, future generations and a healthy ecosystem of planet Earth?</p>	
<b>Entry requirement for</b>	This course is an entry requirement for: N/A	

<b>Instructional modes</b>	
<b>Instructional modes</b>	Excursion, a walk in the woods (required) Lectures (required) Seminars (required)
<b>Assessment</b>	
<b>Explanation</b>	<i>What will be assessed?</i> 4 columns (500-600 words), 4 newspaper comments (200-300 words), 1 paper (2500-3000 words)
<b>Study materials</b>	
<b>Literature</b>	Required: Book: Curry, Patrick: Ecological Ethics Book: Berg, Floris van den: Philosophy for a Better World. Book: Oreskes, Naomi; Conway, Erik: The Collapse of Western Civilization Book: Callenbach, Ernest: Ecotopia

<b>SUSD-Sustainability Modelling &amp; Indicators</b>		
<b>Code:</b> GEO4-2331	<b>Credits:</b> 7,5 EC	<b>Level:</b> M
<b>Programme</b>	SD/WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	2 C+D	
<b>Language</b>	English	
<b>Coordinator</b>	dr. M.J. Ferreira dos Santos	
<b>Instructor(s)</b>	dr. H.J. de Boer and other lecturers	
<b>Open to other students</b>	No	
<b>Remarks</b>	Students that have to take this course to qualify for the profile Complex Systems should contact the Education Coordinator, Mrs. Erika Dijksma (e.b.dijksma@uu.nl) before 1 October 2017.	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students must be registered for one of the following degree programmes: MSc Water Science and Management MSc Sustainable Development  Students must not be exclusively registered for one of the following degree programmes: Guest Student Geosciences	
<b>Assumed previous knowledge</b>	Perspectives on Sustainable Development (GEO4-2301)	
<b>Course content</b>		
<b>Objectives</b>	After completion of this course, the student is able to: <ul style="list-style-type: none"> <li>- Develop knowledge of modelling techniques used in Sustainability Science.</li> <li>- Apply diverse models that are used in research about sustainability issues.</li> <li>- Explain how the concepts taught in Perspectives on Sustainable Development (GEO4-2301) relate to trends, projections and scenarios.</li> <li>- Understand what are Sustainable Development Indicators and the methods most frequently used to measure them.</li> <li>- Describe and critically evaluate the concepts and methodology of Sustainable Development Indicators.</li> </ul>	
<b>Content</b>	This course is a must for those who want to work in Sustainable Development, as it provides hands-on experience answering pressing sustainability questions, by exploring a portfolio of models, state-of-the-art modelling tools and techniques, and how they are used as sustainability indicators for Sustainable Development Goals. The course also provides a foundation for policy-makers who are involved in Sustainable Development, but in any case it is worthwhile for every environmental specialist. Both students with a natural scientific background as well as those following a social sciences programme may follow the course.  We will start with system analysis and introduce the concepts behind this methodological approach through the use of simple models. Then we will use Excel, a tool familiar to most students, to develop projections and models that allow answering the question on whether we can sustainably feed the growing global population. After that we expose the students to fully-coupled Integrated Assessment models that are used to investigate the important subsystems of	

	<p>global change (population, land use, resource use, climate) and their interactions. These Integrated Assessment models provide the basis for a meaningful exploration of future policy strategies. After that students will work with Netlogo to learn about agent-based modelling, that is, a platform to understand the effects of individual behavioral choices in collective outcomes. Alongside with these topics, students are asked to develop their own research project in which they explore a sustainability topic of their interest and use quantitative analysis and different sustainability indicators, such as: Environmental Performance Index, Human Development Index, Ecological Footprint, Happy Planet Index and quality of life indicators to test their hypotheses. The results of students work culminate in a Sustainability Symposium at the end of the course.</p> <p><b>The course is a sequel to the course SUSD-Perspectives on Sustainable Development (GEO4-2301) and its content is assumed to be known.</b></p>
<b>Entry requirement for</b>	This course is an entry requirement for: Master Thesis SD (GEO4-2321)
<b>Instructional modes</b>	
<b>Instructional modes</b>	Computer practicals (required) Lectures (required) Tutorials (required)
<b>General remarks</b>	Computer practicals: Focus on work in small groups, practical sessions and tutorials. Lectures, Computer exercises, Assignments in small groups, Individual assignments, Simulation and experimental games
<b>Assessment</b>	
<b>Explanation</b>	<i>40% Exam</i> <i>30% Assignment 1 – Sustainable Development Goals and Sustainability Indicators (10% oral presentation and 20% scientific paper)</i> <i>20% Assignment 4 – Food Security and Land Use</i> <i>10% Assignment 6 – Systems Integration for Global Sustainability</i> <i>Pass/Fail ALL Other assignments</i>
<b>Study materials</b>	
<b>Literature</b>	Required: Literature: Sustainability Science (Bert de Vries) Literature: to be determined

<b>SBI-Toolbox 1: Environmental Assessment and Management Approaches</b>		
<b>Code: GEO4-2602</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	SBI/SD/ES/WSM/IS/Chemistry	
<b>Status</b>	Obligatory for SBI; Elective for other programmes	
<b>Period/Timeslot</b>	2 D	
<b>Language</b>	English	
<b>Coordinator</b>	dr. E.T.A. Hoefnagels	
<b>Instructor(s)</b>	dr. E.T.A. Hoefnagels, prof. dr. H.M. Junginger	
<b>Open to other students</b>	Yes, but not for exchange students	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students must be registered for one of the following degree programmes: <ul style="list-style-type: none"> <li>- Energy Science</li> <li>- Water Science and Management</li> <li>- Innovation Sciences</li> <li>- Sustainable Business and Innovation</li> <li>- Sustainable Development</li> <li>- Chemistry (MSc.)</li> </ul>	
<b>Assumed previous knowledge</b>	Basic background of natural science.	
<b>Previous knowledge can be gained by</b>	Following the Bachelor course on Life Cycle Assessment (GEO3-2124)	
<b>Resources for self study</b>	Scientific literature provided on blackboard (mandatory). Recommended (but not obligatory): Henrike Bauman. Anne-Marie Tillman, The Hitch Hikers guide to LCA. Gazelle Book Services, 2004. ISBN 9144023642, 9789144023649	
<b>Course content</b>		
<b>Objectives</b>	<p>The objectives of this course are to introduce students to a variety of tools and approaches to assess, manage and improve the environmental impact of products and production processes. After completion of the course, the students:</p> <ul style="list-style-type: none"> <li>• have insight in the most important (research) methods and tools to assess and manage the environmental impact of products, production processes and services;</li> <li>• know strong and weak points of each tool and understand the level of uncertainty in using them;</li> <li>• can critically interpret studies that are carried out using these tools and are able to carry out basic calculations themselves.</li> </ul>	
<b>Content</b>	<p>The course will focus on the sustainability of products and production processes of firms.</p> <p>About two thirds of the course will focus on tools to assess the environmental (and to a limited extent social and economic) impact of products and production processes, and will be based (mainly) on life cycle assessment (LCA), including carbon footprinting. In 3-4 lectures, a general introduction and explanation of concepts such functional unit, different ways of allocation and the difference between attributional &amp; consequential LCA will be provided. Also one or two</p>	

	<p>concrete case studies on how LCAs are carried out, interpreted and used by firms will be presented. Next to two assignments, also, two half-day LCA computer practical will be held introducing the students to SimaPro. Other approaches covered during lectures will include an introduction to social LCA, environmental impact assessment (EIA) to evaluate the impacts of location &amp; time specific projects, and to environment risk assessment (ERA) to assess uncertainty and long-term risks of products and production processes.</p> <p>In the remaining third of the course, the students will gain knowledge on concepts how products and production processes can be improved and last but not least how the economic implications of these changes can be assessed. This will include an introduction to concepts such as a circular economy (CE), cradle-to-cradle (C2C), eco-design, cleaner production, and to economic concepts such as net present value (NPV), internal rate of return (IRR) and Life Cycle Costing (LCC). The course mainly aims to provide an overview of the state of the art of current tools in use. A secondary aim is to highlight on-going trends in academia and the further development and expansion of existing concepts, such as the development of social and socio-economic LCA.</p> <p>Academic skills:</p> <ul style="list-style-type: none"> <li>• Comprehending (and to a limited extent applying) the scientific concepts and tools taught in the course</li> <li>• Understanding and critically reviewing scientific articles, including a review of an existing LCA study and writing a concise review paper</li> <li>• Making and presenting a scientific poster</li> </ul>
<b>Entry requirement for</b>	<p>This course is an entry requirement for:</p> <ul style="list-style-type: none"> <li>• Consultancy Project SBI (GEO4-2605)</li> <li>• Master's Thesis (GEO4-2606)</li> </ul>
<b>Instructional modes</b>	
<b>Instructional modes</b>	<p>1-day Excursion Lectures by UU staff and guest speakers Poster presentation (required) Tutorials &amp; practicals</p>
<b>General remarks</b>	<p>Lectures by UU staff and guest speakers: Lectures will be both by UU staff and guest lecturers from companies (previously we had e.g. Philips, Shell, Royal Haskoning CO2 performance ladder, Desso and Interface).</p>
<b>Class session preparation</b>	<p>Lectures by UU staff and guest speakers: You should prepare for lectures by reading the literature provided on Blackboard in advance.</p>
<b>Contribution to group work</b>	<p>Tutorials &amp; practicals: You will perform a critical review of an existing LCA study (see assessment) in groups of 3-4 persons. You are expected to meet with your group on your own to discuss the assignment and prepare the paper. All group members are expected to contribute equally to the assignment.</p>
<b>Assessment</b>	
<b>Explanation</b>	<p><i>What will be assessed?</i></p> <p>The assessment will be carried out by means of a written, closed-book exam (50% of the final grade). The other 50% will be covered by a group assignment to analyse and critically review an existing LCA study. The deliverables that will be assessed are a paper with your critical review (40%) and a poster presentation where you present the LCA study and your review to your peers (10%).</p>

<b>Study materials</b>	
<b>Literature</b>	Reader: will be available digitally on blackboard. Items: List of scientific articles on Blackboard

<b>SBI-Toolbox 2: CS Implementation: theory and practice</b>		
<b>Code: GEO4-2603</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	SBI/ES/IS/SD/WSM	
<b>Status</b>	Obligatory for SBI; Elective for other programmes	
<b>Period/Timeslot</b>	3 D	
<b>Language</b>	English	
<b>Coordinator</b>	Dr. W.J.V. Vermeulen	
<b>Instructor(s)</b>	Dr. ir. S. Witjes; dr. W.J.V. Vermeulen	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students must be registered for one of the following degree programmes: <ul style="list-style-type: none"> <li>• Energy Science</li> <li>• Water Science and Management</li> <li>• Innovation Sciences</li> <li>• Sustainable Business and Innovation</li> <li>• Sustainable Development</li> </ul>	
<b>Assumed previous knowledge</b>	Business and Sustainability Challenges (GEO4-2601) and Understanding and Assessing Technologies for Sustainability (GEO4-2608)	
<b>Course content</b>		
<b>Objectives</b>	<p>The objectives of this course are:</p> <ul style="list-style-type: none"> <li>• Make students aware of the theoretical background and methods applied in practice of the tools which companies apply in order to be able to manage sustainability internally and externally.</li> <li>• Make students acquainted with theoretical concepts and models relevant for these tools.</li> <li>• Give the students the possibility in group work and in individual work to analyse and reflect upon case studies.</li> </ul> <p>After completion of the course, the student:</p> <ul style="list-style-type: none"> <li>• Has advanced knowledge and understanding of the organizational and management processes related to the contribution to corporate sustainability;</li> <li>• Has advanced knowledge and understanding of various tools and methodologies related to corporate sustainability and is able to compare and relate them to each other and assess them from a comprehensive synthesis perspective;</li> <li>• Can recognize organizational structures and its elements assuring the compliance with corporate sustainability.</li> </ul>	

<b>Content</b>	<p>In this course 5 elements will be addressed:</p> <ul style="list-style-type: none"> <li>• <i>Visioning and strategy development: How can companies develop a long-term vision on SD and how can they translate this into a transformative strategy?</i></li> <li>• <i>Stakeholder theory and engagement: Who are they, why are they relevant, how can they influence the sustainability of a company and how can companies engage with them?</i></li> <li>• <i>Management systems and standards: How do companies assure that the whole organization is working towards the set goal for sustainability?</i></li> <li>• <i>Sustainability marketing theory: Who are the customers and what are companies doing to sell the fact that they are sustainable or that they have sustainable products?</i></li> <li>• <i>Value chain management: What is the value chain in the sustainability of a company and how can companies collaborate with value chain partners, ensuring sustainable production practices in the entire value chain?</i></li> </ul> <p>For every element there is a mixture of theoretical knowledge, contact with practice and the possibility for the students to explore themselves these elements by means of assignments.</p> <p>Academic skills: <i>after completion of the course, the student:</i></p> <ul style="list-style-type: none"> <li>• <i>Is able to connect with companies and communicate with them about integrating Corporate Sustainability;</i></li> <li>• <i>Is able to understand organisations, their internal and external stakeholders, and how they influence and contribute to sustainability;</i></li> <li>• <i>Critically reflect on and analyse organisations and their context, in order to be able to understand the playing field of corporate sustainability;</i></li> <li>• <i>Critically reflect on diverse theoretical approaches available in the academic fields studying corporate sustainability.</i></li> </ul>
<b>Entry requirement for</b>	<p>This course is an entry requirement for:</p> <p>Master's Thesis (GEO4-2606)</p> <p>Recommend for Consultancy Project SBI (GEO4-2605)</p>
<b>Instructional modes</b>	
<b>Instructional modes</b>	<p>Lectures (required)</p> <p>Group feedback meetings (required)</p>
<b>General remarks</b>	<p>Lectures:</p> <p>Lectures, group papers, presentations and debate.</p>
<b>Class session preparation</b>	<p>Lectures:</p> <p>Readings for lectures; readings for group assignment</p>
<b>Contribution to group work</b>	<p>Lectures:</p> <p>Prepare presentations and paper in small groups (3-5 students)</p>
<b>Assessment</b>	
<b>Explanation</b>	<p><i>What will be assessed?</i></p> <ul style="list-style-type: none"> <li>• Exams (50%)</li> <li>• Group work (15%)</li> <li>• Presentation of assignments (10%)</li> <li>• Final group paper (25%)</li> </ul>
<b>Study materials</b>	
<b>Literature</b>	<p>Required:</p> <p>Reader: Readings t.b.a.</p>

<b>SBI-Governance and Change Management for Sustainability</b>		
<b>Code: GEO4-2604</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	SBI/IS/SD/ES/WSM	
<b>Status</b>	Obligatory for SBI; Elective for other programmes	
<b>Period/Timeslot</b>	2 A	
<b>Language</b>	English	
<b>Coordinator</b>	dr. A. Kalfagianni	
<b>Instructor(s)</b>	dr. M.M.H. Chappin, dr. A. Kalfagianni	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students must be registered for one of the following degree programmes: <ul style="list-style-type: none"> <li>- Energy Science</li> <li>- Water Science and Management</li> <li>- Innovation Sciences</li> <li>- Sustainable Business and Innovation</li> <li>- Sustainable Development</li> </ul>	
<b>Assumed previous knowledge</b>	Business, Sustainability and Innovation (GEO3-2122) or equivalent	
<b>Course content</b>		
<b>Objectives</b>	<p>The course provides students the skills and knowledge to engage with governance and change management for sustainability. The objectives of this course are to teach students why firms engage with sustainable practices, how they do so individually (by introducing and managing change) and collectively (in the form of private standards and certification schemes), how successful and legitimate they are in these efforts, and what they can do to improve their sustainability performance. The course will make the students acquainted with theoretical concepts and frameworks relevant for these subjects and train their academic skills necessary for recognizing, analysing, and governing sustainability issues that emerge in practice from a theoretical perspective.</p> <p>After completion of the course, the students:</p> <ul style="list-style-type: none"> <li>• Are able to evaluate the power of business actors in the sustainability domain; Can explain the emergence, evolution and effectiveness of private governance institutions (e.g. standards and certification schemes);;</li> <li>• Are able to reflect on normative questions of legitimacy and equity related to private sustainability governance;</li> <li>• Have advanced knowledge and understanding of change management at the level of the firm;</li> <li>• Can recognise drivers, barriers to change, and strategies to overcome the barriers in a sustainability context within the firm; and</li> <li>• Can understand the institutionalisation and success factors of efforts towards change.</li> </ul>	
<b>Content</b>	<p>Sustainability has appeared as an alternative to development models prioritising economic activities at the expense of environmental and social issues. Sustainability aims to produce a dynamic balance among economic, environmental and social aspects, and the time dimension. During the past twenty years, business actors have been engaging with efforts to foster sustainability: at the level of the firm; and the level of cooperation among firms and other societal actors</p>	

	<p>particularly in the form of private governance institutions (such as standards and certification schemes), with varying levels of success.</p> <p>The course aims to give students the skills and knowledge to engage with governance and change management for sustainability at two levels: (a) the level of institutionalised cooperation among firms and/or other actors, such as civil society organisations (private governance); and (b) the level of the firm including the perspective of individuals, groups, and the organisation, as well as their respective attitudes. The course content is designed to address these two levels and reflect on the broad array of scholarship on understanding, assessing and governing change within and among firms and their organisations.</p>
<b>Entry requirement for</b>	<p>This course is an entry requirement for:</p> <ul style="list-style-type: none"> <li>- Master's Thesis (GEO4-2606)</li> <li>- Consultancy Project SBI (GEO4-2605)</li> </ul>
<b>Instructional modes</b>	
<b>Instructional modes</b>	Lectures Seminars (required)
<b>General remarks</b>	Lectures: Lectures, Guest Lectures, Interactive and participatory Workshops, and Student meetings
<b>Assessment</b>	
<b>Explanation</b>	<p><i>What will be assessed?</i></p> <p>See course manual</p>
<b>Study materials</b>	
<b>Literature</b>	Items: List of scientific articles

<b>AW-Managing Future Deltas</b>		
<b>Code:</b> GEO4-4403	<b>Credits:</b> 7,5 EC	<b>Level:</b> M
<b>Period/Timeslot</b>	3 B	
<b>Language</b>	English	
<b>Coordinator</b>	prof. dr. H. Middelkoop	
<b>Instructor(s)</b>	t.b.a.	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students should be registered for a Master's programme	
<b>Assumed previous knowledge</b>	General principles of coastal and river geomorphology. Students have to appreciate the role of interdisciplinary science and the role of (applied) sciences in societal issues and coastal zone and river basin management problems and challenges. In-depth lectures concerning these subjects will not be given but relevant literature will be provided	
<b>Previous knowledge can be gained by</b>	Previous knowledge can be gained by following the BSc courses Systeem Aarde 2 (GEO1-4102), Coastal Morphodynamics (GEO3-4306), River Morphodynamics (GEO3-4305), or similar courses covering the principles of coastal and river geomorphology	
<b>Resources for self study</b>	<ul style="list-style-type: none"> <li>• Masselink, G., M.G. Hughes and J. Knight, 2011. Introduction to coastal processes &amp; geomorphology (Second Edition). Hodder Arnold, 416 pp, ISBN 978-1-444-12240-4.</li> <li>• Hoekstra, P., 2011/2012. Coastal Morphodynamics; Processes, landforms and sedimentary products. Part 1 (chapters 1-6) and Part 2 (chapters 7-12). Available as PDFs in Blackboard during the course.</li> <li>• Other relevant literature will be provided during the course.</li> </ul>	
<b>Course content</b>		
<b>Objectives</b>	<p>By the end of the course the student has:</p> <ol style="list-style-type: none"> <li>1. developed a generic understanding of the physical, ecological, socio-economic, political and legal factors that play a role in delta management;</li> <li>2. knowledge of the role of decision makers, policymakers and stakeholders in developing and implementing coastal zone and river management strategies and solutions;</li> <li>3. a solid grasp of the key threats and opportunities of the worlds deltas and the challenges for delta management;</li> <li>4. learned about the interdisciplinary nature and context of coastal zone and river management;</li> <li>5. become familiar with approaches, methodologies and tools involved in delta management;</li> <li>6. applied this knowledge in a realistic case study, and;</li> <li>7. developed skills to synthesize knowledge on these subjects from scientific literature and reports through discussions, presentations and writing.</li> </ol>	
<b>Content</b>	This course focuses on the integrated management of coastal and fluvial systems within the context of delta areas. Deltas are characterised by dynamic interactions between hydrodynamics, sedimentation, morphology, ecology and man. They support rich ecosystems, intense agriculture and many major cities and harbours	

	<p>are located in deltas. The management of deltas poses considerable challenges, and involves both fundamental knowledge of the physical and ecological processes involved as well as the understanding and negotiating among the different interests from the 'users' of these systems. Moreover, future climate change, sea-level rise and increasing societal demands further complicate a sustainable management of rivers and coasts. Emphasis is therefore on the key factors, philosophies and techniques of integrated management of delta areas, with a sharp focus on the every-day practices. The course includes classes, a group project, individual work and a field component.</p> <p><b>Development of transferable skills</b></p> <ul style="list-style-type: none"> <li>Ability to work in a team: During the course, you will work together in teams of 5 people. You will learn about team processes, both by doing as through lectures on working in teams.</li> <li>Written communication skills: You will write a chapter of the team report and receive feedback on your writing from your peers and from the supervisor(s).</li> <li>Problem-solving skills: The case study work will require you to pin-point the main issues at hand in your case study area and to think about possible solutions for these issues.</li> <li>Verbal communication skills: Plenary discussions and presentations as well as communication within your cast study group will provide ample opportunities for practicing verbal communication skills.</li> <li>Strong work ethic: As a team member you are expected to respect the team plan agreed during the team's 'kick-off' meeting at the beginning of the course.</li> <li>Initiative: For your case study work you are expected to contact stakeholders or experts on your cast study area yourself.</li> </ul>
<b>Entry requirement for</b>	This course is the entry requirement for: n/a
<b>Instructional modes</b>	
<b>Instructional modes</b>	<p>Excursions (required)</p> <p>(Guest) Lectures and exercises</p> <p>Case study (required)</p> <p>Abstract (required)</p>
<b>General remarks</b>	<p><b>Excursions:</b> The field component will consist of a full day field trip to the Dutch southwest Delta area and a full-day field trip to the Sand Motor, demonstrating and covering themes related to several of the aspects covered in class.</p> <p><b>(Guest) Lectures and exercises:</b> (Guest)lectures are strongly recommended. Exercises are compulsory. Class meetings will consist of lectures by UU scientists and invited speakers, student presentations and discussions, serious gaming, and exercises.</p> <p><b>Case study:</b> For much of the course every student will work in a team that will be assigned a delta area of their own. Each team is to identify the key challenges for their delta area and discuss possible pathways for sustainable solutions up to 2100, by researching the themes and applying the techniques covered in class.</p> <p><b>Abstract:</b> After the lectures, presentations and discussions, each student will write an extended abstract on her or his view on the problems, challenges and possible solutions in delta areas in the coming 100 years. It should form a recommendation to the steering committee of the Future Deltas focus area at Utrecht University.</p>

<b>Class session preparation</b>	(Guest) Lectures and exercises: An important part of the self-study is to prepare for the next lecture by studying the recommended materials. These materials consist of books, scientific papers, websites, virtual games and documentaries. Furthermore, students are expected to study information concerning their own specific delta and to read hand-outs given during the course.
<b>Contribution to group work</b>	(Guest) Lectures and exercises: For much of the course every student will work in a team that will be assigned a delta area of their own. Furthermore, each student will collaborate with the students who cover the same themes in the other delta teams. This requires collaboration with the other students and participation throughout the course. <b>Case study:</b> For much of the course every student will work in a team that will be assigned a delta area of their own. Within each "delta team", each student will be responsible for researching and reporting a specific theme covered in class, constituting a chapter of the team report. Students from the different delta teams but with the same themes will compare and discuss their findings, to be included as a discussion at the end of their chapter.
<b>Assessment</b>	
<b>Explanation</b>	<i>What will be assessed?</i> The result for the course is determined by: <ul style="list-style-type: none"><li>• Report – team effort: 40%</li><li>• Report – individual effort: 40%</li><li>• Presentations: 10%</li><li>• Abstract: 10%</li></ul>
<b>Study materials</b>	
<b>Literature</b>	Required: Manual: Course guide Coastal Zone and River Management Reader: Various handouts Items: Articles, reports, provided weblinks

<b>AW-Land Surface Hydrology</b>		
<b>Code: GEO4-4404</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	1 B	
<b>Language</b>	English	
<b>Coordinator</b>	dr. L.P.H. van Beek	
<b>Instructor(s)</b>	dr. L.P.H. van Beek	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	None	
<b>Assumed previous knowledge</b>	This course does has no formal requirements but expects basic knowledge of quantitative analysis, including statistics, mathematics (differentiation, integration) and physics (mechanics).	
<b>Previous knowledge can be gained by</b>	Essential statistics are covered in the textbook of the course (Dingman, Physical Hydrology, Appendix C) while background information on the mathematics can be found in the Conceptual Toolbox (Part C) of Introduction of Physical Hydrology (Hendriks, 2010). An overview of elementary mechanics can be found in Chapter 2 of Mechanics in the Earth and Environmental Sciences (Middleton and Wilcock, 1994).	
<b>Course content</b>		
<b>Objectives</b>	<p>GEO4-4404 Land Surface Hydrology covers the hydrological processes that interact with streamflow over a range of scales. It considers the mechanism of runoff generation in light of atmosphere and land surface interactions. In addition, it considers changes in the travel time and storage as stream flow travels downstream along the drainage network (routing). This course will impart the student with knowledge of the relevant physical processes and the implications thereof in the natural and built environment. It will also provide him/her with the capacity to analyze these processes quantitatively through a variety of models.</p> <p>After completion of the course, students will be able to:</p> <ul style="list-style-type: none"> <li>• Characterize and quantify the hydrological processes that operate at various points and times within a catchment through measurements and modelling;</li> <li>• Analyze total catchment behaviour by means of hydrograph separation and frequency analysis techniques;</li> <li>• Perform simple river discharge routing and interpret the results of more complex schemes;</li> <li>• Evaluate the consequences of errors and uncertainty in measurements and modelling of catchment hydrological behaviour;</li> <li>• Interpret stream flow data for design and planning purposes.</li> </ul>	
<b>Academic skills</b>	<p>Once completed, the student</p> <ul style="list-style-type: none"> <li>• Has obtained expertise in the field of understanding / modelling / simulation of key underlying processes in the field of study;</li> <li>• Has obtained the ability to integrate / interpolate / extrapolate</li> </ul>	

	<p>(incomplete) knowledge at a high level including information gathered from research-articles;</p> <ul style="list-style-type: none"> <li>• Is able to think / develop / apply (partly) original ideas in a (semi) research context;</li> <li>• Demonstrates skills for pursuing (advanced) research in a (sub) field.</li> </ul>
<b>Content</b>	<p>This course concentrates on land surface hydrology and the ways by which it is influenced by different environmental factors, including man. The course focuses on quantitative analyses, including modelling, and offers students an opportunity to improve their analytical skills and understanding of hydrology. The course content will be applied directly during practicals and in the individual assignment that the student has to complete over the duration of the course.</p> <p>This course will be taught on the basis of a textbook and a reader comprising the exercises, additional background materials and articles. Details are published in the course guide.</p> <p>This course is compulsory for the Hydrology track of the master programme Earth, Surface and Water and also within the master programme Water Science and Management.</p>
<b>Entry requirement for</b>	This course is an entry requirement for: Master's thesis Internship (GEO4-6004 or GEO4-6006)
<b>Instructional modes</b>	
<b>Instructional modes</b>	<p>Computer practicals Lectures Tutorials</p> <p>The first lecture, the tutorials and the computer practicals are compulsory.</p>
<b>General remarks</b>	<p>Lectures: Lectures are used to present the theoretical background on the different aspects covered and to provide an overview of their recent applications in the field of land surface hydrology, from both a practical and scientific perspective.</p> <p>Tutorials: Tutorials are intended to offer students the opportunity to directly apply their knowledge to selected problems and obtain help from the teaching staff. This will improve their ability to assess and solve problems. Two tutorials are intended to help students design and improve their individual assignment via peer-review and direct feedback.</p> <p>Computer practicals: Computer practicals are designed to offer students hands-on experience with quantitative analysis and different techniques in hydrology. Principally, they serve to deepen the understanding of the students of the information offered during the lectures and tutorials and obtain direct feedback from the teaching staff. At the same time, they provide a means for the student to improve his/her skills to complete the individual assignment and work under guidance on this.</p>
<b>Class session preparation</b>	In the course guide a detailed schedule with all the due dates and the material that has to be studied or prepared in advance to the course meetings will be provided.
<b>Contribution to group work</b>	Group work is limited to the problems that have to be completed during the tutorials and some of the computer practicals. All marks for the course are based on individual tasks and the completion thereof is the responsibility of each individual student.

<b>Assessment</b>	
<b>Explanation</b>	<ul style="list-style-type: none"> <li>• Intermediate test: 25%</li> <li>• Final test: 25%</li> <li>• One computer practical, selected by the student: 10%</li> <li>• Individual assignment: 40%</li> </ul>
<b>Study materials</b>	
<b>Literature</b>	<p>Required:</p> <p>Book: S. Dingman Physical Hydrology, 3rd Edition (ISBN: 978-1-4786-1118-9).  Waveland Press: <a href="http://www.waveland.com/Titles/Dingman.htm">http://www.waveland.com/Titles/Dingman.htm</a> can be ordered via the UAV.</p> <p>Reader: Land Surface Hydrology, available via the OSZ (Onderwijs- en Studentenzaken/Educational and Student Affairs; to be announced).</p> <p>Handouts: Hand-outs of the lectures and solutions to the exercises are available as PDFs after each lecture/tutorials via Blackboard.</p>

<b>AW-Unsaturated Zone Hydrology</b>		
<b>Code: GEO4-4417</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Period/Timeslot</b>	2 C	
<b>Language</b>	English	
<b>Coordinator</b>	prof. dr. M.F.P. Bierkens	
<b>Instructor(s)</b>	prof. dr. M.F.P. Bierkens, prof. dr. ir. S.M. Hassanzadeh, dr. M.R. Hendriks, W.W. Immerzeel	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students should be registered for a Master's programme	
<b>Assumed previous knowledge</b>	Recommended: - Knowledge of groundwater hydrology: GEO2-4203 Physical hydrology or GEO4-1434 Principles of groundwater flow (or equivalent); - Basic physics/mathematics skills.	
<b>Resources for self study</b>	Book Introduction to Physical Hydrology by Martin Hendriks. Oxford University Press. ISBN: 978-0-19-929684-2	
<b>Course content</b>		
<b>Objectives</b>	After completing the course the student has in-depth knowledge of the below mentioned topics.	
<b>Content</b>	This course covers the theory and principles of soil physics, soil moisture storage, unsaturated flow and transport, matrix flow, infiltration, preferential flow and evaporation, the determination of soil physical parameters, soil moisture dynamics, the use of an integrated soil-water-atmosphere-plant model and a critical evaluation of unsaturated flow theories. After completion of the course a student has in-depth knowledge of the above mentioned topics. Contributions to the following skills: <ul style="list-style-type: none"> <li>• ability work in teams (practicals)</li> <li>• Problem solving skills (homework exercises)</li> <li>• Analytical/quantitative skills (equation solving)</li> <li>• technical skills (computer skills)</li> </ul>	
<b>Entry requirement for</b>	This course is the entry requirement for: n/a	
<b>Instructional modes</b>		
<b>Instructional modes</b>	Computer practicals Lectures Tutorials	
<b>Assessment</b>		
<b>Explanation</b>	<i>What will be assessed?</i> Homework exercises + reports computer practicals (40%) Exam (60%)	

<b>Study materials</b>	
<b>Literature</b>	<p>Required:</p> <p>Literature: Hendriks, M.R. (2010). Introduction to Physical Hydrology, Oxford University Press, 352 pp. ISBN: 978-0-19-929684-2</p> <p>Literature: Kutilek, M and Nielsen, D.R. (1994). Soil Hydrology, Catena Verlag, 370 pp.</p> <p>Syllabus: Syllabus (pdf) and URLs on Blackboard</p>

<b>WSM-Quantitative Water Management</b>		
<b>Code: GEO4-6001</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	2 A	
<b>Language</b>	English	
<b>Coordinator</b>	dr. ir. N. Wanders	
<b>Instructor(s)</b>	dr. ir. N. Wanders	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	None	
<b>Assumed previous knowledge</b>	<ul style="list-style-type: none"> <li>- A bachelor level natural sciences background.</li> <li>- One or more of the following courses: GEO2-4203 Physical Hydrology; GEO3-4307: Fluid mechanics 1; GEO4-1434 Principles of groundwater flow; GEO4-4404: Land surface hydrology.</li> </ul>	
<b>Previous knowledge can be gained by</b>	Students without a natural science bachelor's degree should contact the course coordinator before registering for the course.	
<b>Course content</b>		
<b>Objectives</b>	<p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• present an overview of quantitative regional and local water management issues, with focus on drainage (Dutch topic) and design and management of reservoirs (international topic);</li> <li>• perform calculations that promote understanding c.q. proper application of current theory and practice in the above mentioned fields;</li> <li>• appreciate different visions and occasional conflicts between the theory and practice of regional and local water management;</li> <li>• reflect on current and future developments in quantitative water management in the context of global change.</li> </ul>	
<b>Content</b>	<ul style="list-style-type: none"> <li>• Groundwater drainage: Donnan, Hooghoudt and beyond.</li> <li>• Groundwater drainage practice in The Netherlands: agricultural vs. urban areas.</li> <li>• Urban stormwater drainage and the urban water assignment: pluvial flooding and sewer management, flooding from regional surface waters, and governance issues.</li> <li>• Side effects of drainage: downstream flooding, land subsidence, salinization and operational water resources management, ecohydrological drought, and foundation damage.</li> <li>• Reservoir management and irrigation: basics of irrigation scheduling, hydrological change and sustainable reservoir planning and management.</li> </ul>	
<b>Entry requirement for</b>	This course is an entry requirement for: N/A	

<b>Instructional modes</b>	
<b>Instructional modes</b>	Lecture (required) Seminar (required)
<b>Assessment</b>	
<b>Explanation</b>	See course manual
<b>Study materials</b>	
<b>Literature</b>	See course manual

<b>WSM-Water, Governance and Law</b>		
<b>Code: GEO4-6002</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	4 A	
<b>Language</b>	English	
<b>Coordinator</b>	dr. mr. A.M. Keessen	
<b>Instructor(s)</b>	dr. B. Bluemling, mr. H.F.M.W. van Rijswick, dr. C. Dieperink, dr. mr. A.M. Keessen, dr. C.J. van Leeuwen	
<b>Open to other students</b>	Yes	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Letter of acceptance of a Master's programme.	
<b>Course content</b>		
<b>Objectives</b>	Gaining insight in the policy, governance and legal aspects of water management in order to understand their relevance for water management.	
<b>Content</b>	<p>Governance and Legal aspects will be discussed, taken the international, European and Dutch levels into account (multi-level governance). Normative, institutional and instrumental (including economic instruments) aspects of water management are part of the course, just as the relation with land use planning, environmental and nature conservation law.</p> <p>The relationship between several stakeholders (governments and private parties) will be discussed, and also the way they can be involved (public participation, private responsibilities and private and public enforcement).</p> <p>Typical water management topics like flood protection, waste water treatment, drinking water supply, fresh water supply, river basin management, urban water and urban developments are a major part of the course.</p> <p>During the course there will be attention for specific skills that are needed to deal with legal research and practice.</p> <p>Academic skills: <i>Academic writing, cooperation, discussion, reading literature, working interdisciplinary</i></p>	
<b>Entry requirement for</b>	This course is an entry requirement for: N/A	
<b>Instructional modes</b>		
<b>Instructional modes</b>	Lectures (required) Small-group session (required)	
<b>General remarks</b>	<p>Lectures:</p> <p>Various modes of instruction: lectures, working groups, probably an excursion</p>	
<b>Class session preparation</b>	<p>Lectures:</p> <p>Reading book and materials.</p>	
<b>Explanation</b>	<i>What will be assessed?</i> Essay and group assignment.	
<b>Study materials</b>		
<b>Literature</b>	Reader: course manual with additional materials.	

<b>WSM-Drinking Water and Sanitation</b>		
<b>Code: GEO4-6003</b>	<b>Credits: 7,5 EC</b>	<b>Level: M</b>
<b>Programme</b>	WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	4 B	
<b>Language</b>	English	
<b>Coordinator</b>	dr. ir. P.W.H.M. Smeets	
<b>Instructor(s)</b>	dr. ir. D.G. Cirkel, dr. T.L. ter Laak, dr. ir. P.W.H.M. Smeets	
<b>Open to other students</b>	Yes	
<b>Remarks</b>	Max. 40 students. Students of the Water Science and Management programme have priority. Students of other programmes should contact Erika Dijksma (E.B.Dijksma@uu.nl) before 26 February 2018 and will be put on a waiting list.	
<b>Entry requirements</b>		
<b>Entry requirements</b>	<p>Letter of acceptance of a Master's programme.            You need a bachelor level natural sciences background. Students without a natural science Bachelor's degree should contact the course coordinator before registering for the course.</p>	
<b>Previous knowledge can be gained by</b>	<p>Bachelor courses:</p> <ul style="list-style-type: none"> <li>- Physical chemistry</li> <li>- Physical hydrology</li> </ul>	
<b>Resources for self study</b>	Please contact coordinators of the suggested Bachelor courses.	
<b>Course content</b>		
<b>Objectives</b>	<p>Upon successful completion of the course, students are able to:</p> <ul style="list-style-type: none"> <li>• Understand the key role of drinking water and sanitation in society;</li> <li>• Understand and apply the principle concepts for design and maintenance of drinking water provision and sanitation (abstraction, treatment and disposal);</li> <li>• Understand origin, fate and risk of contaminations in the water cycle;</li> <li>• Understand the functioning of water infrastructure;</li> <li>• Identify the sustainability of drinking water supply and sanitation techniques and practices.</li> </ul>	
<b>Content</b>	<p>Safe water supply and sanitation are essential contributors to public health. In this course students learn the principle concepts for design of drinking water provision and sanitation and how to manage waterborne health risks through these concepts. These risks includes both the traditional issues such as arsenic, pesticides and pathogenic micro-organisms and new risks such as pharmaceuticals, nano-particles, anti-biotic resistance and emerging pathogens. The current water supply and sanitation systems in both developed and developing countries are explained, but also recent developments and future challenges which may lead to new, innovative concepts. Students will learn basic design calculations and decisions to enable them to participate in projects involving water supply and sanitation in the broader context of water science and management.</p> <p>Academic skills: <i>Academic reasoning, conceptual thinking, analysing a problem, asking critical questions, thinking from different perspectives. Effective teamwork,</i></p>	

	<i>oral presentation skills, writing skills.</i>
<b>Entry requirement for</b>	This course is an entry requirement for: N/A
<b>Instructional modes</b>	
<b>Instructional modes</b>	Field trip Lecture Seminars
<b>General remarks</b>	<p>Individual assignment (ICP) and presentation</p> <p>Students will write one individual course paper (ICP). The ICP consists of a 'literature review assignment', on a subject within the fields of drinking water and/or sanitation that students can choose from a list of subjects (see course content at Blackboard). Students will present their results or discuss them with fellow students.</p> <p>A field trip to a wastewater treatment plant or drinking water plant will provide insight in the scale and technology involved.</p>
<b>Class session preparation</b>	<p>Lecture:</p> <p>Students need to prepare for each lecture by reading the assigned study materials for that lecture. This information will not all be repeated in the lectures but will be part of the exam.</p>
<b>Contribution to group work</b>	Seminars will include team assignments to be performed during the seminars. Some assignments will require preparation at home.
<b>Assessment</b>	
<b>Explanation</b>	<p><i>What will be assessed?</i></p> <p>Assessment will take place through one individual assignment, a presentation and one written exam. If the basic requirements are fulfilled, the final mark is calculated according to the following weights:</p> <p>Written exam (65%); ICP (25%); Presentation ICP (10%).</p>
<b>Study materials</b>	
<b>Literature</b>	<p>Book: De Moel P.J., J. Q. J.C. Verberk and J.C. van Dijk (2012); Drinking Water; Principles and Practices. Kiwa/TU Delft. ISBN: 981-256-836-0</p> <p>Additional supporting information and exercise materials will be made available on BlackBoard</p>

<b>WSM-Master's thesis (internship) Water Science Management</b>		
<b>Code: GEO4-6004</b>	<b>Credits: 30 EC</b>	<b>Level: M</b>
<b>Programme</b>	WSM	
<b>Status</b>	Obligatory	
<b>Period/Timeslot</b>	N/A	
<b>Language</b>	English	
<b>Coordinator</b>	prof. dr. M.F.P. Bierkens (Earth Sciences track); dr. P.P. Schot (Environmental Sciences track)	
<b>Instructor(s)</b>	Supervisors from the staff	
<b>Open to other students</b>	No	
<b>Entry requirements</b>		
<b>Entry requirements</b>	<p>Students must be registered for one of the following degree programmes: Water Science and Management</p> <p>Students that started the WSM programme in February 2016 and who do not fulfil this entrance requirement need to file a request with the Board of Examiners for an exemption of the entrance requirement.</p> <p>Number of credits achieved: 60EC of the Master's programme.</p>	
<b>Course content</b>		
<b>Objectives</b>	<p>After completion the student is able to:</p> <ul style="list-style-type: none"> <li>• translate a problem in the field of water science and management into a research question, based upon relevant scientific and other literature;</li> <li>• develop a research plan, choosing and justifying appropriate methodologies for data collection;</li> <li>• conduct the empirical work needed and analyse the collected data;</li> <li>• interpret the findings in the light of solving the given problem;</li> <li>• write a scientifically sound report about the findings geared to the target audience.</li> <li>• conduct a full research cycle within a restricted amount of time.</li> </ul>	
<b>Content</b>	<p>The Master's thesis is a research project in which the student will learn to conduct independent research, applying new or existing methods to a problem relevant to water science and management. The Master's thesis may be executed by on-site training during an Internship. This allows the student to obtain insight into the demands and constraints of doing research within the day-to-day practice of the professional water manager. In that case the academic report of the Internship is the student's Master's thesis. The Master's thesis may also be executed at a university.</p> <p>For internships the student will work under the guidance of a supervisor at the place of internship, and will have regular meetings with the university supervisor to discuss updates of achieved progress in the form of written concept-versions of the Master's thesis. For research at university the student will be guided only by the university supervisor.</p> <p>The student is expected to show ample initiative to realise the goals of the defined research. This includes collecting and analysing relevant scientific and other literature, approaching specialists or other relevant persons for additional</p>	

	<p>information or assistance on research related methods and skills, making timely and regular appointments with the internship supervisor and university supervisor, etc.</p> <p>Learning-by-doing is part of the project. The student is encouraged to attend meetings or conferences etc. that are relevant to the research work.</p>
	<p><b>Note</b></p> <p>Students needs to motivate their choice for either a 30 EC or 45 EC Master's thesis (Internship) (GEO4-6004 or GEO4-6006) based on the problem description and time estimation at the place of internship, data collection and analyses needed, etc.</p>
<b>Entry requirement for</b>	This course is an entry requirement for: N/A
<b>Instructional modes</b>	
<b>Instructional modes</b>	Individual (required)
<b>General remarks</b>	<p>Individual:</p> <p>Introductory lectures. Individual guidance at place of internship and by university supervisor</p>
<b>Assessment</b>	
<b>Explanation</b>	<p><i>What will be assessed?</i></p> <p>Research proposal, Thesis content (70%), Presentation (10%), Process (20%), attending at least ten other students' presentations.</p> <p>The grade for the thesis content must be at least 5.50.</p>
<b>Study materials</b>	
<b>Literature</b>	<p>Recommended: B. Malmfors et al., Writing and Presenting Scientific Papers. Nottingham: UP, 2004 (2nd edition).</p>

<b>WSM-Tailor-made course Water Science and Management</b>		
<b>Code: GEO4-6005</b>	<b>Credits: 7.5 EC or 15 EC</b>	<b>Level: M</b>
<b>Programme</b>	WSM	
<b>Status</b>	Elective	
<b>Period/Timeslot</b>	N/A	
<b>Language</b>	English	
<b>Coordinator</b>	dr. P.P. Schot	
<b>Instructor(s)</b>	students have to find their own qualified supervisor	
<b>Open to other students</b>	No	
<b>Entry requirements</b>		
<b>Entry requirements</b>	Students must be registered for the following degree programme: Water Science and Management Number of credits achieved: 45EC of the Master's programme.	
<b>Course content</b>		
<b>Objectives</b>	Build on competences of the student in relation to the degree requirements of the master programme.	
<b>Content</b>	<p>Students in Water Science and Management may choose other Master's courses as electives in their program. They may also opt for a Tailor Made Course in which they develop their own project. This project must contribute to the competences of the students as specified in degree requirement of the Master program. Moreover the contents of the project must be additional to the courses already followed. Examples of projects include research projects, literature reviews, participation in summer schools, etc. The student takes the initiative to formulate a proposal for a Tailor-made course and must find a staff member willing to provide guidance and grading during the course. Note that staff members are not obliged to supervise a Tailor Made Course.</p> <p>The proposal must be approved by the Board of Examiners and should contain at least the following elements:</p> <ol style="list-style-type: none"> <li>1. start with "<i>Proposal for a Tailor-made course within the Master's programme Water Science and Management</i>";</li> <li>2. Name and studentnumber;</li> <li>3. Date;</li> <li>4. Supervisor (staff member);</li> <li>5. Title for your course;</li> <li>6. Requested EC (7,5 or 15);</li> <li>7. Intended learning outcomes;</li> <li>8. Relation of learning outcomes to Master's programme degree requirements;</li> <li>9. Short description of activities;</li> <li>10. End products;</li> <li>11. Mode of assessment;</li> <li>12. Time planning.</li> </ol> <p>After the proposal has been written, it must be approved and signed by the staff member who is supervising and grading the course, and then be sent to the Board of Examiners. Please note that these procedures take time, so <i>start with organising your Tailor-made course well ahead of the start date</i>. The course will not start until the Board of Examiners has approved your proposal. The Board of Examiners may take a maximum of 6 weeks to assess your proposal. If you have any questions</p>	

	regarding the possible content of your Tailor-made course please contact your Master's programme leader.
<b>Entry requirement for</b>	This course is an entry requirement for : N/A
<b>Instructional modes</b>	
<b>Instructional modes</b>	Individual (Required)
<b>General remarks</b>	Individual: Dependent on the content of the proposed Tailor-made course.
<b>Assessment</b>	
<b>Explanation</b>	<i>What will be assessed?</i> Dependent on the identified ways of assessment in the proposed Tailor-made course.
<b>Study materials</b>	
<b>Literature</b>	Dependent on the content of the proposed Tailor-made course.

<b>Sustainable Entrepreneurship</b>		
<b>Code:</b> ECMSE	<b>Credits:</b> 7,5 EC	<b>Level:</b> M
<b>Programme</b>	SBI	
<b>Status</b>	Elective for SBI, IS, SD, ES, WSM and SBM	
<b>Period/Timeslot</b>	3 D	
<b>Language</b>	English	
<b>Coordinator</b>	dr. N.S. Bosma (n.s.bosma@uu.nl)	
<b>Instructor(s)</b>	dr. N.S. Bosma	
<b>Open to other students</b>	Yes	
<b>Remarks</b>	<p><b>Registration for this course in Osiris runs from 30 October – 26 November 2017.</b></p> <p><b>This course can be used for the Annotation Sustainable Entrepreneurship &amp; Innovation and the Climate-KIC MSc. Label.</b></p>	
<b>Entry requirements</b>		
<b>Entry requirements</b>	<p>Students must be registered for one of the following degree programmes:</p> <ul style="list-style-type: none"> <li>• Energy Science</li> <li>• Water Science and Management</li> <li>• Innovation Sciences</li> <li>• Sustainable Business and Innovation</li> <li>• Sustainable Development</li> <li>• Science and Business Management</li> </ul>	
<b>Recommended pre-requisites</b>	International Business Ventures (ECMIBV)	
<b>Course content</b>		
<b>Objectives</b>	<p>This course is designed to provide academic knowledge related to idea development, value proposition, market introduction and management of new sustainable business and to put these into practice. The major learning objectives include:</p> <ul style="list-style-type: none"> <li>• To provide understanding of (sustainable) entrepreneurship (what entrepreneurship is, cognitive foundations of entrepreneurship, and entrepreneurial opportunities, distinctive characteristics of entrepreneurs);</li> <li>• To analyse and evaluate the economic sources of social and environmental problems and to identify opportunities to alleviate or eliminate these problems and the underlying conditions;</li> <li>• To apply the accumulated knowledge by either developing a business model from scratch or by introducing an initially developed plan to the market by means of bootstrapping methods;</li> </ul> <p>This necessitates that students understand the concepts of sustainability and sustainable entrepreneurship, and that students learn about the economic, environmental and social problems facing local and global communities and recognise the opportunities that arise from this. Finally, students should be able to evaluate the risks and rewards of undertaking sustainable entrepreneurship, which</p>	

	<p>involves finding ways to measure the economic as well as social and environmental risks and rewards of a new venture.</p>
<b>Content</b>	<p>Entrepreneurship focuses on identifying new opportunities for creating value for customers or users and commercially developing those opportunities to establish a profitable business. Sustainable entrepreneurship combines the traditional focus of entrepreneurship with an emphasis on opportunities to alleviate social or environmental conditions. Sustainable entrepreneurship is about entrepreneurs striving simultaneously for profit and for improving local and global environmental and social conditions.</p> <p>This course is addressed to students interested in exploring the challenges of sustainable entrepreneurship. The course will provide academic insights into the entrepreneurial process and in particular:</p> <ul style="list-style-type: none"> <li>• The opportunities and challenges of developing a new venture, given characteristics of the market and the institutional context;</li> <li>• The challenges of aligning profits with social and environmental value;</li> </ul> <p>The overall objective of this course is to make the students aware of the opportunities offered by an entrepreneurial career, the skills needed for and academic knowledge about entrepreneurial processes, in the context of sustainability. The course emphasizes the business &amp; management perspectives to entrepreneurship.</p>
<b>Entry requirement for</b>	<p>This course is an entry requirement for:</p> <ul style="list-style-type: none"> <li>• Consultancy Project SBI (GEO4-2605)</li> <li>• Master's Thesis (GEO4-2606)</li> </ul>
<b>Instructional modes</b>	
<b>Instructional modes</b>	<p>This course is an interactive and participatory course that teaches students the key concepts from theory to practice. It adopts a mix of lectures, tutorial sessions, workshops and activities related to the business model assignment. Students are expected to attend and participate in all lectures and take part in all tutorial sessions. The students will be allocated into groups (4 or 5 students) for the business model assignment. For each group the aim is to establish a mix of enrolled students from Utrecht University School of Economics and from Geosciences , in order to facilitate multidisciplinary work.</p>
<b>Assessment</b>	
<b>Explanation</b>	<p>The elements that constitute the final grade are the following:</p> <p><i>Business Model Assignment (group work):</i>  Groups will either develop a business model from scratch, or introduce developed ideas to the market. This will be achieved in several steps throughout the course period. The evaluation will be based on the quality of the final work, the presentation and the process towards the final document(s).</p> <p><i>Business Case Assignment (group work):</i>  Students will be presented with a case study and are required to answer questions that relate to the case. The questions focus on marketing and finance applied to sustainable entrepreneurship. The evaluation will be based on a concise report in which the answers are motivated.</p> <p><i>Written Exam (individual work):</i>  There will be a midterm exam that consists of open-ended questions. The questions are based on the key course concepts that are taught and discussed during the course.</p> <p><b>Assessment method</b></p> <ul style="list-style-type: none"> <li>• Written midterm exam with open-ended questions (30%); Individual</li> </ul>

	<ul style="list-style-type: none"> <li>• Evaluation of Business Case Assignment (20%); Group grade</li> <li>• Evaluation of business model assignment (50%). Group grade, with a group component (25%) and an individual component (25%).</li> </ul>
<b>Study materials</b>	
<b>Literature</b>	<ul style="list-style-type: none"> <li>• Sustainable Venturing: Entrepreneurial Opportunity in the Transition to a Sustainable Economy. Dean. ISBN-13.: 978-0136044895. Pearson: Boston</li> <li>• Syllabus with academic articles</li> <li>• Course manual</li> </ul>

## **Appendices**

## **Appendix I      Rules for choosing elective courses**

1. Students in the Master's programme choose elective courses from another or their own Master's programme. Courses that are obligatory in the examprogramme cannot be used as elective courses.
2. The student must subject in advance his elective courses to the approval of the Board of Examiners. The coordinator of the student's track will advise the Board in this matter.
3. The Board tests the proposed elective course on the following criteria:
  - a. They must be thematically linked to the Master's programme;
  - b. The track coordinator supports the proposition;
  - c. It concerns a course at a master level (M);
  - d. The course is not taught in the same period and timeslot as another course the student has selected.
4. Within these bounds students are **free to propose any course** (even in Dutch) from any other programme in the Faculty of Geosciences, the UU or another recognized University in the Netherlands (see [www.vsnu.nl](http://www.vsnu.nl) > universiteiten) or abroad. Useful sources to find electives are the Osiris webpage ([www.uu.nl/osirisstudent](http://www.uu.nl/osirisstudent)) and the USI website ([www.usi-urban.nl](http://www.usi-urban.nl)).
5. If the student wishes to choose an elective course, he must do so by a written request (form) to the Board of Examiners and he must attach written information on the contents, the level, and the study load of the course, preferably by means of a copy of the course's description from the course catalogue. The 'Application Form Elective courses IMEW' can be found on the Blackboard community Water Science and Management, or can be downloaded at [http://students.uu.nl/sites/default/files/geo-ies-application\\_form\\_optional\\_courses.pdf](http://students.uu.nl/sites/default/files/geo-ies-application_form_optional_courses.pdf).
6. The student can either ask the track coordinator to sign the application form or forwards an email containing the **track coordinator's approval** to the Board of Examiners. The form (and email if applicable) and the course description can be sent to the Board's secretary, [Examencommissie.geo@uu.nl](mailto:Examencommissie.geo@uu.nl). If in hard copy, for Environmental Sciences: mrs. drs. Erika Dijksma (room 10.23, or pigeon-hole on the 10<sup>th</sup> floor of the Van Unnik building, Heidelberglaan 8). For Earth Sciences: mrs. Ingrid Beekman (room N005, Earth Sciences Building, Budapestlaan 4).
7. Recommended elective courses as mentioned on the Blackboard community WSM do not need to be approved by the track coordinator but must still be approved *before starting* by the Board of Examiners.
8. Actual participation is only possible if the student satisfies the course's entrance conditions; in case of doubt he should contact the course coordinator first.
9. In the programme's course schedule, room has been reserved for taking electives. However, the student is free to deviate from this planning, e.g. because he wishes to take an interesting elective course in another period. If this causes delay in his study planning, the responsibility is for account of the student! Students are therefore advised to take their electives in the reserved periods and timeslots, or use a part of the time planned for their internship and/or Master's thesis.

## **Appendix II Teaching and examination regulations Graduate School Geosciences 2017-2018**

The Education and Examination Regulations set out the degree programme-specific rights and obligations of students on the one hand and of Utrecht University on the other hand. The University's [student charter](#) contains the rights and obligations that apply to all students.

These Regulations were adopted by the Dean of the Graduate School of the Faculty of Geosciences on 11 April 2017 with the approval of the Faculty Council on 11 April 2017.

### **SECTION 1 – GENERAL PROVISIONS**

#### **Art. 1.1 – applicability of the Regulations**

These Regulations apply to the teaching and examinations of the Master's degree programmes in Development Studies, Earth Sciences, Environmental Sciences, Geographical Sciences, Human Geography, Human Geography and Planning (research programme), Spatial Planning and Science and Innovation (hereinafter called the degree programmes) and to all students registered for these degree programmes and to all students who have applied for admission to these degree programmes for the academic year 2017-2018.

The degree programmes and individual Master's programmes are run by the Graduate School of Geosciences within the Faculty of Geosciences.

#### **Art. 1.2 – definition of terms**

In these Regulations, the terms below have the following meanings:

- a. the Act: the Dutch Higher Education and Research Act 1992 (Wet op het Hoger onderwijs en wetenschappelijk onderzoek 1992, WHW).
- b. student: a person who is registered at the University to take courses and/or sit the tests and final examination of the degree programme. In these Regulations, reference to a student is in the masculine form, in accordance with the General Regulations Guideline applicable to Dutch legislation.
- c. credit: a value expressed in EC (according to the European Credit Transfer System), where the study load is expressed as one credit being equivalent to 28 hours of learning.
- d. degree programmes: the Master's degree programmes referred to in Art. 1.1 of these Regulations, consisting of a coherent whole of units of study. A Master's degree programme may comprise several Master's programmes.
- e. component: a unit of study (course) within the degree programme, as included in the prospectus and the University Course Catalogue.
- f. course: the whole of education and testing of a component.
- g. test: interim examination as referred to in Art. 7.10 of the Act.
- h. examination: the final examination of the degree programme that is passed if all obligations of the entire Master's degree programme have been fulfilled.
- i. special needs contract: the contract concluded by the Director of Education (or another officer on behalf of the degree programme) and the disabled student, which lays down the necessary and reasonable facilities to which the student is entitled.
- j. International Diploma Supplement: the annex to the Master's degree certificate, which includes an explanation of the nature and contents of the degree programme (partly in an international context).
- k. Board of Studies: the Board of the Graduate School of Geosciences.
- l. Student Affairs Geosciences: student information desk and student progress administration unit of the Faculty.
- m. course guide: document specifying for each course: the exit qualifications; the requirements (such as the attendance and effort requirements) that a student must meet to achieve the exit qualifications; the way in which the final grade is calculated; the timetable and the instructional formats; name and availability of the course coordinator.
- n. academic vacation periods: periods without any teaching obligations for teaching staff and learning obligations for students, as laid down in the academic calendar for the degree programmes.
- o. Examiner: an assessor whose competence has been determined by the Board of Examiners of the program.

The other terms have the meanings ascribed to them in the Act.

## **SECTION 2 – ADMISSION**

### **Art. 2.1 – admission requirements of the degree programmes**

1. The holder of a Dutch or foreign higher education degree who possesses knowledge, understanding and skills at university bachelor's level and who demonstrates the specific knowledge, understanding and skills as specified in Annex 1, can be admitted to one of the Master's programmes.
2. Selection of students is based on a review of the following core competences of applicants:
  - a) motivation and talent (partly based on GPA and study progress);
  - b) level of relevant knowledge and competence in the methods and techniques of the field of study concerned;
  - c) general level of academic and professional skills;
  - d) level of proficiency in the language(s) of instruction used in the programme.

This information is used to assess whether a student is able to complete the Master's programme successfully within the nominal duration.

### **Art. 2.2 – English language (for Master's Degree Programmes taught in English)**

1. Registration for the degree programmes is possible only after it has been demonstrated that the requirement of adequate command of the English language is fulfilled. Deficiencies in previous education in English must be made up before the start of the degree programme by sitting one of the following tests: IELTS (International English Language Testing System), academic module. The minimum required IELTS score (overall band) is: 6.5 with at least 6.0 for the component 'writing'.
  - o TOEFL (Test of English as a Foreign Language). The minimum required TOEFL score is 93 (internet-based test).
  - o Cambridge EFL (English as a Foreign Language) Examinations, with one of the following certificates:
    - Cambridge Certificate in Advanced English; minimum score B.
    - Cambridge Certificate of Proficiency in English; minimum score C.
2. The holder of a university Bachelor's degree awarded in the Netherlands fulfils the requirement of adequate command of the English language.

### **Art. 2.3 – proficiency in Dutch for holders of foreign qualifications (for Master's Degree Programmes taught in Dutch)**

Holders of a foreign diploma may only register:

1. once it has been demonstrated that the requirement of adequate command of the Dutch language has been fulfilled by passing the state examination in Dutch as a Second Language, Programme 2, or the certificate in Dutch as a Foreign Language, 'Educatief Professioneel' ('Educational Professional', previously 'Academic Language Skills Profile' (PAT)) or 'Educatief Startbekwaam' ('Educational Beginner's proficiency', previously 'Higher Education Language Skills Profile' (PTHO)), and
2. once it has been demonstrated that the requirement of adequate command of the English language has been fulfilled. Deficiencies in previous education in English must be made up before the start of the degree programme by sitting one of the following tests:
  - o IELTS (International English Language Testing System), academic module. The minimum required IELTS score (overall band) is: 6.5 with at least 6.0 for the component 'writing'.
  - o TOEFL (Test of English as a Foreign Language). The minimum required TOEFL score is 93 (internet-based test).
  - o Cambridge EFL (English as a Foreign Language) Examinations, with one of the following certificates:
    - Cambridge Certificate in Advanced English; minimum score B.
    - Cambridge Certificate of Proficiency in English; minimum score C.

### **Art. 2.4 – deficiencies**

1. The Board of Admissions of the Graduate School may require those applicants who do not meet the admission requirements referred to in Art. 2.1 to complete a package of courses to a maximum of 60 EC, to be taught by Utrecht University and tailored to the Master's programme concerned, in order to make up for prior educational deficiencies.
2. The Board of Admissions may establish in its decision that deficiencies must be made up within a certain period of time and prior to admission to the Master's degree programme.
3. In the event of insufficient qualitative progress and/or participation in the defined deficiency programme, the Board of Admissions of the Graduate School may exclude the student from further or repeated participation.

## **Art. 2.5 – admissions procedures**

1. Responsibility for admission to the degree programmes of the Graduate School and the various Master's programmes lies with the Board of Admissions of the Graduate School.
2. In order to determine eligibility for admission to the degree programme, the Board of Admissions will consider and evaluate the knowledge, understanding and skills of the applicant. The Board may request experts within or outside the University to assess the applicant's knowledge, understanding and skills in particular areas, in addition to a review of written documents of qualifications gained.
3. In order to determine eligibility for admission to a programme within the Master's degree programme, the Board of Admissions will examine whether the applicant meets the admission requirements referred to in Art. 2.1(1) or will meet them in time. In its review, the Board will include the applicant's core competences referred to in Art. 2.1(2), as well as the applicant's knowledge of the programme's language of instruction. On this basis the Board of Admissions will assess whether the candidate is able to achieve the exit qualifications of the Master's degree programme with sufficient effort within the nominal duration of the programme.
4. Requests for admission to one of the degree programmes and to a specific Master's programme are submitted to the Board of Admissions before 1 June. In special cases, the Board of Admissions may consider requests submitted after this closing date.
5. The applicant will receive written notification whether or not he has been admitted to the degree programme and a specific Master's programme. The possibility to appeal to the Examinations Appeal Board will be indicated in this notification.

## **SECTION 3 – CONTENTS AND STRUCTURE OF THE DEGREE PROGRAMMES**

### **Art. 3.1 – aim of the degree programmes**

1. The degree programme aims to:
  - o equip students with specialist knowledge, skills and understanding in the field of Geosciences, and help them achieve the exit qualifications referred to in paragraph 2;
  - o prepare students for a career in one or more sub-fields of Geosciences;
  - o prepare students for undertaking a programme to train as a researcher in the field of Geosciences.
2. The graduate:
  - o has a deep knowledge and understanding of the subject matter of Geosciences;
  - o has a thorough knowledge of a specialism in his degree programme and thorough knowledge at the interface of the degree programme and another field;
  - o has the skills to identify, formulate, analyse and suggest possible solutions to problems independently in the field of Geosciences;
  - o has the skills to conduct research in the field of Geosciences and to report on this research in a manner that meets the customary standards of the discipline;
  - o possesses professional and academic skills, particularly in relation to the field of Geosciences;
  - o is able to apply knowledge and understanding in such a way that demonstrates a professional approach to his work or profession;
  - o is able to communicate conclusions, as well as the underlying knowledge, grounds and considerations, to an audience composed of specialists or non-specialists.

The prospectuses for the Master's degree programmes set out the subject-specific exit qualifications for the different Master's programmes.

### **Art. 3.2 – mode of attendance**

The degree programmes in Development Studies, Earth Sciences, Environmental Sciences, Human Geography and Planning (research programme) and Science and Innovation are offered full-time. The degree programmes in Spatial Planning, Geographical Sciences and Human Geography are offered full-time as well as part-time.

### **Art. 3.3 – language of instruction**

All degree programmes are taught in English.<sup>1</sup>

### **Art. 3.4 – study load**

The degree programmes in Earth Sciences, Environmental Sciences, Geographical Sciences, Human Geography and Planning (research programme) and Science and Innovation have a total study load of 120 credits. The degree programmes in Development Studies, Spatial Planning and Human Geography have a total study load of 60 credits.

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<sup>1</sup> The degree programmes below are taught in Dutch

### **Art. 3.5 – programmes; start dates**

1. The Graduate School of Geosciences offers the following Master's degree programmes and Master's programmes:

<b>Master's degree programmes</b>	<b>Master's Programmes</b>
Earth Sciences	Earth, Life and Climate Earth Structure and Dynamics Earth Surface and Water Marine Sciences Water Science and Management
Environmental Sciences	Sustainable Development Water Science and Management
Geographical Sciences	Geographical Information and Management Applications
Human Geography and Planning	Urban and Economic Geography
Science and Innovation	Innovation Sciences Energy Science Sustainable Business and Innovation
Development Studies	International Development Studies
Spatial Planning	Spatial Planning
Human Geography <sup>2</sup>	Human Geography Economische Geografie Geo-communicatie Urban Geography

The Master's degree programmes prepare students for undertaking research in one or more sub-fields of Geosciences.

2. All Master's degree programmes have one start date a year: 1 September.

### **Art. 3.6 – components of the Master's programmes**

1. The core components of the different Master's programmes and their study loads are described in Annex 2.
2. Upon approval by the Board of Examiners, the student will choose one or more components. The study loads for the elective components of the specific Master's programmes are set out in Annex 2.
3. In the prospectus, the contents and form of instruction of the components of the different Master's programmes are described in more detail, stating the prior knowledge desirable to pass the relevant component.

### **Art. 3.7 – components taken elsewhere**

1. The condition for gaining the degree certificate of the Master's examination of the programme is that at least half of the Master's degree programme is passed in components provided by Utrecht University.
2. Components passed elsewhere during the degree programme can only be incorporated in the student's examinations programme with prior permission from the Board of Examiners.
3. Exemption can be granted for components passed at an institute of higher education prior to the start of the Master's degree programme only on the basis of Art. 5.13.
4. Contrary to Art. 3.7.3., components that have been passed in a Master's degree programme at Utrecht University prior to the start of the Master's degree programme may be counted towards the student's examinations programme with the classification awarded.

### **Art. 3.8 – actual teaching structure**

The teaching structure of each course is shown in the University Course Catalogue and/or course guides and/or in the digital learning environment (Blackboard).

The student can view the room timetables of the classes for which he is registered via [MyTimetable](#).

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<sup>2</sup> From the academic year 2017-2018 the programmes Economische Geografie, Geo-communicatie and Urban Geography are open only for re-enrolment.

## **SECTION 4 – COURSES**

### **Art. 4.1 – course**

All courses that are part of the degree programmes have been included in the prospectuses for the programmes and can be found at the [student site](#).

### **Art. 4.2 – course admission requirements**

The Board of Studies will decide the order in which the required components of a Master's degree programme must be completed. This will be announced in the prospectus and/or the course guide.

### **Art. 4.3 – registration for courses**

Participation in a course is possible only if the student has registered for it in good time. The Board of Studies will decide how and when registration takes place. Registration rules and closing dates will be published through the [student site](#).

### **Art. 4.4 – attendance and effort requirements**

1. Each student is expected to participate actively in the course for which he is registered.
2. Besides the general requirement for the student to participate actively in the course, the additional requirements for each component are listed in the University Course Catalogue and the course guide.
3. A student may be granted exemption from attendance for reasons demonstrably beyond his control (for instance as a result of illness or family circumstances), at the discretion of the course coordinator. The student must notify the study programme's secretariat of his absence in advance. The course coordinator may request the student to provide written evidence.
4. In the event of qualitatively or quantitatively inadequate participation, the course coordinator may exclude the student from further participation in the course or part of it.
5. Effort requirements (such as holding a presentation or writing a paper) can never expire. If a student fails to meet an effort requirement in time for reasons beyond his control, he must report to the course coordinator immediately after the situation has arisen and, if instructed by the course coordinator, provide evidence of the exceptional circumstances.
6. Students who wish to apply for special arrangements with regard to course obligations as a result of chronic illness, disability or Outstanding Student Athlete status, may submit a request to the Board of Examiners (see also Art. 7.3).

### **Art. 4.5 – evaluation of the quality of education**

1. The Director of Education is responsible for monitoring the quality of education. To this end, the Director ensures that courses are evaluated as well as the curriculum. In this quality control of the courses he will draw on the advice and suggestions for improvement of the education committee on promoting and safeguarding the quality of the course.
2. Students are informed of the outcomes of the course and curriculum evaluations.

## **SECTION 5 – TESTING**

### **Art. 5.1 – general**

1. During the course, the student will be tested for academic schooling and on the extent to which he has sufficiently achieved the learning objectives set. The testing of the student will be concluded at the end of the course.
2. The University Course Catalogue and/or course guide describe the achievements the student must demonstrate to pass the course, as well as the criteria on which the student is assessed. In the event of a difference of opinion, the course guide will be followed.
3. If a course has to be repeated, the last classification gained will count.
4. Should a student pass a course, but still wishes to repeat the course, the complete course must be repeated.
5. The Regulations of the Board of Examiners describe the testing process (see: [student site](#)).

### **Art. 5.2 – Board of Examiners**

1. The Dean will establish a Board of Examiners for each degree programme or group of degree programmes and will sufficiently ensure that the Board of Examiners can operate independently and professionally.
2. The Dean will appoint the chair and the members of the Board of Examiners for a period of three years on the basis of their expertise in the field of the degree programme(s) in question or the field of testing, in which:

- at least one member comes from outside the degree programme or group of degree programmes concerned, and
- at least one member is a lecturer on the degree programme or group of degree programmes concerned.

Re-appointment is possible. Before making this appointment, the Dean will consult the members of the Board of Examiners concerned.

3. Persons holding management positions that include financial responsibilities or who are wholly or partially responsible for Master's degree programmes are not eligible for appointment to the Board of Examiners or as chair of the Board of Examiners. These persons will in any event include the Dean, the Vice Dean, directors/heads/managers of a department, members of a department's management/governing team, members or chairs of the Board of Studies of the Graduate or Undergraduate School and the Director of Education.
4. Membership of the Board of Examiners will end on completion of the term of appointment. The chair and members of the Board may also be dismissed by the Dean at their own request. The chair and members of the Board will be dismissed by the Dean if they no longer meet the requirements of paragraphs 2 or 3 of this article. The Dean may also dismiss a chair or members found to be performing their statutory duties unsatisfactorily.
5. The Dean will announce the composition of the Board(s) of Examiners to students and lecturers.

#### **Art. 5.3 – assessment of traineeship or research assignment and thesis**

1. A traineeship or research assignment will be assessed by the supervisor and also examiner in question and by one or more other internal and/or external experts.
2. Master's theses will be assessed by at least two examiners.

#### **Art. 5.4 – grades**

1. Grades will be awarded on a scale of 1 to 10. The final assessment of a course is either pass or fail, expressed in numbers: 6 or higher and 5 or lower respectively.
2. The final course grade will be rounded to one decimal place. A partial course grade will never be rounded.
3. The final course grade of 5 will not have any decimal places. An average grade of 4.95 to 5.49 is a fail (5); an average grade of 5.50 to 5.99 is a pass (6).
4. The course guide sets out the way in which the final course grade is calculated.
5. Alphanumeric results are awarded in the following cases:
  - a student who is registered for a course and has not participated in one of the test modules will be given an NV (Niet Verschenen – No Show). If non-participation is for reasons beyond the student's control the student will be given an ND (Niet Deelgenomen– Not Participated);
  - a student who has not participated in all the test modules will be given an NVD (Niet VolDaan – Incomplete);
  - if the student has completed a module, but has not received a grade for it, he may be given a V (Voldoende – Satisfactory) as the result;
  - if the student has not completed a module but does not receive a grade for it, the student can be given an ONV (ONVoldoende - Unsatisfactory) as the result;
  - a student who has been granted exemption by the Board of Examiners will be given a VR (VRijstelling – Exemption);
  - if the Board of Examiners establishes fraud, the student may be given an FR (FRaude – Fraud) as the result.

#### **Art. 5.5– repeat exams: supplementary or replacement tests**

1. If during the course the student satisfies all the effort requirements and does not receive a pass grade but does receive a final grade of at least 4.00 before rounding, he will be given a once-only opportunity to take a supplementary test.
2. The lecturer will determine the form and content, as well as date and time, of the supplementary test.
3. If the student passes the individual supplementary test, a final grade of 6 for the entire course will be recorded in the student progress administration system. Partial course grades that the student has achieved will not be taken into account in establishing the final grade of the supplementary test.
4. If the student does not pass the supplementary test, the initial final grade will be entered into the student progress administration system, thus rendering all partial course grades no longer valid.
5. Students who miss a test or part of a test owing to circumstances demonstrably beyond their control will be given only one opportunity to sit a replacement test. Only students reporting these circumstances beyond their control immediately after their occurrence to the course coordinator will be eligible to sit a replacement test.
6. The lecturer will determine the form and content of the replacement test.
7. If the student is not present at the replacement test, or fails to meet the terms of the replacement test in good time, he will not be offered another opportunity.

#### **Art. 5.6 – type of test**

1. Testing as part of a course will take place as stated in the course guide.
2. Upon request, the Board of Examiners may allow a test to be administered in a manner which departs from the provisions of the first paragraph.

#### **Art. 5.7 – oral tests**

1. Only one person at a time may be tested orally, unless the Board of Examiners decides otherwise.
2. Oral tests will be administered in public, unless the Board of Examiners or the examiner in question has decided otherwise in a special case, or the student has objected to this.

#### **Art. 5.8 – provision for testing in special cases**

1. If not providing for an individual testing possibility would result in a 'special case of manifest unfairness', the Board of Examiners may decide to grant an individual testing possibility.
2. Requests for a special possibility to sit a test must be submitted to the Board of Examiners as soon as possible, together with supporting documentary evidence.

#### **Art. 5.9 – time limit for grading tests**

1. Within 24 hours of administering an oral test the examiner will determine the grade and provide the student with a written statement of the grade awarded.
2. The examiner will grade a written or differently administered test or partial test within 10 working days of the test date, and will provide the administrative office of the Faculty with the information necessary to provide the student with written or electronic proof of his grade.
3. If there is a third examiner, a new assessment period of 10 working days will commence, immediately following the first period of 10 working days. It is not possible to commence a new period following this second period.
4. Time frames for assessment do not apply during academic vacation periods.
5. The written statement of the grade awarded must inform the student of the right of inspection referred to in Art. 5.11 and of the possibility to appeal to the Examination Appeals Board.

#### **Art. 5.10 – period of validity**

1. The term of validity of courses passed is eight years between test date and exam date.
2. Notwithstanding this, in case of special circumstances the Board of Examiners may, if the student requests, determine an extended validity period for a course, or impose a supplementary or replacement test.
3. Partial tests and assignments passed in a course that was not successfully completed will expire at the end of the academic year in which they were passed. Partial tests and assignments expire at the end of the period in which they were passed, if the course concerned is taught more than once per academic year.

#### **Art. 5.11 – right of inspection**

1. Within 30 days after the announcement of the result of a written test, the student is allowed to inspect his graded work upon request. A copy of that work will be supplied to the student on request.
2. During the period referred to in the first paragraph, any interested party may inspect the questions and assignments of the test concerned, as well as the standards on which the grade was based.

#### **Art. 5.12 – retention of tests**

1. The assignments, answers and the work assessed in the written tests will be kept in paper or electronic form for a period of two years following the assessment.
2. The thesis and its assessment will be kept in paper or electronic form for a period of seven years following the assessment.

#### **Art. 5.13 – exemption**

At the student's request, the Board of Examiners may, after consulting the examiner in question, grant the student exemption from a programme component if he:

- a. has already either completed a university or higher vocational programme component which is equivalent in content and level; or
- b. has demonstrated through work or professional experience that he has sufficient knowledge and skills in relation to that component.

#### **Art. 5.14 – fraud and plagiarism**

1. Fraud and plagiarism are defined as an action or failure to act on the part of a student, as a result of which a correct assessment of his knowledge, understanding and skills is made impossible, in full or in part.

Fraud includes:

- cheating during examinations. The person offering the opportunity to cheat is an accessory to fraud;
- having within reach tools and resources during examinations, such as a pre-programmed calculator, mobile phone, smartwatch, smartglasses, books, course readers, notes, etc., consultation of which is not explicitly permitted;
- having others carry out all or part of an assignment and passing this off as own work;
- gaining access to questions, assignments or answers of an examination prior to the date or time that the examination takes place;
- making up survey or interview answers or research data.

Plagiarism is defined as including data or sections of text from others in a thesis or other paper without quoting the source. Plagiarism includes the following:

- cutting and pasting text from digital sources such as encyclopaedias and digital magazines without using quotation marks and referring to the source;
- cutting and pasting text from the internet without using quotation marks and referring to the source;
- using excerpts from texts of printed material such as books, magazines and encyclopaedias without using quotation marks and referring to the source;
- using a translation of the abovementioned texts without using quotation marks and referring to the source;
- paraphrasing of the abovementioned texts without clearly referring to the source: paraphrasing must be marked as such (by explicitly linking the text with the original author, either in text or a footnote), so that the impression is not created that the ideas expressed are those of the student;
- using visual, audio or test material from others without referring to the source and presenting this as own work;
- resubmission of the student's own earlier work without referring to the source, and allowing this to pass for work originally produced for the purpose of the course, unless this is expressly permitted in the course or by the lecturer;
- using the work of other students and passing this off as own work. If this happens with the permission of the other student, the latter is also guilty of plagiarism;
- in the event that, in a joint paper, one of the authors commits plagiarism, the other authors are also guilty of plagiarism, if they could or should have known that the other was committing plagiarism;
- submitting papers obtained from a commercial institution (such as an internet site offering excerpts or papers) or having such written by someone else whether or not in return for payment.

2. a. In all cases in which fraud or plagiarism is found or suspected, the examiner will inform the student and the Board of Examiners of this in writing.  
b. The Board of Examiners will give the student the opportunity:
  - to respond to that in writing;
  - to be heard.
3. The Board of Examiners will determine whether fraud or plagiarism has occurred and will inform the student of its decision in writing and of the sanctions in accordance with the stipulations of the fourth paragraph, stating the possibility of appeal to the Examination Appeals Board.
4. Fraud and plagiarism will be punished by the Board of Examiners as follows:
  - a. In any event:
    - o invalidation of the paper or examination submitted
    - o a reprimand, a note of which will be made in OSIRIS.
  - b. In addition, – depending on the nature and scale of the fraud or plagiarism, and on the student's phase of study – one or more of the following sanctions:
    - o removal from the course
    - o no longer being eligible for a positive degree classification (cum laude) as referred to in art. 6.2
    - o exclusion from participation in examinations or other forms of testing belonging to the educational component concerned for the current academic year, or for a period of 12 months
    - o complete exclusion from participation in all examinations or other forms of testing for a period of 12 months.
  - c. In the event that the student has already received a reprimand: complete exclusion from participation in all examinations or other forms of testing for a period of 12 months.
  - d. In the case of extremely serious and/or repeated fraud or plagiarism, the Board of Examiners may recommend that the Executive Board permanently terminate the student's registration for the degree programme.
5. If the Board of Examiners determines that there has been widespread or organised fraud, on a scale which would affect the examination results in their entirety, the Board of Examiners will decide without delay that the examination concerned is invalid and that all the participants must resit the whole examination at short notice. The Board of Examiners will set the date on which the examination must be retaken. This date will be no later than two weeks after the fraud was established, so that the participants can still benefit from their preparatory work for the examination.

#### **art. 5.15 – control of plagiarism**

1. For the purpose of controlling plagiarism handing in an electronic version of written assignments by the student (such as papers, theses) can be imposed as a compulsory condition by the examiner of the relevant course, whether or not using a designated plagiarism detection system. If the student does not submit an electronic version of the assignment in time, the assessor may decide not to assess the assignment.
2. By submitting a written assignment, the student gives permission in the broadest sense of the word for the control of plagiarism via a plagiarism detection system as well as for recording the written assignment in databases, to the extent necessary, for future plagiarism checks.
3. In the event of a particular course decides to disclose documents, the student reserves the right not to disclose his written assignment other than for the purpose of plagiarism as referred to in paragraphs 1 and 2 of this article.

#### **Art. 5.16 – right of appeal**

The student has a right to appeal decisions taken by the Board of Examiners or by examiners. The appeal must be made in writing, and explaining the basis for the appeal, to the Examination Appeals Board within six weeks of taking the test or examination, or of the decision being made, pursuant to Section 7.61 of the Higher Education Research Act 1992.

### **SECTION 6 – EXAMINATION**

#### **Art. 6.1 – examination**

1. As soon as a student has fulfilled the requirements of the examinations programme, the Board of Examiners will determine the result of the examination and award a certificate, as described in Art. 6.4.
2. Prior to determining the result of the examination, the Board of Examiners may conduct its own examination of the student's knowledge of one or more components or aspects of the degree programme, if and in so far as the results of the relevant tests give it reason to do so.
3. Assessment of the examinations file constitutes part of the final examination. The date of examination will be the last working day of the month in which the Board of Examiners has determined that the student has fulfilled all the requirements of the examinations programme.
4. Conditions to pass the examination are
  - all components are passed;
  - the composition of the course package completed meets the level requirements set.
5. A further condition for passing the examination and receiving the certificate is that the student was registered for the degree programme during the period in which the tests were taken. If the student does not fulfil this condition, the Executive Board may issue a statement of no objection in relation to the passing of the examination and the issue of the certificate, after the student has paid the tuition fees and administration charges owing for the 'missing' periods.
6. A student who has passed the examination and is entitled to a certificate may request the Board of Examiners to not yet grant the certificate and to postpone the examination date referred to in paragraph 3. This request has to be submitted within two weeks after the student has been informed of the result of the examination. The student will indicate in this request when he does wish to receive the certificate. The Board of Examiners will grant the request in any case if the student:
  - is to fulfil a management position for which Utrecht University has provided an administrative grant
  - is to do a traineeship or take a component of a programme abroad.The Board of Examiners may also grant the request if refusal would result in an exceptional case of extreme unfairness on account of the circumstance the student concerned could not have taken automatic graduation into account when he was planning his study.
7. After the student has passed the final examination he can request the institution to terminate his registration.

#### **Art. 6.2 – cum laude classification**

1. If a student has demonstrated outstanding academic achievement in his Master's degree programme, the degree will be awarded cum laude; this classification will be noted on the degree certificate.
2. The cum laude classification will be awarded to the Master's examination if each of the following conditions have been met:
  1. the weighted average (based on EC) of the grades achieved for the Master's programme components is at least 8.00.
  2. the student has received a minimum grade of 8.00 for the Master's thesis.
  3. the student has been granted no more than 7.5 credits in exemptions that do not count towards the examination programme (1-year programmes) or no more than 15 credits (2-year programmes).

4. there has been no decision by the Board of Examiners (as referred to in Art. 5.14) that because it has been established that fraud/plagiarism has been committed the student no longer qualifies for a positive classification (cum laude).
5. the Master's examination has been passed within one and a half years (one-year degree programmes) or three years (two-year degree programme).
3. The Board of Examiners may decide to award the cum laude classification even if not all the requirements referred to in paragraph 2 are met. Such a decision must be unanimous.
4. Classifications other than cum laude will not be noted on the degree certificate.

#### **Art. 6.3 – degree**

1. The Master of Science degree will be awarded to the student who passes the examination.
2. The degree awarded will be noted on the examination certificate.

#### **Art. 6.4 – degree certificate**

1. The Board of Examiners will award a certificate as proof that the examination was passed.
2. The Board of Examiners will add the International Diploma Supplement to the certificate which provides (international) insight into the nature and contents of the completed degree programme.

#### **Art. 6.5 – grading tables**

1. The International Diploma Supplement gives the student's cumulative average mark and an ECTS Grading Table.
2. The cumulative average mark shows the student's academic performance on a scale of 1 to 10. It is calculated based on the final results for the courses the student has successfully completed within the degree programme. Courses that are not assessed on a numerical basis are not included in the calculation. The cumulative average mark is weighted based on the number of credits for each course.
3. The ECTS Grading Table gives a clear picture of Utrecht University's marking culture for educational institutions and employers outside the Netherlands. Based on the Grading Table, they can convert the results into their own marking system. The ECTS Grading Table is an institution-wide table for all Master's Degree programmes. This table uses a ten-point scale where only the marks from 6 to 10 are shown, as only passing marks are included in the Grading Table. The marks are expressed only as whole or half points. The percentage given with each mark indicates how frequently each mark is awarded.  
The ECTS Grading Table is calculated on the basis of:
  1. all final passing marks in courses undertaken towards the degree, excluding alphanumerical results;
  2. not weighted according to study load;
  3. in the three most recent academic years;
  4. of students who were registered for a Master's Degree programme at Utrecht University.

### **SECTION 7 – STUDENT COUNSELLING**

#### **Art. 7.1 – student progress administration**

1. The Faculty must record the individual study results of the students and make them available through Osiris-student.
2. Certified student progress files may be obtained from Student Affairs Geosciences.

#### **Art. 7.2 – student counselling**

1. The Faculty is responsible for providing an introductory programme and student counselling to students registered for the degree programmes.
2. Student counselling encompasses:
  - encouraging students to feel part of the community;
  - supervising programme choices;
  - assisting a student to familiarise himself with the job market.
  - an introductory programme in the first week of the first semester of the first year of study
  - referring and assisting students who encounter difficulties during their studies.

#### **Art. 7.3 – disability**

Students with special needs are afforded the opportunity to take classes and sit tests in the manner agreed in their special needs contracts. Requests for special needs contracts are submitted to the student adviser.

## **SECTION 8 – TRANSITIONAL AND FINAL PROVISIONS**

### **Art. 8.1 – safety net arrangements**

In cases for which these Regulations do not provide, do not clearly provide or lead to obviously unreasonable outcomes, a decision will be taken by or on behalf of the Dean, after having heard the Board of Examiners. If, on the basis of the law, the decision falls within the competence of the Board of Examiners, the Dean will send the request to the Board of Examiners for it to settle.

### **Art. 8.2 – amendments**

1. Amendments to these Regulations will be laid down by the Dean after having heard the Degree Programme Committee and after consultation with the Faculty Council, in separate resolutions.
2. An amendment to these Regulations is not to be applied to the current academic year, unless it is reasonable to assume that it will not harm the interests of the students.
3. Furthermore, an amendment may not have an adverse effect for students on any other decision the Board of Examiners has taken pursuant to these Regulations with respect to a student.

### **Art. 8.3 – publication**

The Dean will provide for the publication of these Regulations, as well as each amendment, on the internet.

### **Art. 8.4 – effective date**

These Regulations take effect on 1 September 2017.

## **APPENDIX 1 Admission requirements Master's degree programmes**

### **Earth, Life and Climate**

Admission to the programme Earth, Life and Climate is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Earth Sciences, Biology or Chemistry, at advanced level of the major Earth Sciences, Biology or Chemistry at Utrecht University, or equivalent to that level.
- b) insight in Earth Sciences at advanced level of the major Earth Sciences, Biology or Chemistry at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Earth Sciences, Biology or Chemistry at Utrecht University, or equivalent to that level.

### **Earth Structure and Dynamics**

Admission to the programme Earth Structure and Dynamics is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level.

Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Earth Sciences or Physics, at advanced level of the major Earth Sciences or Physics at Utrecht University, or equivalent to that level.
- b) insight in Earth Sciences at advanced level of the major Earth Sciences or Physics at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Earth Sciences or Physics at Utrecht University, or equivalent to that level.

### **Earth Surface and Water**

Admission to the programme Earth Surface and Water is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills on a university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Earth Sciences, at advanced level of the major Earth Sciences at Utrecht University, or equivalent to that level.
- b) insight in Earth Sciences at advanced level of the major Earth Sciences at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Earth Sciences at Utrecht University, or equivalent to that level.

### **Energy Science**

Admission to the programme Energy Science is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Environmental Sciences, Science and Innovation Management, Physics or Chemistry at advanced level of the major Environmental Sciences, Science and Innovation Management, Physics or Chemistry at Utrecht University, or equivalent to that level.
- b) knowledge of Thermodynamics, Energy Analysis and Mathematics
- c) insight in Environmental Sciences, Science and Innovation Management, Physics or Chemistry at advanced level of the major Environmental Sciences, Science and Innovation Management, Physics or Chemistry at Utrecht University, or equivalent to that level.
- d) academic and research skills of the major Environmental Sciences, Science and Innovation Management, Physics or Chemistry at Utrecht University, or equivalent to that level.

### **GIMA (Master of Science in Geographical Information Management and Applications)**

Admission to the programme Geographical Information Management and Applications is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, understanding and skills at university Bachelor's level, for instance equivalent to the advanced level of the major Human Geography and Planning at Utrecht University:

- a) knowledge in the field of geo-information, geography, GIS or another GIMA related field of study.
- b) insight in geographical data processes and collecting, processing and distributing information.
- c) Academic skills and research skills.

### **Human Geography**

Admission to the programme Human Geography is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, understanding and skills:

- a) knowledge in the field of Urban Geography or Economic Geography at advanced level of the major Human Geography and Planning at Utrecht University, or equivalent to that level.
- b) insight in Urban Geography or Economic Geography at advanced level of the major Human Geography and Planning at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Human Geography and Planning at Utrecht University, or equivalent to that level.

### **Innovation Sciences**

Admission to the programme Innovation Sciences is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Science and Innovation Management, Natural Sciences or Life Sciences, at advanced level of the major Science and Innovation Management, Natural Sciences or Life Sciences at Utrecht University, or equivalent to that level.
- b) knowledge in the field of emerging technology issues and complex multidisciplinary problems.
- c) insight in Science and Innovation Management, Natural Sciences or Life Sciences, at advanced level of the major Science and Innovation Management, Natural Sciences or Life Sciences at Utrecht University, or equivalent to that level.
- d) academic and research skills of the major Science and Innovation Management, Natural Sciences or Life Sciences at Utrecht University, or equivalent to that level.

### **International Development Studies**

Admission to the programme International Development Studies is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Development Geography, at advanced level of the major Human Geography and Planning at Utrecht University, or equivalent to that level.
- b) insight in Development Geography at advanced level of the major Human Geography and Planning at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Human Geography and Planning at Utrecht University, or equivalent to that level.

### **Marine Sciences**

Admission to the programme Marine Sciences is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Earth Sciences or Biology, at advanced level of the major Earth Sciences or Biology at Utrecht University, or equivalent to that level.
- b) insight in Earth Sciences or Biology at advanced level of the major Earth Sciences or Biology at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Earth Sciences or Biology at Utrecht University, or equivalent to that level.

### **Spatial Planning**

Admission to the programme Spatial Planning is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Planning, at advanced level of the major Human Geography and Planning at Utrecht University, or equivalent to that level.
- b) insight in Planning at advanced level of the major Human Geography and Planning at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Human Geography and Planning at Utrecht University, or equivalent to that level.

### **Sustainable Business and Innovation**

Admission to the programme Sustainable Business and Innovation is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Science and Innovation Management, Environmental Sciences, Environmental Studies or Economics, at advanced level of the major Science and Innovation Management, Environmental Sciences, Environmental Studies or Economics at Utrecht University, or equivalent to that level.
- b) knowledge of sustainable development and/or innovation sciences.
- c) basic knowledge of natural sciences at Bachelor's level, including Mathematics, and/or Chemistry and/or Physics.
- d) insight in Science and Innovation Management, Environmental Sciences, Environmental Studies or Economics at advanced level of the major Science and Innovation Management, Environmental Sciences, Environmental Studies or Economics at Utrecht University, or equivalent to that level.
- e) academic and research skills of the major Science and Innovation Management, Environmental Sciences, Environmental Studies or Economics at Utrecht University, or equivalent to that level.

### **Sustainable Development**

Admission to the programme Sustainable Development is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Environmental Sciences, Natural Sciences or Social Sciences at the advanced level of a major in Earth Sciences, Physics, Chemistry, Biology, Economics, Public Administration and Organisation Science or Social Sciences at Utrecht University, or equivalent to that level.
- b) knowledge in the field of sustainability issues.
- c) basic knowledge of physical processes in the environment
- d) basic knowledge of mathematics at bachelor's level
- e) insight in Environmental Sciences, Natural Sciences or Social Sciences at the advanced level of a major in Earth Sciences, Physics, Chemistry, Biology, Economics, Public Administration and Organisation Science or Social Sciences at Utrecht University, or equivalent to that level.
- f) academic and research skills of a major in Earth Sciences, Physics, Chemistry, Biology, Economics, Public Administration and Organisation Science or Social Sciences at Utrecht University, or equivalent to that level.

### **Urban and Economic Geography (Research Master)**

Admission to the research programme Human Geography and Planning is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Human Geography or Spatial Planning, at advanced level of the major Human Geography and Planning at Utrecht University, or equivalent to that level.
- b) insight in Human Geography or Spatial Planning at advanced level of the major Human Geography and Planning at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Human Geography and Planning at Utrecht University, or equivalent to that level.

### **Water Science and Management**

Admission to the programme Water Science and Management is given to a student holding a Dutch or foreign diploma confirming that he has gained the knowledge, insights and skills at university Bachelor's level. Furthermore, the student needs to prove that he has gained the following specific knowledge, insights and skills:

- a) knowledge in the field of Earth Sciences, Environmental Sciences or Natural Sciences, at advanced level of the major Earth Sciences or Environmental Sciences at Utrecht University, or equivalent to that level.
- b) insight in Earth Sciences, Environmental Sciences or Natural Sciences at advanced level of the major Earth Sciences or Environmental Sciences at Utrecht University, or equivalent to that level.
- c) academic and research skills of the major Earth Sciences or Environmental Sciences at Utrecht University, or equivalent to that level.

### **APPENDIX 2 Structure of Master's degree programmes**

#### **Earth, Life and Climate**

Theoretical courses: required electives	45 EC
Deficiency courses	0-15 EC
MSc research/thesis	30-45 EC
Individual programme/ internship	
Verplicht 2e report	up to 30 EC
Additional theoretical courses, seminar modules, advanced-level courses	0- 45 EC

#### **Earth Structure and Dynamics**

Theoretical courses: required electives	45 EC
Deficiency courses	0-15 EC
MSc research/thesis	30-45 EC
Individual programme/ internship	
Verplicht 2e report	up to 30 EC
Additional theoretical courses, seminar modules, advanced-level courses	0- 45 EC

#### **Earth Surface and Water**

Theoretical courses: required electives	45 EC
Deficiency courses	0-15 EC
MSc research/thesis	30-45 EC
Individual programme/ internship	
Verplicht 2e report	up to 30 EC
Additional theoretical courses, seminar modules, advanced-level courses	0- 45 EC

#### **Energy Science**

Required/theoretical	22.5 EC
Methods of research	15 EC
MSc thesis/internship	30-52.5 EC
Elective	22.5-37.5 EC

#### **Geographical Information Management and Applications**

Required / theoretical	40 EC
Required (practical methods)	20 EC
MSc research/thesis	30 EC
Internship or Individual programme	30 EC

**Human Geography**

Required / theoretical	27,5 EC
Methods of research	7,5 EC
Elective	5 EC
MSc research/thesis	20 EC

**International Development Studies**

Starting from September 2017		Starting date before September 2017	
Required / theoretical	15 EC	Required / theoretical	20 EC
Methods of research	10 EC	Methods of research	10 EC
Elective course	5 EC	MSc research/thesis	30 EC
MSc research/thesis	30 EC		

**Marine Sciences**

Theoretical courses	45 EC
Elective courses	15-30 EC
MSc research / thesis Individual programme / internship Verplicht 2e report	30-45 EC
	15-30 EC

**Innovation Sciences**

Required / theoretical	37.5 EC
Methods of research	22.5 EC
MSc research/thesis	45 EC
Elective	15 EC

**Spatial Planning**

Starting from September 2017		Starting date before September 2017	
Required / theoretical	20 EC	Required / theoretical	22,5 EC
Methods of research	5 EC	Methods of research	7,5 EC
Elective course	5 EC	MSc research/thesis	30 EC
MSc research/thesis	30 EC		

**Sustainable Development**

Required / theoretical	45 EC
Methods of research	15 EC
MSc research/thesis	30-45 EC
Elective	15-30 EC

**Sustainable Business and Innovation**

Required/theoretical	45 EC
Methods of research	15 EC
MSc research/thesis	45 EC
Elective	15 EC

**Urban and Economic Geography**

Required / theoretical	60 EC
Elective	15 EC
MSc research/thesis	45 EC

**Water Science and Management**

Required / theoretical	75 EC
MSc research / thesis	30-45 EC
Elective / MSc individ. programme	0-15 EC

**Structure re-enrolment programmes:****Economische Geografie**

Required / theoretical	22.5 EC
Methods of research	7.5 EC
MSc research/thesis	30 EC

**Geo-communicatie**

Required / theoretical	30 EC
Individual project/ internship	7.5- 15 EC
MSc research/thesis	15-22,5 EC

**Urban Geography**

Required / theoretical	22.5 EC
Methods of research	7.5 EC
MSc research/thesis	30 EC

**Appendix III Teaching periods teaching institutes Innovation, Environmental & Energy Sciences and Earth Sciences, 2017-2018. Always check course manuals for exact start and end dates of each course!!**

36	37	38	39	40	41	42	43	44	45
1 4/9-10/9	2 11-17/9	3 18-24/9	4 25/9-1/10	5 2-8/10	6 9-15/10	7 16-22/10	8 23-29/10	9 30/10-5/11	10 6-12/11
MSc GEO Intro									break exams

46	47	48	49	50	51	52	1	2	3	4	5
1 13-19/11	2 20-26/11	3 27/11-3/12	4 4-10/12	5 11-17/12	6 18-24/12	Xmas break	Study week	7 8-14/1	8 15-21/1	9 22-28/1	10 29/1-4/2
			5/12 rep. 1	12/12 rep. 1				rep. 1	rep. 1	exams	break
				AGU							break

6	7	8	9	10	11	12	13	14	15	16
1 5-11/2	2 12-18/2	3 19-25/2	4 26/2-4/3	5 5-11/3	6 12-18/3	7 19-25/3	8 26/3-1/4	9 2-8/4	10 9-15/4	11 16-22/4
8/2 UU Careerday			27/2 rep. 2	6/3 rep. 2			30/3 Good Friday	2/4 Easter	Friday 13/4 break	break
				rep. 2					exams	break
									EGU	

17	18	19	20	21	22	23	24	25	26	27	28	29
1 23-29/4	2 30/4-6/5	3 7-13/5	4 14-20/5	5 21-27/5	6 28/5-3/6	7 4-10/6	8 11-17/6	9 18-24/6	10 25/6-1/7	11 2-8/7	Break	Break
27/4 King's day	5/5 Liberation day	10/5 Ascension day	15/5 rep. 3	22/5 rep. 3	exams					break	9-12/7 rep. 4	
		11/5 break		21/5 Pentecost						exams	rep. 3	

Green = IEES	Red = GEO wide	Blue = Earth Sc.	Rep. = scheduled repair exams
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## **Appendix IV    UU-time table 2017-2018**

### **Teaching periods**

#### *Semester I:*

- Period 1:                          Monday 4 September – Friday 10 November  
Period 2:                            Monday 13 November – Friday 2 February

#### *Semester II:*

- Period 3:                            Monday 5 February – Friday 20 April  
Period 4:                            Monday 23 April – Friday 13 July

### **Timeslots**

- A       Monday morning and/or Wednesday morning
- B       Tuesday morning and/or Thursday afternoon
- C       Monday afternoon and/or Thursday morning
- D       Wednesday afternoon, Friday morning and/or Friday afternoon
- E       Monday evening, Tuesday evening, Wednesday evening, Thursday evening and/or Friday evening

### **Course registration (only via Osiris Student: [www.uu.nl/osirisstudent](http://www.uu.nl/osirisstudent))**

For period 1: 29 May 2017 up to and including 25 June 2017  
- late registration 21 and 22 August 2017

For period 2: 18 September 2017 up to and including 1 October 2017  
- late registration 23 and 24 October 2017

For period 3: 30 October 2017 up to and including 26 November 2017  
- late registration 22 and 23 January 2018

For period 4: 29 January 2018 up to and including 25 February 2018  
- late registration 3 and 4 April 2018