



UNESCO-IHE
Institute for Water Education

MASTER PROGRAMME WM 2015-2017



General description UNESCO-IHE

Study guide - part 1

Table of contents

- 1 UNESCO-IHE
 - 1.1 Introduction
 - 1.2 MSc Degree Programmes
 - 1.3 Research and PhD Programmes
 - 1.4 Organisation
- 2 Programme framework
 - 2.1 Introduction
 - 2.2 Academic Regulations
 - 2.3 Structure of the Programmes
 - 2.4 Curriculum Information
 - 2.5 Final Qualifications
 - 2.6 Teaching Methods
 - 2.7 Examinations
 - 2.8 Study Load
 - 2.9 Planning and Scheduling
 - 2.10 Participation in coursework and lunch seminars
 - 2.11 Evaluation of the Programme by Students
- 3 Regulations
 - 3.1 Education and Examination regulations
 - 3.2 Library regulations
 - 3.3 Code of conduct
 - 3.4 Plagiarism
- 4 Facilities
 - 4.1 Location
 - 4.2 Student Affairs (office)
 - 4.3 Student Association Board
 - 4.4 ICT services
 - 4.5 General Facilities in the Building
 - 4.6 UNESCO-IHE Library and Information Services
 - 4.7 Laboratories
 - 4.8 Study Materials
 - 4.9 English support courses

1 UNESCO-IHE

1.1 Introduction

UNESCO-IHE continues the work that was started in 1957 when IHE first offered a postgraduate diploma course in hydraulic engineering to practicing professionals from developing countries. Over the years, IHE has developed into an international education institute providing a host of postgraduate courses and tailor-made training programmes in the fields of water, environment and infrastructure; conducting applied research, implementing institutional capacity building and human resources development programmes, participating in policy development, and offering advisory services world-wide.

The Institute has gradually expanded its academic base to include disciplines such as sociology, economics, and environmental and management sciences. The range of activities has broadened accordingly, from identifying solutions to engineering problems to designing holistic and integrated approaches in the development and management of water and environmental resources, and urban infrastructure systems. The services of the Institute now also include integrated water resources management, effective service delivery and institutional reform, all of which aim to enhance full stakeholder involvement, equity, accountability and efficiency in water sector development and management.

In November 2001, UNESCO's 31st General Conference decided to make IHE an integral part of the Organisation. By March 2003, the necessary treaties and agreements between the IHE Delft Foundation, UNESCO and the Netherlands Government were signed, allowing for the entry into operation of the new UNESCO-IHE Institute for Water Education. UNESCO-IHE is governed by a thirteen-member Governing Board appointed by the Director General, and is managed by a Director and Deputy Director. The IHE Delft Foundation provides all other staff and facilities to UNESCO-IHE.

The mission of the Institute is to contribute to the education and training of professionals and to build the capacity of sector organisations, knowledge centres and other institutions active in the fields of water, the environment and infrastructure, in developing countries and countries in transition.

UNESCO-IHE is located in Delft, an internationally renowned centre of excellence in civil engineering and in water related sciences. The Delft University of Technology, the laboratories of WL/Delft Hydraulics, GeoDelft, and The Netherlands Organisation for Applied Scientific Research are situated nearby. UNESCO-IHE maintains intensive relations with national and international institutions to ensure a continuous exchange of knowledge and experience.

1.2 MSc Degree Programmes

The backbone of the Institute are the postgraduate programmes in the fields of:

Environmental Science
Urban Water and Sanitation
Water Management
Water Science and Engineering

Each year, these programmes are attended by hundreds of engineers, chemists, biologists, earth scientists, and other professionals from all over the world. The graduates are awarded a Master of Science degree. The programmes are subject to accreditation under Dutch law.

1.3 Research and PhD Programmes

UNESCO-IHE carries out scientific research, often in co-operation with universities and research institutes in developing countries.

A number of positions are available for PhD research.

The PhD programme has a nominal duration of 4 years and can be carried out either in Delft or in a sandwich construction.

The PhD degrees are awarded by UNESCO-IHE together with a Dutch university. Candidates should preferably hold a UNESCO-IHE MSc degree, but an equivalent degree from another reputed university may also be acceptable.

1.4 Organisation

The Rectorate of the Institute consists of a Rector, a vice rector Academic Affairs and a Business Director. The organisation is structured into departments, which are further subdivided into various sections. Within the organisation structure, three academic departments are distinguished:

Water Science and Engineering
Environmental Engineering and Water Technology
Integrated Water Systems and Governance

These departments have one or more academic cores in the major fields, each with a leading professor, who is assisted by academic staff and research fellows. Process management support units and an education bureau provide administrative support.

Besides the academic staff of UNESCO-IHE, education is provided by selected guest lecturers, who are experts employed by universities, research institutes, government agencies, consulting firms, international organisations, etc. in the Netherlands and abroad.

2 Programme framework

2.1 Introduction

The Master of Science Degree Programmes

The Institute provides the following Master of Science degree programmes:

the master programme in Environmental Science;
the master programme in Urban Water and Sanitation;
the master programme in Water Management; and
the master programme in Water Science and Engineering.

These programmes have a nominal duration of 18 months and are leading towards a Master of Science (MSc) degree in the respective field upon successful completion. Each programme has several distinct specialisations, in which students follow a programme curriculum best suited to their preference.

The minimum study load of the programmes is 106 credit points, expressed in units defined by the European Credit Transfer and Accumulation System (ECTS).

2.2 Academic Regulations

The *Education and Examination Regulations* (separate part of this handbook) provide the basic data of the programme, including the major rules around the examinations and the rights of students to inspect the results of the examination assessment.

The regulations describe the precise details of how examinations are assessed and marked, the procedures and rules for re-examinations, procedures for appeal, and which results are required for awarding the Master of Science degree.

Students are strongly advised to familiarise themselves with these procedures at an early stage during their study.

2.3 Structure of the Programmes

The curriculum follows a modular structure.

The Delft-based curricula of the MSc Programmes have a duration of 18 months, and consist of 106 ECTS credit points divided between a Taught Part (61 ECTS credit points) and a Thesis Research Part (45 ECTS credit points).

The Taught Part is formed by 13 modules.

A module consists of a teaching period (usually 3 weeks) and an exam period (within the exam week following each two consecutive modules). Modules may be shared between or among specializations and/or programmes.

The Thesis Research Part consists of two modules on research methodology and MSc proposal drafting and defence, followed by a period of six months of individual research and writing of the thesis. The MSc thesis is defended publically at the end.

2.4 Curriculum Information

All components of the programme curriculum are described by a syllabus (summary) in the programme-specific part of the handbook providing the following information, which is further detailed in the sections below:

- the name and code of the subject;
- the learning objectives;
- the pre-requisite knowledge or skills;
- the study load hours and credit points;
- the lecture, exercise and examination contact hours;
- the nature and weights of the examination parts;
- the responsible lecturers/examiners;
- a concise description of the contents and working methods; and
- the required and recommended literature, and other materials.

2.5 Final Qualifications

Each programme specialisation has a set of final qualifications that state the knowledge, insight and skills achieved by students who successfully complete the programme. A distinction is made between discipline-specific qualifications, which are required by the field of study, and general academic skills, which are expected from university education graduates.

Similarly, each module of the curriculum has a set of learning objectives, which detail the specific outcomes if the student completes that part of the programme. The individual subjects in the modules usually aim to achieve a further detailed subset of the module learning objectives.

2.6 Teaching Methods

The programmes are conducted using a combination of lectures, exercises, assignments and examinations. The latter are described separately in the next section.

Lectures serve one or more of the following functions:

- to impart information;
- to introduce and explore a topic;
- to build-up complex structures step-by-step;
- to clarify and illustrate concepts and ideas detailed in the literature or lecture notes; and
- to provide a framework for further independent study and reading.

An exercise takes one of the following forms:

- a design or practical exercise;
- a computer or other workshop;
- a laboratory session;
- a fieldwork or fieldtrip; and
- a group work discussion.

Assignments are carried out independently by the students and consist of all required activity to:

- study or practice the lecture material;
- prepare a report, thesis or presentation;
- work out the results of an exercise;
- conduct an experiment or test;
- prepare for an examination; and
- conduct a research or other study.

2.7 Examinations

Examinations serve to test if students have achieved the learning objectives of a module, and ultimately those of the programme itself. The examination for a module may be composed of multiple parts. For example, a combination of a written or oral test and one or more assignments to handed in separately.

Examination work can also be produced by (small) groups of students working together on an assignment, e.g. the group work report.

Assessment of examination material is carried out by appropriate examiners, which are usually the involved lecturers. Students who successfully complete a module will be granted the credit points for that module. Fieldtrips may require active participation instead of an examination in order to receive the credit points.

For each examination, students are informed about the assessment results via e-mail. When all examinations have been passed, the student has successfully completed the so-called programme examination and will be awarded the degree.

2.8 Study Load

All scheduled education activity taking place in the presence of a lecturer or an assistant is designated as contact time. All other time spent by students in relation to the study programme is designated as independent study time.

The study load for (a part of) a programme is the cumulative contact time and independent study time that is nominally required to successfully complete that (part of the) programme. Study load is expressed in whole ECTS credit points, where one ECTS credit point is equivalent to 28 working hours.

The study load credits for a curricular activity indicate the notional time spent by an average learner to achieve the required outcomes for that activity, as specified by the learning objectives. The nominal time expenditure for a 5 ECTS credit points module is therefore 140 hours.

Where study load involves scheduled class-based activity, one lecture period is taken equal to two hours of contact time.

2.9 Planning and Scheduling

Lectures and exercises taking place inside the Institute are, in principle, scheduled into 'periods' of two hours each, for which the following times are available:

Period 1 08:45 – 09:30 and 09:45 – 10:30

Period 2 10:45 – 11:30 and 11:45 – 12:30

Period 3 13:45 – 14:30 and 14:45 – 15:30

Period 4 15:45 – 16:30 and 16:45 – 17:30

Throughout the academic year, the student will receive the following information and materials:

schedules of the educational activities;

required lecture notes, textbooks and other course-related material;

announcements of examination planning details; and

statements on examination results and study progress.

2.10 Participation in coursework and lunch seminars

Active participation and attendance by students is required for all curricular activities on the schedule.

Special attention is required for lunch seminars. During the academic programme lunch seminars are organised focussing on a specific topic. Participants are required to attend these seminars as well. Students have to inform their programme coordinator as early as possible when they are not able to attend a scheduled programme activity.

2.11 Evaluation of the Programme by Students

As part of the quality assurance procedures of the Institute the programmes are routinely evaluated in order to obtain feedback from the students regarding the quality of the content and the performance of the lecturers. The evaluations are based on a module questionnaire, which the students complete in separate class sessions.

The questionnaire asks the students to provide a rating for achievement of the learning objectives, the study load feasibility, the contents of the subject matter, the balance between the various working and examination methods, the quality of the lecture materials, and the presentation by the lecturers. Furthermore, additional written comments and an overall rating for the module may be provided.

The module evaluations are carried after the examination, but before the results have been announced. Students can also request to address specific programme related issues in a group or individual discussion with the involved coordinator or lecturers.

Feedback on the programmes from the students is much appreciated. The Institute uses the results of the evaluations to improve the academic programmes where necessary, in order to maintain high standards of education.

3 Regulations

3.1 Education and Examination regulations

See for the Education and Examination regulations the separate part after the Academic Calendar

3.2 Library regulations

Fair use of on-line information resources at the UNESCO-IHE Library

The UNESCO-IHE Library Services provides access to a large number of on-line information resources and databases. Access to these resources is provided to all computer users within the premises at Westvest and through remote authentication via the UNESCO-IHE portal.

By using these on-line resources you agree with the following conditions:

- 1) Systematic downloading of electronic journals articles using manual means is permitted only within reasonable amounts; no more than 50 downloads per user within 24 hours.
- 2) Programmatic downloading / 'web crawling' are not allowed. In addition to systematic downloading of files manually, the use of a spider (web crawler), the intention of which is to programmatically download data within a specific website, is prohibited.
- 3) Copyright/reproduction. It is prohibited to reproduce entire or parts of publications in your own publication without the consent of the publisher. You are obliged to provide a correct source reference of all of the material at all times.
- 4) Selling and providing material to third parties is strictly forbidden. The re-sale of material purchased subject to license to third parties is prohibited; this applies both within and outside of the Institute for which the materials have been purchased.
- 5) Permanent archiving. Large-scale archiving is not permitted on the local servers or your hostel personal computer nor is the continued use of these servers as an archive, in collaboration with third parties or otherwise. The temporary storage of archive material for personal use is permitted for a period not longer than 120 days.
- 6) Making changes to an original work. Infringing upon an original work by merging various original texts into a document or by amending original texts is prohibited. Processing materials in such a way is an infringement upon the copyright that is held by the publisher or the author him/herself.

Infringement of one or all of the above mentioned stipulations will be considered as academic misconduct and will result in disciplinary measures, which will be proportionate to the seriousness of the infraction. The Rector will decide upon the disciplinary measures which will be taken. These measures may include temporary or permanent suspension from attending class.

3.3 Code of conduct

THE RECTORATE OF UNESCO-IHE

In consideration of the need for rules and regulations concerning the safety and the proper use of the buildings, grounds and facilities of UNESCO-IHE by students and visitors;

In accordance with article 7.57h and article 9.2, first paragraph, of the Higher Education and Scientific Research Act of the Netherlands; Having heard the Student Association Board;

RESOLVES To establish the following Regulations:

Article 1 Definitions

1.1 WHW

Higher Education and Scientific Research Act of the Netherlands (Staatsblad Bulletin of Acts and Decrees 1992, 593);

1.2 the Director

The director of UNESCO-IHE

1.3 the Rectorate

The director and the deputy director

1.4 Central services department

The central services department of UNESCO-IHE

1.5 Facilities

The institute buildings, the interior and equipments as well as rented office and accommodation facilities

1.6 Buildings

The buildings of UNESCO-IHE, located at Westvest 7, Delft

1.7 Student

Anyone who is enrolled at UNESCO-IHE for the purpose of education provided by UNESCO-IHE and who uses the educational and examination facilities of UNESCO-IHE for this purpose;

1.8 Visitor

Anyone who is not a student nor is employed by IHE-Delft as referred to in article 1.1 of the Collective Labour Agreement (CAO) for Dutch Universities.

Article 2 Compliance requirement for rules, guidelines and instructions

2.1 Any student or visitor making use of the grounds, buildings or facilities of UNESCO-IHE is required to comply with all rules, instructions and/or directions issued by the Rectorate and delegated staff with regard to maintaining order and proper social conventions of the host country within the buildings and on the grounds. According to the in the institutes code of undesirable behaviour the following is considered to be undesirable behaviour: sexual harassment, aggression, or violence, both verbal and non-verbal towards course participants, staff, visitors or contracted staff. Furthermore all participants, staff, visitors and contracted staff are to observe and comply with the rules and regulations with regard to appropriate and legitimate use of the facilities of UNESCO-IHE scrupulously and without delay, and is required to deport him or herself such that:

- a. he or she does not cause direct or indirect damage to UNESCO-IHE or to other persons who are present on the grounds or in the buildings of UNESCO-IHE or who make use of the facilities of UNESCO-IHE, nor that he or she causes nuisance or annoyance;
- b. he or she does not infringe on the rights of UNESCO-IHE or of other persons who are present on the grounds or in the buildings of UNESCO-IHE or who make use of the facilities of UNESCO-IHE;
- c. he or she does not act contrary to statutory obligations;
- d. he or she does not act contrary to appropriate and proper social conventions with regard to people or property.

2.2 It is prohibited to wear clothing that covers the face or to wear other clothing and/or accessories that severely interfere with communication between teaching staff and students or between students themselves or between members of the teaching staff. When sitting an examination it is prohibited to wear clothing that covers the face or to wear other clothing and/or accessories that severely limit the ability to establish the identity of the person in question.

2.3 The Head of the Central Services department may, on behalf of the Rectorate, issue instructions and directions for the purpose of ensuring the smooth and proper use and functioning of buildings and grounds of UNESCO-IHE entrusted to him/her.

Article 3 Disciplinary Measures

The Rectorate may take the following measures against any student or visitor who fails to comply with the contents of these Regulations, with due observance of the procedure described in these Regulations:

- a. excluding the student or visitor from the buildings and grounds of UNESCO-IHE or from one or more parts of UNESCO-IHE, with the provision that a student may only be excluded from buildings or grounds in whole or in part for a period not to exceed one year;
- b. excluding the student or visitor from the use of the facilities of UNESCO-IHE;
- c. fining the student if such fine has been agreed on or follows from the statute;
- d. issuing a written reprimand;
- e. retribution for damages to properties and or facilities.

Article 4 Exclusion Order by the Rectorate

4.1 The Rectorate may immediately issue an exclusion order for the buildings or grounds, or for parts of those buildings or grounds, to a student or visitor who commits an infringement on these Regulations or the rules referred to in article 2, or it may issue an exclusion order for the institute facilities.

4.2 Anyone who is subjected to measures as referred to in the first paragraph will be given the opportunity for a subsequent hearing as soon as possible by or on behalf of the Rectorate if this was not previously possible due to the urgent nature of the matter at hand.

4.3 The exclusion order will contain at least the following:

- a. an indication of the buildings and/or grounds or the parts of the buildings and/or grounds of UNESCO-IHE and/or the facilities or use of the facilities of UNESCO-IHE to which the exclusion order applies;
- b. the duration of the exclusion order;
- c. the reasons for the exclusion order;
- d. any conditions which will result in the effectuation of the exclusion order in case of non-compliance.

Article 5 Termination of the exclusion order

5.1 The Rectorate may, of its own accord or in response to a request by a person who is subject to a disciplinary measure in the form of an exclusion order as referred to in these Regulations, choose to terminate the exclusion order or alter its scope before it has elapsed if there is sound reason to do so according to the judgement of the Rectorate.

5.2 The Rectorate may attach special conditions to the termination or alteration of the exclusion order.

5.3 If in the judgment of the Rectorate the person subject to the exclusion order, and on behalf of whom a proposal to terminate said order has been forwarded, has not met the special conditions set by the Rectorate, then the original exclusion order will once again be put into force; the period of time that has passed since the termination or alteration of the exclusion order will not be deducted from the originally specified period in this case.

Article 6 Entry into force

These Regulations enter into force on October 1st 2007

Article 7 Method of Citation

These Regulations may be cited as “Regulations for the use of buildings, grounds and facilities by students and visitors of UNESCO-IHE”.

Approved in the rectorate meeting of September 25th 2007

3.4 Plagiarism

NOTE: FAILURE TO COMPLY WITH THE TERMS OF THIS SECTION COULD JEOPARDISE YOUR DEGREE. PLEASE READ AND DIGEST CAREFULLY.

It is very important that all students understand UNESCO-IHE's rules about plagiarism. Students sometimes break these rules unintentionally because they do not realise that some of the ways in which they have incorporated other people's work into their own, before they came to UNESCO-IHE, may be against the rules here.

At the beginning of the programme, and before submitting any assessments, you will be required to agree to an 'own work declaration' (see annex). You will also be invited to give consent for the scanning of your work by plagiarism detection software. Work cannot be submitted unless these conditions are agreed to.

What is plagiarism?

Plagiarism is the practice of taking someone else's work or ideas and passing them off as one's own.^[1] This act is considered as academic fraud. (in the sense of the word as established by Article 2.1 of the Education and Examination Regulations.) When there is a strong presumption of plagiarism, whether occurring during the course of the study or after the completion of the study, cases will be investigated by the Examination Board, (as stipulated by 17. 2 of the Education and Examination Regulations.) The Examination Board shall examine the cases of alleged plagiarism on their individual merits. After examining all the evidence, the Examination Board shall establish whether plagiarism and implicitly fraud has been committed. When fraud has been established the offender will be given the mark of 1.0 for the examination work.

^[1] Oxford English Dictionary,

Plagiarism detection

UNESCO-IHE uses a computer program called Turnitin ® to assist with the detection of plagiarism. The plagiarism detection service is an online service that enables UNESCO-IHE and its staff to carry out electronic comparison of students' work against electronic sources including other students' work.

Turnitin ® works by executing searches of the World Wide Web, and extensive databases of reference material, as well as content previously submitted by other UNESCO-IHE students. Each new submission is compared with all the existing information. The software makes no decisions as to whether a student has plagiarised, it simply highlights sections of text that are duplicated in other sources. All work will continue to be reviewed by the course coordinator. Once work has been submitted to the system it becomes part of the ever growing database of material against which subsequent submissions are checked.

The software is used as a tool to highlight any instance where there is a possible case of plagiarism. Passages copied directly or very closely from existing sources will be identified by the software and both the original and the potential copy will be displayed for the examiner to view. Where any direct quotations are relevant and appropriately referenced, the examiner will be able to see this and will continue to consider the next highlighted case.

Citing references

The key to avoiding plagiarism is to make sure that you give correct references for anything that you have taken from other sources to include in your academic work. This might include, for example, any ideas, theories, findings, images, diagrams or direct quotations that you have used. At UNESCO-IHE the house style for references is based on the Hydrogeology Journal output. If you take any material word for word from another source, it is essential that you make it clear to your reader that this is what you have done.

If you take material from another source, change a few words and then include the reference you may still have committed a plagiarism offence because you have not made it clear to your reader that you have essentially reproduced part of the original source. You should either express the ideas fully in your own words and give the reference or else use clearly labelled direct quotes. Bear in mind that if you include too many direct quotes in your work this may reduce your grade, as the marker will find it difficult to see evidence of your own understanding of the topic. You must also include a bibliography and references section at the end of your work that provides the full details of all of the sources cited within the text. You should be aware that, for work done in other subject areas, you might be expected to use a different referencing system.

The process of referencing may seem rather complicated and arbitrary, if it is new to you, but it should begin to make more sense as you progress through your studies. In order to assess your work and to give you useful feedback your marker needs to have a clear sense of what ideas you have developed for yourself and what comes from elsewhere. To be fair to all of the students on the course it is important that each student is given grades that accurately reflect their own efforts. As you learn to produce work at a Master standard, you are developing the skills that will allow you to participate within wider communities of scholars. In these communities new knowledge and understanding is often developed by building on the work of others. By properly acknowledging earlier work you give credit where it is due and help to maintain the integrity and credibility of academic research in this area. Clear referencing also allows readers to learn about the wider literature through your work. It is often the case that understanding the ways in which particular scholars have contributed to the development of the literature makes it much easier to make sense of the current state of play.

Team work, accidental and self-plagiarism plagiarism

Students sometimes wonder where to draw the line between discussing their ideas with their peers (which can be an excellent learning experience) and unacceptable collusion. The time to be particularly careful is when you are preparing work for assessment. You need to be certain that the work you submit represents your own process of engagement with the task set. You may get into difficulty if, for example, reading another student's plan for their work influences you, or if you show them your plan. Assisting another student to plagiarise is a cheating offence.

In addition to giving references for all of the materials that you have actually included within your assignments, it is important to appropriately acknowledge other sources of guidance you have used when preparing your work.

Accidental plagiarism is sometimes a result of a student not yet having fully come to terms with how to study effectively at university. For example, the ways in which students take their notes sometimes makes it difficult for them to later distinguish between verbatim quotes, paraphrased material and their own ideas. A student may also plagiarise unintentionally because they have been feeling daunted by a piece of work and so have put it off for so long that they have had to rush to meet the deadline. If you think these kinds of wider issues may be relevant to you then you should contact your module coordinator.

Plagiarism guide's references

The following sources were used in the development of the plagiarism guide:

Blum, S. D. (2009). *My word! : plagiarism and college culture*. Ithaca: Cornell University Press.

Carroll, J. and Appleton, J. (2001). *Plagiarism: A Good Practice Guide*. Oxford: Oxford Brookes University and Joint Information Systems Committee

Eisner, C., & Vicinus, M. (2008). *Originality, imitation, and plagiarism : teaching writing in the digital age*. Ann Arbor: University of Michigan Press.

Sutherland-Smith, W. (2008). *Plagiarism, the Internet and student learning : improving academic integrity*. New York: Routledge.

Harvard University Guide to Plagiarism

<http://isites.harvard.edu/icb/icb.do?keyword=k70847&pageid=icb.page355322>

Purdue University Writing Lab

<http://owl.english.purdue.edu/>

University of Princeton Academic Integrity

Site <http://www.princeton.edu/pr/pub/integrity/pages/plagiarism/>

University of Teesside Plagiarism Guidance

<http://dissc.tees.ac.uk/Plagiarism/Plag-4.htm>

4 Facilities

4.1 Location

The UNESCO-IHE buildings and facilities are located on a single compound at the Westvest 7 in the centre of Delft. The buildings provide a pleasant and efficient atmosphere for optimal learning and creativity, direct communication with lecturers and other staff, as well as meeting with fellow students. The building is open during the following times:

Monday to Friday 07:30 – 20:00

Saturday 08:00 – 12:30

4.2 Student Affairs (office)

The Student Affairs office provides non-academic support to students. The SA office takes care of student applications and student registration. The new students are also assisted with formalities such as applications for residence permits, insurance, bank accounts, and fellowship issues. Housing arrangements in one of the hostels are being made immediately upon arrival.

Throughout their study period, students can contact the staff during office hours for information or questions related to health, religion or other issues related to the student's wellbeing. Personal matters can be discussed with the student counsellor and will be dealt with strictly confidential.

During the entire academic year, SA organizes a number of social and cultural activities including the weekly movie night, social evenings and the annual Christmas dinner. Other activities include cultural excursions to interesting cities and places in the Netherlands and other countries in Europe.

Furthermore, the students are given opportunity to actively practice sports on a regular basis. From October to May, the Institute arranges accommodation in Delft for such sports as soccer, volleyball, basketball and badminton. The SA office organizes sports events and tournaments, in which the teams can compete internally, but also against players from other international institutes.

4.3 Student Association Board

The Student Association Board (SAB) is composed of representatives who are elected by the students in annual elections that take place several weeks after the opening of the academic year.

The SAB provides a forum through which students can share their experiences, problems and general issues on study-related matters. If necessary, the SAB will bring these matters forward in discussions with the executive levels of the Institute. The board can be contacted directly via its members or the general e-mail address sab@unesco-ihe.org.

The SAB closely co-operates with the Student Affairs office in organizing social and sporting events.

4.4 ICT services

UNESCO-IHE provides modern computing (IT) facilities for education and research. A local wired- and wireless network is available in UNESCO-IHE's building. Through UNESCO-IHE's networks all computers have access to a fast Internet connection. Besides that, participants have unlimited access to Internet in all hostels provided by UNESCO-IHE.

All UNESCO-IHE desktop and laptop PCs are Intel based with Microsoft Windows operating system. The UNESCO-IHE laptop PC will be provided in order to get access to the IT-facilities. The laptop is on loan for use during studying at UNESCO-IHE. At the end of the study, UNESCO-IHE offers the possibility to buy the laptop. The contract given clearly states the terms and conditions for borrowing the laptop. Bringing one's own laptop is allowed; however, laptops other than the UNESCO-IHE laptop might not give access to all the required IT-facilities and might not be supported by IT-service desk.

A wide range of software packages is available, ranging from standard PC-software, like Microsoft Office (Word, Excel, etc.) to special modelling software used for the education programmes. Upon registration you will receive an UNESCO-IHE e-mail account which enables you to make use of all relevant computing facilities at the Institute. Your account will be revoked when you will have ended your study at UNESCO-IHE. A web-based E-learning and collaborative system is accessible for all participants to exchange learning information and documents.

For specific applications during the thesis study, it may be possible to use specialist software packages on the laptop PCs. This is, however, dependent on the particular type of licence agreement that the Institute has with the supplier. Enquiries for specific software should be made at the computer helpdesk.

4.5 General Facilities in the Building

In the reception area of the building, students have their own locker for the distribution of schedules, lecture notes and other study-related papers, and private mail. Two monitor screens opposite the reception desk are regularly updated with news or information on events taking place at UNESCO-IHE.

The restaurant provides a wide variety of reasonable-priced multicultural meals and beverages during lunchtime. The meals can be paid using the bank-card or cash. Coffee, tea and soft drinks can be obtained from machines throughout the day.

The building houses a number of fully-equipped lecture rooms and theatres, which can accommodate groups of all sizes from 15 to 300 persons. Rooms for facilitating computer classes and workshops are present and can be used freely by students outside class hours. Furthermore, the Institute has its own printing and reproduction facilities and also contains an in-house distance learning and video conferencing centre. Photocopy services are available to students. In the building also a meditation room is available, which is located on the third floor.

4.6 UNESCO-IHE Library and Information Services

UNESCO-IHE's Library provides access to over 35,000 printed titles, among which the complete collection of UNESCO-IHE Master thesis and PHD dissertations. Furthermore the collection contains over 8.000 online journals. The online journals collection is accessible on the network at the Westvest premises or through remote authentication through the UNESCO-IHE portal. For more information please visit the Library's Internet page

<http://www.unesco-ihe.org/library>

The library is open to all UNESCO-IHE participants and staff, and to visitors by appointment. The services provided by the library include lending out books, requesting articles and other materials through the inter-library loan system and providing assistance in searching the electronic catalogue.

Membership

Upon registration UNESCO-IHE participants receive a registration card which can also be used to borrow items from the library collection.

The catalogue

The library collection is accessible through an electronic catalogue, which is searchable by author, title (word) and subject, as well as by Boolean operators. Please visit <http://www.unesco-ihe.org/library> for more information.

Borrowing library items

A maximum of ten items may be borrowed from the library at any one time. The maximum loan period is 21 days, renewable up to a maximum of 42 days. Renewals can be made online, <http://www.unesco-ihe.org/library> by using the borrower information function within the catalogue or by email (library@unesco-ihe.org). Please note that the loan period can be extended only if the items have not already been reserved by another person.

Reference works, MSc theses, bound and non-bound periodicals and materials bearing a green sticker may not be borrowed. By using their library card to borrow items from the library, borrowers agree to be responsible for those items, including the cost of replacing lost or damaged items.

Opening Hours

Monday 09:00–18.30

Tuesday-Friday 09:00–19.00

Saturday 09:30–12:30

Please note that the Library opening hours are subject to change. Visit the Library webpage for regular updates. For further information please contact the library reference desk.

Email: library@unesco-ihe.org

Tel: +31 (0)15 215 1714

Fax: +31 (0)15 212 2921

4.7 Laboratories

Modern educational and research laboratories are available in the fields of chemistry, process technology, microbiology, aquatic ecology and soil science. A wide range of standard analytical tests can be performed for chemical, physical and microbiological water, air and soil quality analyses.

Elemental analyses, various kinds of microscopy and analytical techniques such as spectrophotometry, gas- and ion chromatography, and atomic absorption can be carried out. A wide range of laboratory and bench-scale reactors, temperature and light controlled growth chambers, and various constant temperature rooms are available for research in one of the departmental research programs, including waste water management using aquatic macrophytes and wetlands, the adsorption and/or (an-)aerobic degradation of micro pollutants, self-purification in drains and filtration. Through close co-operation with the Delft University of Technology and other educational and research institutions, research possibilities are quite extensive.

In addition to the in-house facilities, the laboratory has a range of instrumentation and equipment available for field instruction and for conducting hydrological or environmental field experiments and measurements.

4.8 Study Materials

Study materials such as textbooks, lecture notes and hand-outs are provided by the Institute. Students receive the lecture notes either on paper in their personal locker or via the electronic repository 'eCampusXL', before the start of the involved lecture series. Additional material (on paper or electronically) can be provided by the lecturers in the form of hand-outs. Also other materials, such as for example PowerPoint presentations or exercise materials used by the lecturers, can be accessed or downloaded from the electronic repository.

Reference works are available from the Institute library or the library of the Delft University of Technology (see above).

Students can login to the electronic repository from any location via the Internet web page located at <http://ecampusxl.unesco-ihe.org>

Students are expected to bring in other materials, such as electronic calculators and language dictionaries on their own account.

4.9 English support courses

Introduction

A variety of academic writing courses are offered to students during the first 12 months of study. Students are allocated a place on these courses according to their language level, not their specialization. Writing courses are available from 'lower-intermediate' to 'advanced' level, consisting of about 20 hours contact time. These courses run parallel to scheduled lectures, and are not limited to one programme specialization or module.

Placement Test for everyone

Every student must take the English Placement Test. Based on the result, the student may be required to follow an academic writing course.

Placement tests are held in October and January. Participants with weakest English skills are strongly advised to take the test in October, as they will receive support courses first. All remaining participants will be tested in January. Places on writing courses are allocated according to the student's placement test score. A student cannot join a writing course unless s/he has taken the placement test.

Students whose test score is at A1, A2 or B1 level CEFR (The Council of Europe's *Common European Framework* of Reference for Languages is a basis for recognising language qualifications. A1-A2 = Basic; B1-B2 = Intermediate; C1-C2 = Advanced) , are obliged to attend a support course: attendance is required. Students whose test score is B2 are strongly recommended to attend a course. If students who score B2 choose to take a support course, regular attendance is required. Those with score levels C1 and C2 are exempt from academic writing courses.

Scheduling and attendance

Academic Writing courses are given throughout the year, with the first courses starting in October and the last courses ending in August/September. Students are assigned a course based on their Placement Test performance.

English support courses usually consist of about 20 hours contact time, approximately 13 or 14 lectures. English support courses are always scheduled at the following times:

Tuesdays 3.45pm-5.30pm

Thursdays 8.45am-10.30am

Occasionally classes are given on Saturday mornings. In special cases, evening classes may be necessary.

A Certificate of Attendance will be provided on completion of an academic writing course, provided attendance requirements have been met.

If a student does not turn up for the allocated course without giving notification of absence, s/he forfeits their place on the course. An alternative course is not provided.

Summary descriptions of writing courses

First Steps in Academic Writing: lower intermediate

based on textbook '*First Steps in Academic Writing*', Longman

This course provides low-intermediate students with essential tools to master basic academic writing. It focuses on paragraph organization, sentence structure, and grammar. Students are guided through the writing process to produce well-organized, clearly developed paragraphs. Simple explanations are supported by clear examples to help students through typical rough spots, and numerous practices help students assimilate each skill.

New Headway Academic Skills: intermediate

Based on textbook '*New Headway Academic Skills*', Oxford University Press

This course combines reading, writing, and study skills, and is suited to those who have reasonable English but have not studied for a while. It aims to refresh and consolidate existing language through practice, as well as to learn new language. There is guided writing practice and relevant grammatical structures are explained. In addition, skills and strategies which develop good vocabulary learning and recording are included.

Academic Writing: upper intermediate

based on textbook '*Focus on Academic Skills for IELTS*', Pearson-Longman

- Focuses on academic writing skills
- Includes vocabulary building and reading techniques relevant to research.
- Specific writing skills include: collocations; useful phrases and language of research; the language of change (increase, decrease, etc); interpreting and comparing information from diagrams; presenting arguments and opinions; justifying solutions (modal verbs, conditionals) and much more to improve academic writing.
- Life-long learning. This textbook offers systematic preparation for the IELTS exam, hence it can help any student who wishes to gain this internationally-recognised certificate, or improve their existing score.

Advanced Academic Writing: advanced

based on textbook '*Academic Writing, A Handbook for International Students*' Routledge

Specifically aimed at improving key academic writing skills, this is a very practical and thorough course.

Three main areas are covered: The Writing Process – from making an outline to proof-reading; Elements of Writing – writing skills such as making comparisons, describing results and paraphrasing; Accuracy in Writing – to improve common problems, eg articles, passives, prepositions.

The above courses follow a workshop approach and are designed to provide maximum hands-on practice. There is a strong emphasis on collaborative writing activities for students, with the lecturer adopting the role of facilitator.

MSc Thesis Writing: *for all participants.* A reader is provided.

In August/September a series of lectures is given, open to all MSc participants, on thesis writing. The lectures aim to make participants aware of the conventions and structures used to write a proposal, literature review and thesis, and how to present their judgements in a persuasive and reasoned argument. Topics will include proposal writing, literature review, thesis chapters, argument structure, paragraph writing, editing skills, etc.



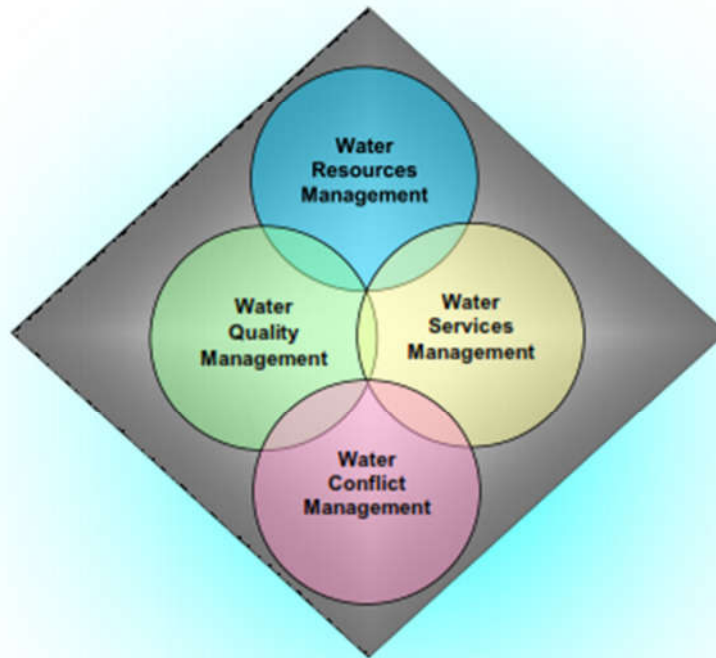
UNESCO-IHE
Institute for Water Education

MASTER PROGRAMME WM 2015-2017



WM Programme description UNESCO-IHE

Study guide - part 1



INTERNATIONAL MASTER'S PROGRAMME IN

Water Management

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Table of contents

WM Programme

Intro to WM Programme

Final Qualifications WM Programme

Specializations

Water Resources Management

Water Quality Management

Water Services Management

Water Conflict Management

Academic Staff

Disclaimer:

|

While UNESCO-IHE Institute for Water Education, Delft does its utmost to ensure that the programme will run as specified in this handbook, the content is subject to change. Certain modules or parts of modules may be changed, withdrawn and/or replaced by other modules. Due to logistical constraints or otherwise, participation of specified lecturers, whether from UNESCO-IHE or from partner organisations cannot be guaranteed. No rights can therefore be derived from the programme as specified in this handbook.

Intro to WM Programme

The International Masters program in Water Management (**WM**) builds on the recognition that:

- o Water plays a key role in the natural and human environment.*
- o Decisions by water resource planners and developers can have far reaching consequences for society and the environment.*
- o Efficiency, equity and ecological integrity of natural resources use can only be achieved through an integrated approach involving engineering, law, policies, institutional development and management.*

WM covers an interdisciplinary field that combines an understanding of water availability in terms of quality and quantity and hence of key biophysical and hydrological processes with a critical understanding of legal, institutional, economic and other arrangements that regulate access, allocation, treatment, use and discharge of water. The programme aims at imparting to students the knowledge, insight and skills that are required to develop, implement and evaluate water management policies and strategies in order to promote the wise use of water and achieve effective governance of water resources, and to be appropriate candidates for further study towards a research career.

Management implies policy development, planning and design of strategies for sustainable development, allocation of scarce resources, implementation of strategies, and the operation of agencies and utilities. The management approach requires an understanding of problems, causes and an integrated approach to dealing with such problems. Consequently, the objectives of the programme in Water Management consist of three types of aspects:

1. technical aspects that enhance the understanding of physical, biological and other technical processes;
2. non-technical aspects that enhance the understanding of legal, social, economic, financial, institutional and managerial aspects; and
3. integrative aspects that enhance the understanding of the interplay between technical and non-technical aspects.

As such the **WM** programme responds to the concepts of integrated management for sustainable use of resources, as emphasised by the 1992 International Conference on Water and Environment in Dublin and the 1992 Earth Summit in Rio and affirmed by the 2000 World Water Forum in the Hague, the 2002 Johannesburg declaration and the 2003 World Summit on Water in Kyoto.

The WM programme exposes students to an academic level of thinking and to new developments in the field of study and prepares them to conduct academic research. Furthermore, the approach of UNESCO-IHE is case and solution oriented with an important focus on developing countries. This means that the value of the achieved knowledge and skills is measured in terms of applicability of the science, technology, engineering, planning and

policies to water and environmental management. As the concept of sustainable development needs its own unique elaboration in contexts where living conditions of large populations are in a critical stage and environmental protection is sometimes seen as a luxury, the **WM** programme, with specialisations in Water Resources Management (**WRM**), Water Quality Management (**WQM**), Water Conflict Management (**WCM**) and Water Services Management (**WSM**), provides approaches and knowledge that are relevant to these challenging conditions.

In water management education, the development of knowledge together with skills is essential. In the UNESCO-IHE approach, lectures by experts in the field are complemented by assignments, exercises, laboratory and fieldwork and group-work. Innovative distance learning and electronic interactive educational tools support the programme, while further innovations and developments to link up with UNESCO-IHE's global network are ongoing. In addition to increasing accessibility to academic programme elements for interested individuals and professional groups on an ad hoc basis, UNESCO-IHE has introduced a modular structure to stimulate participation by professionals who cannot follow the full-time programme. A module is a three-week concentration of courses around a specific theme and generally opens to external participants. Short-term participants may thus accumulate credits towards the UNESCO-IHE Master's Degree.

Structure of WM Programme

Water Management is one of four UNESCO-IHE Master's programmes. It is offered as an 18-month Master's of Science (MSc) programme. The first year of the programme are taught modules and is followed by a six-month research period resulting in a thesis. The first year starts with five general modules followed by three modules in four specialisations and another three common modules.

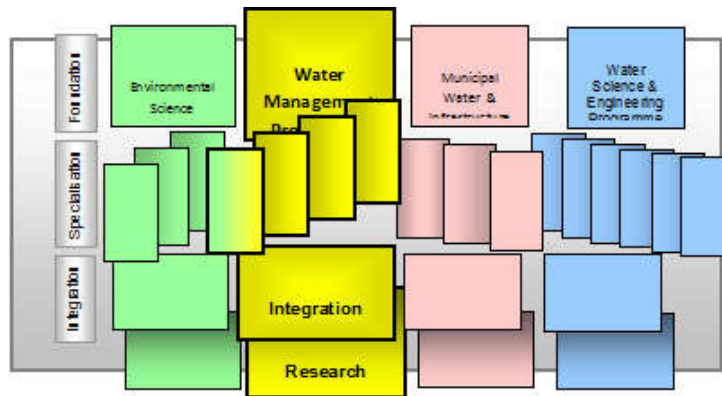


Figure 1 Sharing Specialisations between UNESCO-IHE Master's Programmes

The programme follows a modular structure – each module having duration of three weeks – and consists of three distinct phases:

- 1. Foundation:** a common basis at the start of the programme, where candidates of the WRM, WQM, WCM, WSM specialisations and WM tailor made profile follow 5 common modules.
- 2. Specialisation:** three modules in four different specialisations and tailor made profile/specialization, allow the participants to broaden, but especially deepen their understanding of specific management issues and learn to apply the necessary tools with regard to water resources, conflict, quality and services management. In addition, participants can select two elective modules, either to further deepen or further broaden their knowledge and skills.
- 3. Integration:** participants of the WM program come together to test the knowledge, insight and skills acquired in the preceding modules in a multi-disciplinary, problem-solving environment, consisting of a two-week international field trip, facing contemporary water management issues in Europe and a four-week group work seeking management solutions for a river basin in a development context. The **WM** programme culminates in a research proposal development & summer courses period followed by a 6-month research period, dedicated to integrating and applying individual knowledge and skills through applied research in a field directly pertaining to the participant's professional experience, interest and context, integrated with the existing UNESCO-IHE research lines.

The modular structure of the programme allows for sharing of selected modules between specialisations. To a limited extent participants will be allowed to take a module offered under another specialisation or even another programme. However, if a module has not been designated as an elective subject, this will be possible only after prior consultation with and approval of the programme coordinator.

Final Qualifications WM Programme

Knowledge & understanding

1. Knowledge of current theory and contemporary developments in Water Management.
2. The ability to describe the rationale for an integrated and interdisciplinary approach for managing water systems.
3. Knowledge of biological, physical and chemical principles of water systems.
4. Knowledge of economic, institutional and legal principles, approaches and instruments in water management.
5. Understanding the broader scientific, engineering and socio-economic context and the role of other disciplines required for Water Management.

Applying knowledge and understanding

6. The ability to apply the knowledge and academic capabilities acquired, in management and engineering contexts.
7. The ability to contribute to managing water systems and organisations and to the development of institutional arrangements.
8. The ability to collect, analyse and organise relevant information and to draw sound conclusions.
9. The ability to prepare and implement a scientific research plan.
10. The ability to contribute to theoretical, methodological or applied developments within the field of study.

Making judgements

11. The ability to decide between different ideas and approaches independently, based on available information, and assess the potential for application, integration and further development.
12. The ability to select and apply a variety of techniques, tools and procedures in order to evaluate the consequences of different development and intervention scenarios.
13. The ability to reflect critically on how different activities impact on the sustainable use of water.

Communication

14. The ability to report and communicate results clearly, and to explain and defend the reasoning, knowledge and assumptions to a variety of audiences.

15 The ability to function effectively in a multi-disciplinary team.

16. The capability to assess interests among different stakeholders and to facilitate decision-making processes.

Learning skills

17. The ability to extend and enhance one's own knowledge, insight and skills in a largely autonomous manner.

Specializations

The Water Management Programme has four Specializations consisting of three modules each to allow participants to deepen their understanding of specific management issues and learn to apply the necessary tools relevant for their Specialization. In addition, participants can choose two elective modules from a wide range of topics to further deepen and/or broaden their knowledge and skills.

The following Specializations are offered within the Water Management Programme:

Water Resources Management (WRM)

Water Services Management (WSM)

Water Conflict Management (WCM)

Water Quality Management (WQM)

Participants who chose not to select a particular specialization within the WM programme and registered for the general Water Management programme (WM-WM) instead, will develop - with their mentors - their own study profile. Such a profile includes the foundation and integration modules and can contain modules from different specializations.

For more information on the content of each specific Specialization and its learning objectives, please consult the next sections.

Water Resources Management

The Water Resources Management specialisation studies the ways in which water availability and demand are assessed and managed, and develops alternative land use and water allocation policies and models and legal and institutional arrangements from the local watersheds to the basin scale and beyond.

The specialisation starts with the module *Water Resources Assessment* which focuses on quantification of the different components of the water resources spectrum (rainfall, river flow, groundwater), and assessment of water availability and demand at different scales. The module *Water Systems Modelling* provides a broad introduction to the basics of hydrological, hydraulic and water allocation modelling. By acquiring an understanding of the basic modelling concepts and developing modelling skills, the participant develops an intuitive ability to interact with more advanced modelling approaches useful for system understanding, assessments and decision making processes. Water Resources planning module provides a learning environment for the tested and innovative approaches for effective water resources planning, strategy formulation, economic theory and impact assessment and multi-criteria evaluation of management options at the range of spatial and temporal scales, e.g. river basin, national and international levels, short, medium and long time horizons.

The participants then choose Institutional analysis or a module in the WSE programme. The institutional analysis module focuses on understanding how arrangements over access to water are formed.

Concluding the specialisation, the participant selects the module *Watershed and River Basin Management* or Climate Change and Water Management. *Watershed and River Basin Management* allows the participant the opportunity to assess land and water resources in their natural and anthropogenic interactions at the detailed watershed level, but without losing sight of the potential effects on the larger river basin scale. The study of climate change scenarios and their impact on water resources allows them to effectively contribute in the formulation of alternative water management strategies for climate change adaptation.

The learning objectives of the WRM specialization are as follows:

Knowledge & theory

1. Be able to describe and predict for a given water resources system the main hydrological, hydraulic, chemical and ecological processes and how these processes are dynamically linked with human activities, including land and water use.
2. Be able to describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements over water, including policies, laws and institutions, and by adopting a historical perspective.
3. Be able to explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of water systems and describe the challenges of such approaches.
4. Be able to describe different concepts to determine the value of water for various uses and users in (amongst others) economic and social terms and explain how these concepts can be used in water resources planning at various spatial and temporal scales

Methods, techniques & tools

5. Be able to assess water availability and demand, and model processes of the water system (rainfall-runoff, flooding, water allocation, water accounting), validate models, critically interpret model outcomes in order to derive insight in trends, causes and effects, and define and explain model limitations.
6. Be able to formulate and critically evaluate planning frameworks and strategies related to water resources management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.
7. Be able to combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis & integration

8. Be able to define a given water resources system, and compose the water flows across time and space, including the various water uses, and describe the interdependencies these create between the various water users.
9. Be able to critically evaluate technical and institutional water resources interventions (projects/ programmes/ policies/ agreements) through analysis of implications for the water resources system, its users and their interrelations at various spatial and temporal scales.

Research

10. Be able to conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

11. Be able to clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.
12. Think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.
13. Have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

Water Quality Management

The Water Quality Management specialisation studies the water quality impacts of human activities on aquatic ecosystems, as well as alternative remedial actions, under different levels of environmental stress and in different socio-economic contexts. The specialisation starts with the module *Water Quality Assessment*, in which the participant re-acquaints her-/himself with common and critical water pollution parameters, their indicators, sources, causes and effects. Appropriate monitoring, modelling and risk assessment techniques are demonstrated, discussed, applied in case study and simulated settings.

As the second module the participants choose between *Wetlands for Water Quality* and *Environmental Engineering*.

The third Water Quality Management specialisation module is *Environmental Planning and Management*, where the participant will learn to apply sustainable development concepts to policy analysis techniques, as environmental impact assessment and natural resource valuation.

In the module *Aquatic Ecosystems* the participant is encouraged to grapple with environmental issues related to the use of and impacts on freshwater ecosystems. This module immerses the participant in practical field measurements of a small catchment, combined with laboratory experiments based on samples taken, GIS and computer modelling. Concluding the specialisation, the participant selects either the module *Watershed and River Basin Management* or another module offered by WM or other master programs at UNESCO-IHE.

The the learning objectives of the WQM specialization are as follows:

Knowledge and theory

1. Be able to describe and predict for a given water resources system the main hydrological, hydraulic, chemical and biological processes and how these processes are dynamically linked with aquatic ecosystems as well as with human activities such as land and water use and pollution.
2. Be able to describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements for water quality management, including policies, laws and institutions, and by adopting a historical perspective.
3. Be able to explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of aquatic ecosystems and describe the challenges of such approaches.
4. Be able to describe concepts to determine the value of water for various uses and users in (amongst others) economic and ecological terms and explain how these concepts can be used in water resources planning at various spatial and temporal scales.

Methods, techniques and tools

5. Be able to interpret, design and optimize water quality assessment and monitoring programmes by applying experimental, statistical and modelling tools.

6. Be able to formulate and critically evaluate environmental planning frameworks and strategies related to water quality management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.

7. Be able to combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis and integration

8. Be able to define a given water resources system, and compose the water and pollution flows across time and space, including the various water uses, and describe the interdependencies these create between the various water users.

9. Be able to critically evaluate technical and institutional interventions focused on water quality (projects/ programmes/ policies/ agreements) through analysis of implications for the water resources system, its users and their interrelations at various spatial and temporal scales.

Research

10. Be able to conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

11. Be able to clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.

12. Think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.

13. Have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

Water Services Management

The Water Services Management specialisation studies the provision of water and sanitation services and the management of related infrastructure, and designs new institutional and financial instruments and business models for different socio-economic contexts.

The module *Managing Water Organisations* provides WSM participants profound understanding into what makes and keeps an organisation and its managers effective in addressing changing demands on its services.

The module *Financial Management of Water Organizations* allows the participant to understand financial management at the level of the utility and suggests different ways of financing water companies and cost-recovery for sanitation and wastewater treatment.

Technical and engineering options, standards and developments are unearthed in the module *Water Supply and Sanitation Systems*.

Concluding the specialisation, the participant selects two elective modules in line with her or his professional interests from *Institutional Analysis* or *Partnerships in the Water Sector and Urban Water Governance*.

The learning objectives of the WSM specialization are as follows:

Knowledge and theory

1. Be able to describe for a given water resources system the interplay between the main biophysical processes and social dynamics, in analyzing service delivery modalities.
2. Be able to describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements concerning water supply and sanitation services, including policies, laws and institutions, and by adopting a historical perspective.
3. Be able to explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of water services management and describe challenges of providing water supply and sanitation services at different levels (from global to local).
4. Be able to summarize the current debates relevant for water supply and sanitation services, using institutional and management theories from different academic disciplines (e.g. economics, public administration, sociology, political science, law).

Methods, techniques and tools

5. Design and apply analytical tools to research issues of water services management and describe, modify and apply management tools (e.g. with the benchmarking, cost benefit analysis, management information systems) with the aim of improving water supply and sanitation provision.
6. Be able to formulate and critically evaluate governance frameworks related to water services management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.

7. Be able to combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis and integration

8. Be able to analyze and evaluate governance processes and utility management arrangements in the water services sector, integrating technical, legal, administrative, social and financial components.

9. Be able to critically evaluate technical and institutional interventions (projects/ programmes/ policies/ agreements) through analysis of implications for water supply and sanitation services, its users and their interrelations at various spatial and temporal scales.

Research

10. Be able to conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

11. Be able to clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.

12. Think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.

13. Have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

Water Conflict Management

Water Conflict Management studies the management of conflicts over water resources. It focuses on negotiation, mediation and decision-making processes, in order to prevent, manage and resolve conflicts concerning water.

The specialisation starts with the module Mediation for Water Conflict Management which addresses the issues potential for conflict and for cooperation when sharing water resources. During the second module, Advanced Mediation for Water Conflict Management, the participant will be able to design and facilitate inclusive consultation, negotiation, mediation and decision-making processes between various water users, water managers, politicians and other decision makers.

After the modules on Mediation for Water Conflict Management the participants choose between the Water Resources Planning module (see WRM specialisation) and the Financial Management of Water Organizations module (see WSM specialisation) depending upon her or his professional interests.

Concluding the specialisation, the participant selects two elective modules in line with her or his professional interests from *Institutional Analysis* or *Partnerships in the Water Sector and Urban Water Governance*.

The learning objectives of the WCM specialisation are as follows:

Knowledge & theory

1. Be able to describe for a given water resources system the interplay between the main biophysical processes and social dynamics, in analyzing, anticipating, preventing and managing conflicts.
2. Be able to describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements over water for collaboration, including policies, laws and institutions, and by adopting a historical perspective.
3. Be able to explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of water systems and describe the challenges of such approaches at sector, intersectoral and transboundary levels.
4. Be able to name and critically discuss theories, concepts and tools of conflict management and cooperation building techniques in the context of natural resources and water in particular.

Methods, techniques & tools

5. Be able to design and facilitate inclusive consultation and conflict management processes, such as consensus building, public participation, negotiation and mediation between actors at different levels.
6. Be able to formulate and critically evaluate governance frameworks related to water conflict management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.

7. Be able to combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis & integration

8. Be able to define a given water resources system, assess the different functions of the water resources system and the often competing interests of water using sectors and actors, describe the interdependencies between these, and assess the possibilities and limitations of cooperation.

9. Be able to critically evaluate technical and institutional interventions focused on conflict management (projects/ programmes/ policies/ agreements) through analysis of implications for the water resources system, its users and their interrelations at various spatial and temporal scales.

Research

10. Be able to conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

11. Be able to clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.

12. Think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.

13. Have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

Academic Staff

Programme committee

Prof. M. Zwarteveen, Chair
I. Masih, PhD; Secretary, Programme Coordinator
M. Kooy, PhD; Member, MSc Research coordinator
Prof. P. van der Zaag, PhD; Member, Head WRM Specialization
Prof. J. Gupta, PhD; Member, Head WCM Specialization
Prof. K. Irvine, PhD; Member, Head WQM Specialization
Y. Jiang, PhD; Member, Coordinator WRM
K. Schwartz, PhD; Member, Coordinator WSM
Z. Shubber, LL.M; Member, Coordinator WCM
J.H. Koster, MSc; Senior Education Advisor

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WM4	Y. Jiang
WM5	F. Jaspers
WCM6	Z. Shubber
WQM6	P. Kelderman
WRM6	Y. Mohamed
WSM6	K. Schwartz
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WQM7	H. van Bruggen
WRM7	S. Graas
WSM7	K. Schwartz
WRM8	N. Van Cauwenberg
WSM8	M. Tutusaus
WM9	M. Tutusaus & N. van Cauwenberg
WRM10	H. Smit & J. Kemerink
WSM10	M. Pascual
WSM11	M. Kooy
WM 12	Summer courses
WM13	J. Susnik
WM14	M. Kooy
WM15	M. Kooy

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G. Gettel, Lecturer in Aquatic Biogeochemistry
E.M.A. Hes, Lecturer in Environmental Science
M. Hofstra, Senior Advisor Policy Analysis and Water Governance
K. Irvine, Professor of Aquatic Ecosystems
F.G.W. Jaspers, Associate Professor of Water Resources Management
Y. Jiang, Senior Lecturer in Water Economics
P. Kelderman, Senior Lecturer in Environmental Chemistry
J.S. Kemerink, Lecturer in Water Governance
M. Kooy, Senior Lecturer in Water Governance
F. Kruis, Head of Environmental Laboratory
I. Masih, Senior Lecturer in Water Resources Planning
Y. Mohamed, Associate Professor of Water Resources Management
I.P. Popescu, Associate Professor of Hydroinformatics
M. Ronteltap, Senior Lecturer in Sanitary Engineering
E. de Ruyter, Senior Lecturer Aquatic and Marine Ecology
L. Salame, Lecturer in Water Conflict Management
K.H. Schwartz, Associate Professor of Urban Water Governance
Z. Shubber, Lecturer in Law and Water Diplomacy
H. Smit, Lecturer in River Basin Governance
W.J. Sturrock, Senior Lecturer in Language and Academic Skills
J. Susnik, Lecturer/Researcher in Water Resources
M. Tutusaus, Lecturer/Researcher in Water Services Management
J.J.A. van Bruggen, Senior Lecturer in Microbiology
A.A. van Dam, Senior Lecturer in Ecological & Environmental Modelling
H. van der Kwast, Senior Lecturer in Ecohydrological Modeling
N. van Cauwenbergh, Lecturer in Water Resources Planning
P. van der Zaag, Professor of Integrated Water Resources Management
J. Wenninger, Senior Lecturer in Hydrology

Water Management Programme Overview 2015-2017

	WQM Water Quality Management	WRM Water Resources Management	WCM Water Conflict Management	WSM Water Services Management	WCP Water Cooperation and Peace	ALL
.....-18/10 19/10-25/10	Week one introduction (ALL)				from 15 Jul 2015: Program UPEACE Orientation I 1. Socio-hydrology 2. Water security and peace Orientation II 3. Foundation in peace and conflict studies 4. Negotiation and alternative dispute resolution 5. Environment, security and development 6. Water security and peace (concept and theories) 7. Management of coastal resources 8. Research methodology	Week one introduction (ALL)
1 28/10-01/11 02/11-08/11	Principles of integrated water resources management (WM01)					MSc preparatory course and thesis research proposal (WM14)
2 09/11-15/11 16/11-22/11 23/11-29/11	The Water resources system (WM02)					
.. 30/11-06/12	Examination week				Travel to UNESCO-IHE	
3 07/12-13/12 14/12-20/12	Water governance (WM03)				9. Water governance (WM03)	
.. 21/12-27/12 28/12-03/01	Free period				Free period	
3 04/01-10/01	(WM03) continue				9. (WM03) continue	
4 11/01-17/01 18/01-24/01 25/01-31/01	Water economics (WM04)				10. Water economics (WM04)	
.. 01/02-07/02	Examination week				Examination week	
5 08/02-14/02 15/02-21/02 22/02-28/02	Water and environmental law (WM05)				11. Water and environmental law (WM05)	
6 29/02-06/03 07/03-13/03 14/03-20/03	Water quality assessment (=> ES06W)	Water resources assessment (WRM06)	Water Conflict Management I (WCM06)	Managing water organisations (WSM06)	Water Conflict Management I (WCM06)	
.. 21/03-27/03	Examination week				Examination week	
7 28/03-03/04 04/04-10/04 11/04-17/04	Wetlands for water quality (=> ES07W) or Environmental engineering (=> ES07T)	Water systems modelling (WRM07)	Water Conflict Management II (WCM07)	Environmental Governance and Water Services (WSM07)	13. Water Conflict Management II (WCM07)	
8 18/04-24/04 25/04-01/05 02/05-08/05	Environmental planning and implementation (=> ES08W)	Water resources planning (WRM08)		Financial Management of Water Organisations (WSM08)	14.a Elective module ..	
.. 09/05-15/05	Examination week				Examination week	
9 16/05-22/05 23/05-29/05 30/05-05/06	International fieldwork (WM09)				14.b Research Methodology + thesis proposal .. 2 weeks free	
10 06/06-12/06 13/06-19/12 20/06-26/06	Aquatic ecosystems processes and applications (=> ES10TWL)	Institutional analysis (WRM10)		Partnerships for Water Supply and Sanitation (WSM10)	Travel to OSU	
Click HERE TO CHOOSE YOUR MODULE 10 (2014-2016)					from 15 June 2016:	
Click HERE TO CHOOSE YOUR MODULE 11 (2014-2016)					<ul style="list-style-type: none"> • 15 Natural Resources Leadership Academy • 16 Natural Resources Leadership Academy • 17 Applied field problems/Technical and academic writing in water resources • 18 Seminar/Reading & conference course Collaborative project • 19 Seminar/Reading & conference course Collaborative project 	
11 27/06-03/07 04/07-10/07 11/07-17/07	Watershed and river basin management (=> ES11MW)	IWRM as a tool for adaptation to climate change (=> ES11X)	Urban water governance (WSM11)			
.. 18/07-24/07	Examination week					
12 25/07-31/07	Summer course (WM12)					
13 01/08-07/08 08/08-14/08 15/08-21/08	IWRM Groupwork (WM13)					
.. 22/08-28/08	Examination week					
.. 29/08-04/09	free					
14 05/09-11/09 12/09-18/09 19/09-25/09 26/09-02/10 03/10-09/10	MSc preparatory course and thesis research proposal (WM14)				Travel (if needed)	
.. 10/10-16/10	Examination week				from 15 Sept 2016: 20. OPTION: MSc thesis period (6 months) ..	
15 17/10/15 16/04/16	MSc thesis research work (6 months) (WM15)				at UNESCO-IHE or UPEACE or OSU	
.. 17/04-23/04 24/04-30/04	Final examination week(s) - Diploma awarding 25/04/2017				Free	



UNESCO-IHE
Institute for Water Education

MASTER PROGRAMME WM 2015-2017



Water Management

Exam regulations UNESCO-IHE

Study guide - part 1

Table of Contents

1	General Information	3
2	Content of the Programme.....	9
3	Assessments	11
4	Results of Assessments.....	15
5	Thesis Examination	17
6	Criteria, degrees and certificates	19
7	Appeals.....	23
8	Final Articles	23
Appendix A Qualifications of Graduates		25
1.	Urban Water and Sanitation Programme	25
2.	Environmental Science Programme.....	28
3.	Water Management Programme	33
4.	Water Science and Engineering Programme	40
Appendix B Examination Procedures		48
Appendix C Grading Systems used by partner institutes		50
Appendix D MSc modules: names, credits & assessment methods.....		54
Appendix E MSc thesis marking guidelines		68

1 General Information

Article 1 Scope of the regulations

- 1.1 The present regulations apply to the education offerings and examinations within the following Master programmes:
- a. Urban Water and Sanitation
 - b. Environmental Science
 - c. Water Management
 - d. Water Science and Engineering

referred to hereafter as ‘the programmes’.

The programmes are executed by the UNESCO-IHE Institute for Water Education, Delft, the Netherlands, referred to hereafter as ‘the Institute’ and several partner institutes in various countries.

- 1.2 For the following 4 joint degree specialisations separate examination regulations apply:
- Urban Water Engineering and Management (UWEM);
 - Limnology and Wetland Management (LWM);
 - International Master of Science in Environmental Technology and Engineering (IMETE);
 - Environmental Technology for Sustainable Development (ETSuD).
- 1.3 In case a joint specialisation (see art. 3.1) leads to a double or multiple degrees, the rules and regulations of the partner institute will be applicable for those parts of the programme organised and implemented by the partner.

Article 2 Definition of terms

2.1 The following terms are defined in the context of these regulations:

Act:	the Higher Education and Scientific Research Act (<i>Wet op Hoger Onderwijs en Wetenschappelijk Onderzoek</i>);
Assessment:	is the evaluation of a student's achievement on a course or topic. Assessments can have different formats, such as (written and oral) examinations, assignments, presentations etc.
Blind marking:	the student information is hidden from the examiner while they are marking the examination;
Consent agreement:	a negotiated agreement of examining committee members to an examination which resolves the disputed issues;
Co-mentor:	a staff member from an external institute or different chair group within UNESCO-IHE involved in the daily direction of a student during the MSc thesis research phase;
Degree:	a degree as stipulated in article 7.10a. of the Act;
Double (multiple) degree programme:	a master programme offered by multiple institutes of higher education leading to multiple degrees;
Diploma:	a written proof of evidence as stipulated in art 7.11 of the Act that a student has passed all programme requirements for the award of the degree;
Diploma supplement:	a written document as stipulated in art 7.11/4 giving information about nature and content of the programme and the results obtained by the student for each component of the programme;
ECTS:	the European Credit Transfer and Accumulation System: a standard for comparing the study attainment and performance of students of higher education across the European Union and other collaborating European countries;
ECTS transfer:	the procedure of granting credits to a student for studies completed at another institute;
Examination:	an assessment for a part of the module as stipulated in art 7.10/1 of the Act;
Examination board:	the committee as stipulated in article 7.12 of the Act;
Examination Appeal Board:	the committee as stipulated in article 7.60 of the Act;
(External) Examiner:	a person who sets and marks examinations to test student's knowledge or proficiency. Examiners have to possess at least a Master degree.
Fraud:	a deception deliberately practiced in order to secure unfair or unlawful gain;
Joint degree programme:	a master programme offered by two institutes of higher education leading to a joint degree;
Mentor:	staff member involved in the daily direction of a student during the MSc thesis research phase;
Module:	a self-contained programme unit with specified learning objectives, as stipulated in article 7.3 of the Act;
Module plan:	a document describing a.o. the learning objectives, content, didactic methods and assessments. Modules plans are part of the study guide;
Observer:	a person who is present at an oral examination in order to monitor and listen to what happens;

Online short course:	a module offered as an online non-degree course;
Peer review:	is the evaluation of work by one or more people of similar competence to the producers of the work (peers);
Plagiarism:	the practice of taking someone else's work or ideas and passing them off as one's own;
Practical:	a practical educational activity as stipulated in article 7.13, paragraph 2, clause d of the Act, taking one of the following forms: <ul style="list-style-type: none"> • the writing of a report or thesis; • producing a report, study assignment or design; • conducting a test or experiment; • performing an oral presentation; • participating in groupwork, fieldwork or a fieldtrip; • conducting a research assignment; or • participation in other educational activities that aim to develop specific skills;
Programme evaluation:	the formal evaluation of the student performance before graduation (in the Act: <i>examen</i>);
Study Guide:	a reference document for a specific programme containing generic and programme specific information, which students need to know throughout their programme;
Short course:	a module offered as a face-to face non-degree course;
Student:	a person who is registered in a study programme and sits for assessments;
Supervisor:	professor responsible for the work of student during the MSc thesis research phase.
Taught part:	part of the study programme consisting of taught modules and courses;
Research part:	part of the study programme consisting of an individual research work by the student leading to a MSc thesis, based on an approved research proposal.

Article 3 Master Programme and specialisations

3.1 The programmes are Master of Science programmes with the following specialisations:

1. Urban Water and Sanitation programme:

Specialisation	Offered by	Type of degree
1. Water Supply Engineering	UNESCO-IHE	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Kwame Nkrumah University of Science and Technology, Ghana 	Double degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Universidad de Valle, Cali, Colombia 	Double degree
2. Sanitary Engineering	UNESCO-IHE	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Kwame Nkrumah University of Science and Technology, Ghana 	Double degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Universidad de Valle, Cali, Colombia 	Double degree
3. Urban Water Engineering and Management	<ul style="list-style-type: none"> • UNESCO-IHE • Asian Institute of Technology, Thailand 	Joint degree

2. Environmental Science programme:

Specialisation	Offered by	Type of degree
1. Environmental Science and Technology	UNESCO-IHE	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Universidad de Valle, Cali, Colombia 	Double degree
2. Environmental Planning and Management	UNESCO-IHE	UNESCO-IHE degree
3. Water Quality Management	UNESCO-IHE	UNESCO-IHE degree
4. Limnology and Wetland Management	<ul style="list-style-type: none"> • UNESCO-IHE • BOKU - University of Natural Resources and Life Sciences, Vienna, Austria • Egerton University, Egerton, Kenya 	Joint degree
5. Environmental Technology for Sustainable Development	<ul style="list-style-type: none"> • UNESCO-IHE • Asian Institute of Technology, Thailand 	Joint degree
6. Environmental Technology and Engineering (Erasmus Mundus programme)	<ul style="list-style-type: none"> • UNESCO-IHE • Ghent University, Belgium, • ICTP, Prague, Czech Republic 	Joint degree

3. Water Management programme:

Specialisation	Offered by	Type of degree
1. Water Management	UNESCO-IHE	UNESCO-IHE degree
2. Water Resources Management	UNESCO-IHE	UNESCO-IHE degree
3. Water Services Management	UNESCO-IHE	UNESCO-IHE degree
4. Water Quality Management	UNESCO-IHE	UNESCO-IHE degree
5. Water Conflict Management	UNESCO-IHE	UNESCO-IHE degree
6. Water Co-operation and Peace	<ul style="list-style-type: none"> • UNESCO-IHE • University for Peace, Costa Rica • University of Oregon, USA 	Multiple degree

4. Water Science and Engineering programme:

Specialisation	Offered by	Type of degree
1. Hydrology and Water Resources	UNESCO-IHE	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Hohai University, China P.R. 	UNESCO-IHE degree
2. Hydraulic Engineering - River Basin Development	UNESCO-IHE	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Sriwijaija University, Palembang, Indonesia 	Double degree
3. Coastal Engineering and Port Development	UNESCO-IHE	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Hohai University, China P.R. 	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Sriwijaija University, Palembang, Indonesia 	Double degree
4. Land and Water development	UNESCO-IHE	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Sriwijaija University, Palembang, Indonesia 	Double degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Asian Institute of Technology Thailand 	Double degree
	<ul style="list-style-type: none"> • UNESCO-IHE • University of Nebraska -Lincoln, USA 	Double degree
5. Hydroinformatics- Modelling and information systems for water management	UNESCO-IHE	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Hohai University, China P.R.; 	UNESCO-IHE degree
	<ul style="list-style-type: none"> • UNESCO-IHE • Universidad del Valle, Colombia 	UNESCO-IHE degree
6. Flood Risk Management (Erasmus Mundus programme).	<ul style="list-style-type: none"> • UNESCO-IHE • Technische Universität Dresden, Germany • Universitat Politècnica de Catalunya, Spain • University of Ljubljana, Slovenia 	Multiple degree
7. Groundwater and Global Change - Impacts and Adaptation (Erasmus Mundus programme).	<ul style="list-style-type: none"> • UNESCO-IHE • TU Dresden, Germany • University of Lisbon, Portugal 	Multiple degree

Article 4 Aim of the programmes and courses

- 4.1 The aim of the master programmes is for students to acquire knowledge, insight and skills that are required for them to function as independent professionals within their field of study and to be appropriate candidates for further study towards a research career.
- 4.2 The qualifications of the master programme graduates are listed in Appendix A.
- 4.3 The aim of a short course or an online course is for students to acquire knowledge, insight and skills of a particular field of study.

Article 5 Full-time/part-time

- 5.1 The master programmes and short courses are offered on a full-time basis.
- 5.2 Online courses are offered on a part-time basis.

Article 6 Programme evaluation

- 6.1 Students have passed the programme evaluation, leading to the degree of Master of Science in the programme they are registered for, if all designated modules of that programme have been successfully completed as stipulated in article 7.10a, paragraph 1 of the Act.
- 6.2 Students of short courses or online courses are eligible to sit for the assessments of the course they are registered for provided that the fee to sit for these assessments has been paid for.

2 Content of the Programme

Article 7 Constitution of the specializations and joint specializations

- 7.1 The constitution of each programme specialization is described in the study guides of UNESCO-IHE and the partner institutes (in case of joint or double / multiple degree programmes)
- 7.2 The learning objectives of the modules, the content and assessment methods are described in the module plans of the study guides.

Article 8 Participation

- 8.1 The attendance and active participation of students is required for all scheduled curricular activities and the practicals of the programme in which they are registered.

3 Assessments

Article 9 Quality assurance of examinations

- 9.1 Assessments have to test whether a student has met the learning objectives.
- 9.2 Module coordinators are responsible for organising the assessments which are part of the module.
- 9.3 Module coordinators are responsible for compiling the written examinations.
- 9.4 The programme or specialization coordinators are responsible for checking the written examination for clarity, completeness and consistency.
- 9.5 The programme committees are responsible for approving the student assessment methodologies as proposed by the module coordinators.
- 9.6 The Examination Board annually approves the planned assessments of the taught modules, and any later deviations from that plan, as described in the module plans and proposed by the programme committees.

Article 10 Frequency and duration of assessments

- 10.1 A module is assessed through (a combination of) written and/or oral examinations, assignments and presentations as described in the module plans of the study guide.
- 10.2 The sequence of the modules and its assessments will take place according to the order as described in the study guide.
- 10.3 Students cannot be assessed more than two times for a module per academic year.
- 10.4 The date and time of the written and oral examinations are announced in the programme schedules. Written examinations take place during the examination periods indicated in the academic calendar.
- 10.5 Written and oral examinations for short and online course participants are held immediately at the end of the module. When a module is not immediately followed by an examination week, separate examinations have to be compiled by the examiners for these participants.
- 10.6 The duration of a written examination may not exceed three hours and is scheduled to take place in a morning or afternoon session. In case examination work consists of two or more different parts, a break of 15 minutes is allowed, provided that all examination work of the first part(s) is collected by the invigilators before the break.
- 10.7 In the case of a combination of an oral and written examination of a module during the examination week, the maximum total duration of the combined examination shall not exceed three hours.

Article 11 Re- assessments

- 11.1 Re-assessment consists of re-taking one or more failed assessments as described in the assessment part of the module plan, as are required to achieve a successful module result.
- 11.2 Written and oral re-examinations take place during the following examination period as indicated in the academic calendar. The students involved are notified sufficiently in advance by email about the date and time allocated for re-examinations. Not reading or misreading emails are not accepted as legitimate reasons for failure to participate in a re-examination. All students will take the re-sit of a written examination at the same time.
- 11.3 Students will only be allowed to re-sit an assessment for which a fail (i.e. mark lower than 5.9) has been obtained. The highest mark obtained (first assessment or re-sit) for the assessment will be used to compute the final module mark.
- 11.4 Students are not allowed to sit for further assessments during the programme period they are registered for, if they failed three separate modules (after re-assessments) during the taught part of the programme ('modules' does not include the MSc proposal defence).
- 11.5 The format of a re-examination may deviate from that of the first examination for the same module.

Article 12 The organisation of the examinations

- 12.1 Examinations are carried out according to the Examination Procedures as described in annex B of these regulations.
- 12.2 In the case of an oral or written examination for an online course, the student has to provide proof of identity (e.g. passport) to the examiner.
- 12.3 Students are expected to be in the examination room 10 minutes before the scheduled start of the exam. They will not be allowed to enter the examination room after the scheduled start of the examination.
- 12.4 Misreading the date, time or room allocation are not accepted as legitimate reasons for absence from an examination or for arriving too late.
- 12.5 Students who suffer from a physical or sensory impairment are offered the opportunity to take examinations such that, as much as possible, account is taken of their disability. If required, an expert will be consulted for advice.

Article 13 Oral examinations

- 13.1 Oral examinations are taken individually (only one student at a time). During oral examinations, a second staff member is present as an independent observer.
- 13.2 During oral examinations for online courses a second staff member as independent observer is not required. The oral examination has to be digitally recorded and kept on file for 12 weeks.

- 13.3 Oral examinations are non-public, unless stated otherwise in the module plan or current regulations.

Article 14 MSc proposal defence

- 14.1 The MSc thesis proposal examination is an oral examination during the examination period indicated in the academic calendar. The examination consists of a presentation of the proposal, and a discussion with the examining committee. The examining committee consists of the supervisor and the mentor of the student. The examination is open to public attendance and discussion.
- 14.2 The MSc thesis proposal defence is assessed as a pass or a fail. In the case of a fail, the student may present their defence one more time within one month after the first attempt before the same examining committee as stipulated in article 14.1. In the case of an unsuccessful second attempt the student is not allowed to embark on their MSc thesis work.

Article 15 Exemptions and transfer of credit points

- 15.1 Exemptions for assessments are generally not granted. In exceptional cases, the examination board may evaluate a request and conclude to grant a transfer of credit points, after receiving a favourable recommendation from the programme committee.
- 15.2 For joint specializations credits obtained at the partner institute are accepted on the basis of the credit transfer agreements made in the cooperation documents.

Article 16 Absence from examinations

- 16.1 Absence from an examination must be reported by the student to the programme coordinator as early as possible. Absence is only allowed if the student missed a substantial part of the education relevant for the examination and/or the examination itself due to:
- a. medical reasons, to be confirmed by student counsellor or a statement by a doctor;
 - b. serious personal circumstances beyond control of the student which should be supported by written evidence as far as possible.
- 16.2 For cases in which the programme coordinator, in agreement with the module coordinator, decides that the absence is justified, the student shall sit the examination as soon as is reasonably possible.
- 16.3 For cases in which the programme coordinator, in agreement with the module coordinator, decides that the absence is not justified, a mark of 1.0 will be recorded.
- 16.4 For all cases mentioned under art 16.2 and 16.3 the programme coordinator will inform the Examination Board and the planning office.

Article 17 Fraud

- 17.1 If a student is caught in an attempt to take unfair advantage during an examination, the invigilators or examiners will inform the Academic Registrar who will submit a written

- report to the examination board after investigation of the incident, and after having had a discussion with the student.
- 17.2 Plagiarism is a serious act of fraud.
- 17.3 An examiner who observes or suspects fraud during the marking of examination work is required to submit a substantiating report to the examination board via the module coordinator.
- 17.4 If the examination board, after investigation of the incident as described in articles 17.1-17.3, concludes that there has been a case of fraud, the offender will be given a mark of 1.0 for the examination work.

4 Results of Assessments

Article 18 Assessment and notice of assessment results

- 18.1 Assessment results (including the thesis examination) are represented on a scale of 1.0 to 10.0, with one decimal of accuracy. Marks 6.0 and higher indicate a pass. The following grading scale is used:
- | | |
|---------------|------------|
| 9.0 - 10.0 | Excellent |
| 8.0 - 8.9 | Very good |
| 7.0 - 7.9 | Good |
| 6.0 - 6.9 | Sufficient |
| 5.9 and below | Fail |
- 18.2 Assessment results (including the thesis examination) obtained at partner institutes are represented according to the descriptions in annex C of these regulations.
- 18.3 The mark for a module is determined by the weighted average of the results of the various assessments. The weights for each assessment are stated in the module plan. The minimum mark that should be obtained for each assessment is 5.0.
- 18.4 All written examination work of the students will, where feasible, be blind marked by the examiners involved.
- 18.5 The examiner shall evaluate a written examination or assignment within a period of 14 days after the date of the examination.
- 18.6 Assessment results shall be collected, processed, recorded and notified to the students by the Education Bureau within a period of 21 days after submission of the (examination) work by the student.
- 18.7 The examiner shall determine the result of an oral examination shortly after the examination has been conducted.
- 18.8 The examination committee for the thesis examination shall determine the result immediately after the defence. The mark shall be formally communicated to the student before the diploma awarding by the Education Bureau.
- 18.9 After the assessment of a module has been completed, the student receives a written statement from the Education Bureau mentioning the overall module mark, the marks given for the different assessments, and if successful also the credit points granted for the module.
- 18.10 After a successful re-sit of an assessment, the mark for the module is again recalculated according to the weighted average of the assessment results. However, the maximum module mark which can be awarded when there has been a re-assessment is 7.0.

Article 19 Period of validity

- 19.1 The result of a module, if successful, is valid for an unlimited period of time.

- 19.2 Notwithstanding paragraph 1 of this article, the period of validity for which the examination board takes module results into account for the programme evaluation is four years.

Article 20 Right to inspection of assessments

- 20.1 Students may, upon their own request, peruse their assessment work within ten working days after they were notified of the result.
- 20.2 Where a practical is part of a module, the work for that part may be returned to the students when all assessments of the module are fully completed.
- 20.3 Written examination work is archived for a minimum of 7 years.

Article 21 Study progress and study advice

- 21.1 All study results that are required for evaluating the performance of the students, are recorded by the Education Bureau on behalf of the Examination Board.
- 21.2 Upon request, students will be provided with a written summary of the study results obtained in the programme to date.

5 Thesis Examination

Article 22 The organisation of the thesis examination

22.1 The thesis will be assessed by a thesis examination committee, normally consisting of three members: a professor as the chairperson, the mentor and maximum one external independent examiner.

In special circumstances the committee may consist of more than three members:

- a) If the UNESCO-IHE mentor is a PhD fellow, mentoring the MSc student in the context of his/her own research, is a member of the committee, an additional staff member is compulsory.
- b) If the research work is carried out outside UNESCO-IHE a second co-mentor from that external institute may be appointed.
- c) If the research work is co-mentored by a staff member from another chair group at UNESCO-IHE;
- d) In the case of a double degree or joint degree programme, where the MSc research work is carried out under co-supervision of staff members of the partnering institutes.

External examiners are

- not involved in the thesis work (independent)
- from outside the institute or
- in exceptional cases from a chair group within the institute, but not involved in the supervision of the research work.

22.2 The opportunity to sit the thesis examination is offered once every calendar month.

22.3 All students have to submit the examination version of the thesis report on the same date, and defend their thesis in the designated period, as annually announced by the Examination Board.

22.4 Students can sit the thesis examination only if all other modules required to obtain the degree have been successfully completed.

22.5 If the outcome of the thesis examination, including the defence, is negative, the examination can be repeated once. The examination committee will detail the reasons for the failure in writing and clarify what is required to pass the exam. The student has to finalize the work without further supervision nor financial support. The re-sit shall be taken within three months after the first attempt and will, in principle, be assessed by the same committee as for the first attempt. In special circumstances the examination can take place via videoconference.

22.6 The maximum recorded mark for a re-sit of the thesis examination is 6.0.

- 22.7 The MSc thesis work shall be assessed according to the MSc thesis assessment criteria as outlined in appendix E.
- 22.8 The mark for the thesis examination is based on the following components: written MSc thesis report, oral presentation, and examination. The latter includes the ability of the student to satisfactorily answer questions from the examination committee. The oral presentation of the thesis research has a maximum duration of 30 minutes and is followed by a maximum 30 minutes examination discussion with the examining committee. The oral presentation is open to public attendance and discussion.
- 22.9 The decision on a final mark for the thesis examination in principle will be based on a consensus of the examining committee. In the case of insurmountable disagreements the chair of the examining committee takes a decision.
- 22.10 The maximum duration of the MSc research phase is six months for full-time study. In the case of a *force majeure*, as supported by substantiating documents, extension of this period may be granted by the Examination Board on request by the student through their mentor.

6 Criteria, degrees and certificates

Article 23 Evaluation of the programme

23.1 The student has fulfilled the requirements for the programme evaluation if s/he has:

SINGLE DEGREES:

- For the single UNESCO-IHE degree programmes:
 - Successfully completed all modules of the programme; and
 - Obtained a minimum of 106 ECTS.

JOINT DEGREES:

- For the joint degree Limnology and Wetland Management programme (LWM):
 - Successfully completed all modules of the programme, according to the grading rules of BOKU, Egerton University and UNESCO-IHE; and
 - Obtained a minimum of 120 ECTS.
- For the joint degree International Master of Science in Environmental Technology and Engineering programme (IMETE) (Erasmus Mundus programme):
 - Successfully completed all modules of the programme, according to the grading rules of Ghent University, Institute of Chemical Technology in Prague and UNESCO-IHE; and
 - Obtained a minimum of 120 ECTS.
- For the joint degree Environmental Technology for Sustainable Development (ETSuD) conducted with the Asian Institute of Technology (AIT):
 - Obtained a minimum of 48 AIT credits / 125 ECTS credits, and
 - Obtained a minimum cumulative GPA of 2,75 for courses taken at AIT, and
 - Passed all modules taken at UNESCO-IHE, and
 - Has obtained a grade 'fair' or higher for their Master's thesis at AIT.
- For the joint degree Urban Water Engineering and Management (UWEM) conducted with the Asian Institute of Technology (AIT):
 - Obtained a minimum of 48 AIT credits / 120 ECTS credits, and
 - Obtained a minimum cumulative GPA of 2,75 for courses taken at AIT, and
 - Passed all modules taken at UNESCO-IHE, and
 - Has obtained a grade 'fair' or higher for their Master's thesis at AIT.

DOUBLE / MULTIPLE DEGREES:

- For the double degree programme Land and Water development conducted with the Asian Institute of Technology (AIT):
 - Obtained a minimum of 48 AIT credits / 120 ECTS credits, and
 - Obtained a minimum cumulative GPA of 2,75 for courses taken at AIT, and
 - Passed all modules taken at UNESCO-IHE, and
 - Has obtained a grade 'fair' or higher for their Master's thesis at AIT.
- For the double degree programmes in Water Supply Engineering, Sanitary Engineering, and Environmental Science and Technology conducted with Universidad del Valle:
 - Obtained a GPA of 3.5 or higher for the course work done at Univalle; and
 - Successfully completed all modules at UNESCO-IHE; and
 - Achieved a mark '6' or higher for the thesis examination; and

- Obtained a minimum of 113,36 ECTS.
- For the double degree programmes in Water Supply Engineering, and Sanitary Engineering conducted with KNUST:
 - Obtained a CWA of 55% or higher for the course work done at KNUST; and
 - Successfully completed all modules at UNESCO-IHE; and
 - Achieved a pass for the thesis examination at KNUST; and
 - Obtained a minimum of 118 ECTS.
- For the double degree programme in Land and Water development, conducted with Sriwijaija University:
 - Successfully completed all modules of the programme; and
 - Obtained a minimum of 106 ECTS.
- For the double degree programme Land and Water development conducted with the University of Nebraska-Lincoln:
 - Successfully completed all modules of the programme; and
 - Obtained a minimum of 112 ECTS.

DOUBLE / MULTIPLE DEGREES (Erasmus Mundus programmes):

- For the multiple degree programme on Flood Risk Management:
 - Successfully completed all modules of the programme, according to the grading rules of TU-Dresden, University of Ljublijana, TU-Catalonia and UNESCO-IHE; and
 - Obtained a minimum of 120 ECTS.
 - For the double degree programme Water Co-operation and Peace conducted with the University of Peace and University of Oregon:
 - Successfully completed all modules of the programme, according to the grading rules of UPEACE, University of Oregon, and UNESCO-IHE; and
 - Obtained a minimum of 120 ECTS.
 - For the multiple degree programme in Groundwatch:
 - Successfully completed all modules of the programme, according to the grading rules of the University of Lisbon, Technical University Dresden, and UNESCO-IHE; and
 - Obtained a minimum of 120 ECTS.
- 23.2 The student has fulfilled the requirements for the short or online course if s/he successfully completed all assessments of the course.
- 23.3 The student has successfully completed the programme evaluation or short / online course evaluation if the examination board takes a decision to that effect.

Article 24 Awarding of degrees and certificates

24.1 Master of Science degree.

Students who have successfully completed the programme evaluation requirements will be awarded the Master of Science degree at the next scheduled degree awarding ceremony. The degree is signed by the Chairman of the Examination Board, the Rector of the Institute and the Academic Registrar. In addition to the degree certificate, the graduate receives a degree supplement stating the results achieved and credit points for each component of the programme.

24.2 Certificate of Graduate Study.

Students who fail to meet the master programme evaluation requirements and have accumulated a minimum of 45 credits will be awarded a certificate of graduate study in the programme for which they are registered. Registration as student will be terminated.

24.3 Certificate.

Students who fail to meet the master programme evaluation requirements, or who suspend or terminate their registration, will be issued a certificate stating the result achieved and credit points for each successfully completed component of the programme, and the period of registration.

24.4 Certificate for short or online course.

Students who have successfully completed the short or online course evaluation requirements will be awarded a certificate. The certificate is signed by the Rector of the Institute, the Course coordinator and the Academic Registrar. In addition to this certificate, the graduate receives a supplement stating the result achieved and credit points.

24.5 If a student re-registers within 4 years after termination and meets (after assessment(s)) the requirements of an MSc degree, s/he is obliged to return the certificate as mentioned under art 24.2 and art 24.3.

24.6 With reference to art 24.5, if a student re-registers within 4 years with the aim to obtain an MSc degree, s/he has to re-take in full all failed and missed modules and assessments, and any re-assessments. Re-registration is only possible for a subsequent academic period.

24.7 Certificate of Attendance.

Students who have successfully completed the short or online course without assessments, and who have demonstrated an active participation in the course throughout the whole study period, will be awarded a Certificate of Attendance. The Certificate of Attendance is signed by the Rector of the Institute and the Course coordinator.

Article 25 Criteria for MSc degree with distinction

25.1 The Master of Science degree can be awarded with distinction by the Examination Board if:

For single degree programmes:

- the candidate obtained a mark of 8.5 or higher for the thesis examination, and

- an arithmetic average mark at UNESCO-IHE of 8.0 or higher for all modules that are assessed on a numerical scale, conform article 18.1.,
- there were no re-assessments during the taught part, and
 - a recommendation is made by the chair of the examination committee.

For double / multiple degree programmes where student sits for the thesis examination at UNESCO-IHE:

- the candidate obtained a mark of 8.5 or higher for the thesis examination, and
- an arithmetic average mark at UNESCO-IHE of 8.0 or higher for all modules that are assessed on a numerical scale, conform article 18.1.
- a recommendation is made by the chair of the examination committee.

The recommendation should also be based on the results for the courses obtained at the partner institute(s).

For double / multiple degree programmes where student sits for the thesis examination at a partner institute:

- the candidate obtained an arithmetic average mark at UNESCO-IHE of 8.0 or higher for all modules that are assessed on a numerical scale, conform article 18.1.
- a recommendation is made by the professor responsible for the specialization concerned.

The recommendation should also be based on the results for the courses and thesis obtained at the partner institute(s).

7 Appeals

Article 26 Grounds for appeal

- 26.1 Students have the right to appeal against an assessment result within a period of ten working days after notification, if
- a. the performance of the student suffered through illness or other factors;
 - b. a material administrative error in the conduct of an assessment occurred;
 - c. the assessment or evaluation was not conducted in accordance with the regulations; or
 - d. some other material irregularity occurred;
 - e. there is a serious unsolved conflict between the supervisor and the mentor.

Article 27 Procedure for appeal

- 27.1 A student shall first attempt to resolve the problem through the programme coordinator, with the examiner, or the chairman of the examination committee.
- 27.2 If the student proceeds, the appeal shall be submitted in writing by the student stating the grounds for appeal and enclosing appropriate documentation . The letter shall be presented to the Examination Appeal Board within 6 weeks.

8 Final Articles

Article 28 Amendments

- 28.1 Amendments to these regulations are made by separate decision of the Rectorate.
- 28.2 No amendments shall be made in relation to the ongoing academic year, unless there is reasonable expectation that the amendment will not disadvantage the students.

Article 29 Unforeseen situations

- 29.1 Situations which are not foreseen by the present regulations will be decided on by the Examination Board, where necessary after consultation with the programme committee concerned.

Article 30 Publication

- 30.1 The Rectorate is responsible for the timely publication of these Examination Regulations, and any amendments thereof.

Article 31 Period of application

- 31.1 These regulations take effect for the cohort 2015 – 2017. Approved by the Rectorate of UNESCO-IHE on 8 October 2015

Appendix A Qualifications of Graduates

1. Urban Water and Sanitation Programme

1.1 Sanitary Engineering

After successful completion of the programme graduates will be able to:

Knowledge and Theory

1. apply gained knowledge and skills in practice;
2. understand and explain the role of sanitation in urban water cycle and its relation to public health and environment;
3. develop rational approaches towards sustainable waste(water) management via pollution prevention, appropriate treatment, resources recovery and re-use on both centralized and decentralized level;
4. understand in-depth relevant physical, chemical and biological processes, and their mutual relationships within various sanitation components.

Methods, Techniques and Tools

5. prepare conceptual engineering and process design of sanitation components;
6. apply modern tools for technology selection and carry out modelling of sanitation components;

Analysis, Synthesis and Integration

7. define and critically analyse, assess and evaluate various urban drainage and sewerage schemes, and wastewater, sludge and solid waste treatment process technologies;
8. analyse, synthesise, integrate, interpret, and discuss both scientific and practical information in the context of various research and engineering projects including preparation of Master plans, feasibility studies and preliminary designs;

Research

9. identify, develop and conduct independent research including formulation of hypotheses selection and application of research methodologies, and the formulation of conclusions and recommendations;
10. carry out desk studies, field work, and laboratory based research;
11. contribute to the development of innovative approaches to the provision of adequate and sustainable sanitation services in developing countries and countries in transition;

General Academic Skills

12. clearly communicate concerning both oral and written skills;
13. continuously acquire knowledge and assimilate and implement innovative learning methods and skills in an independent manner;
14. operate both autonomously and in a multidisciplinary and multinational environment.

1.2 Water Supply Engineering

After successful completion of the programme graduates will be able to:

Knowledge and Theory

1. understand the structure of drinking water supply systems, including water transport, treatment and distribution;
2. understand water quality criteria and standards, and their relation to public health, environment and urban water cycle;
3. understand in-depth occurring physical, chemical and biological phenomena and their mutual relationships, within water supply systems;
4. understand water quality concepts and their effect on treatment process selection;
5. understand the interaction of water quality and materials applied;
6. understand hydraulic concepts and their relationship to water transport in treatment plants, pipelines and distribution networks;

Methods, Techniques and Tools

7. design and to rehabilitate raw water abstraction, transport, treatment and distribution processes and systems;
8. understand the importance and methods for operation and maintenance of water supply systems;
9. understand options for centralised and urban systems versus decentralized and rural systems;

Analysis, Synthesis and Integration

10. define and evaluate project alternatives on basis of chosen selection criteria;
11. use statistical and modelling tools for simulating, prediction of performance and operation of water supply system components;
12. understand water supply engineering within a watershed context;

Research

13. conduct independent research, including formulation of hypotheses, selection and application of research methodologies, and the formulation of conclusions and recommendations;

General Academic Skills

14. possess the learning skills to acquire continual knowledge in an independent manner;
15. communicate effectively in oral and written presentations to technical and non-technical audiences.

1.3 Urban Water Engineering and Management

After successful completion of the programme graduates will be able to:

Subject knowledge and skills

1. understand the urban water cycle and its water system components, their characteristics and functioning within greater urban infrastructure systems;
2. understand urban water management problems including ability to: identify water systems' demand; deal with climatic and hydrologic uncertainties and/or extremes; institutional limitations; and work within a data-constrained environment;
3. make appropriate and critical use of methods, techniques and tools necessary to monitor, analyze and design urban water systems including: water supply infrastructure; drinking water treatment and distribution; wastewater collection, treatment, transport and disposal systems; drainage systems;
4. understand water infrastructure/asset planning, financing and management, and utility management;
5. familiarise with the concept of integrated water resources management (IWRM) and its application to a variety of water management problems at the urban catchment scale;

Core academic skills

6. identify, articulate, analyse and solve problems of the urban water cycle and systems, integrating theory and applications;
7. collect, summarise, analyse and interpret technical data/materials in a structured form to gain knowledge on urban water system design and operation and maintenance;
8. critically recognize and assess the need for continued-education and research on planning, design, maintenance and management of urban water systems;
9. work with a range of information technology tools available for solving urban water management problems and for effectively communicating with fellow water managers, researchers, scientists, planners, and policy-makers;

Personal skills

10. learn independently;
11. reporting and give presentation;
12. demonstrate having improved IT skills;
13. work independently and / or as part of a team;
14. manage time effectively.

2. Environmental Science Programme

2.1 Environmental Science & Technology

After successful completion of the programme, graduates will be able to:

Knowledge & theory

1. demonstrate knowledge and understanding of the physical, chemical and biological processes of the environment, of the socio-economic concepts underlying the functioning and exploitation of environmental systems, and of the complex inter-relationship between the protection and wise use of environmental resources;
2. describe the rationale for an integrated and interdisciplinary approach for the sustainable management of water and environmental resources;
3. identify the impacts of human activities on the environment, under different levels of environmental stress and in different socio-economic contexts;
4. name and explain concepts, instruments and technologies for pollution prevention and remedial actions in a national and international context;

Methods, techniques & tools

5. design, optimise and interpret environmental monitoring and assessment schemes (including statistics and modelling) in order to gain an understanding of problems, trends, causes and effects;
6. apply general methods (including statistics and modelling) in scientific and technological approaches, concepts and interventions;
7. contribute as a flexible and creative member in interdisciplinary teams in developing solutions for prevention or remediation of environmental problems, by linking scientific knowledge to engineering interventions and to management decisions in different cultural and socio-economic contexts, and using different levels of available knowledge and information;

Analysis, synthesis & integration

8. critically analyse and evaluate a range of options and alternatives for the prevention or remediation of environmental problems, under different socio-economic, cultural and legal contexts, and under often data-poor conditions;

Research/General academic skills

9. conduct research, independently or in a multidisciplinary team, including the formulation of research questions and hypotheses, the selection and application of research methodologies and techniques and the formulation of well-founded conclusions and recommendations;
10. communicate, debate and defend, clearly and systematically, findings and generated insights, and provide rational underpinning of these in oral and written presentations to a variety of audiences;
11. demonstrate academic attitude and learning skills (including thinking in multidisciplinary dimensions and distinguishing main issues from minor ones), to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

2.2 Environmental Planning & Management

After successful completion of the programme, graduates will be able to:

Knowledge & theory

1. demonstrate knowledge and understanding of the physical, chemical and biological processes of the environment, of the socio-economic concepts underlying the functioning and exploitation of environmental systems, and of the complex inter-relationship between the protection and wise use of environmental resources;
2. describe the rationale for an integrated and interdisciplinary approach for the sustainable management of water and environmental resources;
3. understand the environmental policy cycle and planning process and to analyse and prepare environmental policy strategies, taking into account the impact that society has on water and environmental resources;
4. name and explain principles, concepts and instruments of major national and international water and environmental legislation and common and desired institutional and management arrangements;

Methods, techniques & tools

5. design, optimise and interpret environmental monitoring and assessment schemes (including statistics and modelling) in order to gain an understanding of problems, trends, causes and effects;
6. apply general scientific methods (including statistics and environmental modelling) to processes of water and environmental resources allocation and use at different scales in order to gain an understanding of problems, trends, causes and effects;
7. apply environmental scientific methods (including environmental impact assessment, policy analysis, resource valuation, environmental economics) and models for institutional development with emphasis on policy development, functional decentralisation and good governance;
8. design and facilitate consultation- and decision-making processes between stakeholders, users and their representatives, water managers, politicians and other decision-makers;

Analysis, synthesis & integration

9. critically analyse and evaluate a range of options and alternatives for the prevention or remediation of environmental problems, under different socio-economic, cultural and legal contexts, and under often data-poor conditions;
10. identify and critically assess the different ecological and socio-economic functions and values of the environmental system and the, often competing, interests of the various stakeholders;

Research/General academic skills

11. conduct research, independently or in a multidisciplinary team, including the formulation of research questions and hypotheses, the selection and application of research methodologies and techniques and the formulation of well-founded conclusions and recommendations;
12. communicate, debate and defend, clearly and systematically, findings and generated insights, and provide rational underpinning of these in oral and written presentations to a variety of audiences;

13. demonstrate academic attitude and learning skills (including thinking in multidisciplinary dimensions and distinguishing main issues from minor ones), to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner;
14. design comprehensive environmental resources policies and strategies that aim to enhance the sustainable use of the environment especially focusing on water, and that include a suitable combination of technical, legal, administrative and financial measures.

2.3 Water Quality Management

After successful completion of the programme, graduates will be able to:

Knowledge & theory

1. demonstrate knowledge and understanding of the physical, chemical and biological processes of the environment, of the socio-economic concepts underlying the functioning and exploitation of environmental systems, and of the complex inter-relationship between the protection and wise use of environmental resources;
2. describe the rationale for an integrated and interdisciplinary approach for the sustainable management of water and environmental resources;
3. identify the impacts of human activities on aquatic ecosystems;
4. name and explain principles, concepts and instruments of main national and international water and environmental legislation and common and desired institutional and management arrangements;

Methods, techniques & tools

5. design, optimise and interpret environmental monitoring and assessment schemes (including statistics and modelling) in order to gain an understanding of problems, trends, causes and effects;
6. interpret, design and optimise water quality monitoring and assessment schemes in the watershed;
7. apply experimental, statistical and modelling tools for interpreting and designing water quality management programmes;

Analysis, synthesis & integration

8. critically analyse and evaluate a range of options and alternatives for the prevention or remediation of environmental problems, under different socio-economic, cultural and legal contexts, and under often data-poor conditions;
9. contribute as a flexible and creative member in interdisciplinary teams in developing solutions for water quality management problems in different cultural and socio-economic contexts, and using different levels of available knowledge and information;
10. critically analyse and evaluate alternative water quality management programmes in the watershed under different socio-economic and legal contexts, often in data-poor conditions;

Research/General academic skills

11. conduct research, independently or in a multidisciplinary team, including the formulation of research questions and hypotheses, the selection and application of research methodologies and techniques and the formulation of well-founded conclusions and recommendations;
12. communicate, debate and defend, clearly and systematically, findings and generated insights, and provide rational underpinning of these in oral and written presentations to a variety of audiences;
13. demonstrate academic attitude and learning skills (including thinking in multidisciplinary dimensions and distinguishing main issues from minor ones), to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

3. Water Management Programme

3.1 Water Management

After successful completion of the programme, graduates will be able to:

Knowledge & theory

1. describe and predict for a given water resources system the main hydrological, hydraulic, chemical and ecological processes and how these processes are dynamically linked with human activities, including land and water use.
2. describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements over water, including policies, laws and institutions, and by adopting a historical perspective.
3. explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of water systems and describe the challenges of such approaches.
4. describe different concepts to determine the value of water for various uses and users in (amongst others) economic and social terms and explain how these concepts can be used in water management at various spatial and temporal scales

Methods, techniques & tools

5. formulate and critically evaluate governance frameworks related to water resources management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.
6. combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis & integration

7. critically evaluate technical and/or institutional water resources interventions (projects/ programmes/ policies/ agreements) through analysis of implications for the water system, its users and their interrelations at various spatial and temporal scales.

Research

8. conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

9. clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.

10. think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.
11. have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

Two or more additional learning objectives will be added depending on the study profile of the student.

3.2 Water Resources Management

After successful completion of the programme, graduates will be able to:

Knowledge & theory

1. describe and predict for a given water resources system the main hydrological, hydraulic, chemical and ecological processes and how these processes are dynamically linked with human activities, including land and water use.
2. describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements over water, including policies, laws and institutions, and by adopting a historical perspective.
3. explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of water systems and describe the challenges of such approaches.
4. describe different concepts to determine the value of water for various uses and users in (amongst others) economic and social terms and explain how these concepts can be used in water resources planning at various spatial and temporal scales

Methods, techniques & tools

5. model processes of the water system (rainfall-runoff, flooding, water allocation, water accounting), validate models, critically interpret model outcomes in order to derive insight in trends, causes and effects, and define and explain model limitations.
6. formulate and critically evaluate governance frameworks related to water resources management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.
7. combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis & integration

8. define a given water resources system, and compose the water flows across time and space, including the various water uses, and describe the interdependencies these create between the various water users.
9. critically evaluate technical and/or institutional water resources interventions (projects/ programmes/ policies/ agreements) through analysis of implications for the water resources system, its users and their interrelations at various spatial and temporal scales.

Research

10. conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

11. clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.
12. think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.
13. have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

3.3 Water Conflict Management

After successful completion of the programme, graduates will be able to:

Knowledge & theory

1. describe for a given water resources system the interplay between the main biophysical processes and social dynamics, in analyzing, anticipating, preventing and managing conflicts.
2. describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements over water for collaboration, including policies, laws and institutions, and by adopting a historical perspective.
3. explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of water systems and describe the challenges of such approaches at sector, intersectoral and transboundary levels.
4. name and critically discuss theories, concepts and tools of conflict management and cooperation building techniques in the context of natural resources and water in particular.

Methods, techniques & tools

5. design and facilitate inclusive consultation and conflict management processes, such as consensus building, public participation, negotiation and mediation between actors at different levels.
6. formulate and critically evaluate governance frameworks related to water conflict management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.
7. do combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis & integration

8. define a given water resources system, assess the different functions of the water resources system and the often competing interests of water using sectors and actors, describe the interdependencies between these, and finally assess the possibilities and limitations of cooperation.
9. critically evaluate technical and/or institutional interventions focused on conflict management (projects/ programmes/ policies/ agreements) through analysis of implications for the water resources system, its users and their interrelations at various spatial and temporal scales.

Research

10. conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

11. clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.
12. think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.
13. have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

3.4 Water Quality Management

After successful completion of the programme, graduates will be able to:

Knowledge and theory

1. describe and predict for a given water resources system the main hydrological, hydraulic, chemical and biological processes and how these processes are dynamically linked with aquatic ecosystems as well as with human activities such as land and water use and pollution.
2. describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements for water quality management, including policies, laws and institutions, and by adopting a historical perspective.
3. explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of aquatic ecosystems and describe the challenges of such approaches.
4. describe concepts to determine the value of water for various uses and users in (amongst others) economic and ecological terms and explain how these concepts can be used in water resources planning at various spatial and temporal scales.

Methods, techniques and tools

5. interpret, design and optimize water quality assessment and monitoring programmes by applying experimental, statistical and modelling tools.
6. formulate and critically evaluate governance frameworks related to water quality management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.
7. combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis and integration

8. define a given water resources system, and compose the water and pollution flows across time and space, including the various water uses, and describe the interdependencies these create between the various water users.
9. critically evaluate technical and/or institutional interventions focused on water quality (projects/ programmes/ policies/ agreements) through analysis of implications for the water resources system, its users and their interrelations at various spatial and temporal scales.

Research

10. conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

11. clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.
12. think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.
13. have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner

3.5 Water Services Management

After successful completion of the programme, graduates will be able to:

Knowledge and theory

1. describe for a given water resources system the interplay between the main biophysical processes and social dynamics, in analyzing service delivery modalities.
2. describe and explain the main concepts and instruments for analysing and influencing formal and informal arrangements concerning water supply and sanitation services, including policies, laws and institutions, and by adopting a historical perspective.
3. explain the key concepts for integrated, multi-disciplinary and interdisciplinary analyses of water services management and describe challenges of providing water supply and sanitation services at different levels (from global to local).
4. summarize the current debates relevant for water supply and sanitation services, using institutional and management theories from different academic disciplines (e.g. economics, public administration, sociology, political science, law).

Methods, techniques and tools

5. design and apply analytical tools to research issues of water services management and describe, modify and apply management tools (e.g. with the benchmarking, cost benefit analysis, management information systems) with the aim of improving water supply and sanitation provision.
6. formulate and critically evaluate governance frameworks related to water services management and apply tools for policy analysis with the emphasis on social inclusion and sustainability.
7. combine different types of method and through a process of triangulation synthesize outcomes in a coherent manner.

Analysis, synthesis and integration

8. analyze and evaluate governance processes and utility management arrangements in the water services sector, integrating technical, legal administrative, social and financial components.
9. critically evaluate technical and/or institutional interventions (projects/ programmes/ policies/ agreements) through analysis of implications for water supply and sanitation services, its users and their interrelations at various spatial and temporal scales.

Research

10. conduct, independently or in a multidisciplinary team, research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions, recommendations and limitations.

General academic skills

11. clearly and systematically communicate, argue and defend findings in oral and written presentations to a variety of audiences.
12. think in multidisciplinary and integrated dimensions and be able to distinguish main issues from side issues.
13. have the academic attitude and learning skills to enhance and keep up-to-date the acquired knowledge and application skills in a largely independent manner.

3.6 Water Co-operation and Peace

After successful completion of the programme, graduates will be able to:

1. describe the interwovenness of socio-natural processes;
2. discuss and compare theories and dimensions of conflict and its avoidance, management and resolution;
3. critically analyse water disputes (including actors, policies, institutions, historical, social and bio-physical processes);
4. identify and analyse issues, challenges and potential conflicts of water allocation and access to water resources at different scales;
5. use an interdisciplinary approach to critically assess and evaluate the different means conflict management tools and techniques available to deal with water-related disputes;
6. apply conflict management tools and design conflict resolution processes with the aim of settling water management disputes;
7. research the selection and application of adequate methodologies and techniques of water conflict management tools and formulate well-founded conclusions and recommendations

4. Water Science and Engineering Programme

4.1 Hydraulic Engineering and River Basin Development

After successful completion of the programme graduates will be able to:

1. have in-depth understanding of physical processes and natural phenomena in river basin systems, development of river basins by human interference, such as designing river structures and training works, and the management of floods and droughts;
2. master the major hydraulic methodologies and applications for river structures and river modelling techniques with regard to techniques for data collection, processing and analysis;
3. evaluate and analyse river basin systems and processes at a wide range of scales for the purpose of water resources, including morphological assessments, impact analysis of hydraulic structures and natural hazards assessment and mitigation taking into account relevant aspects of environmental, economical and social planning and management;
4. design and conduct hydraulic research, experiments and tests for both practical and scientific purposes, either independently or within a team-based framework; by intelligent use of engineering and scientific principles, develop and undertake critical evaluations of strategies for the implementation of river engineering works;
5. have knowledge of contemporary research (questions) and relevant literature in the field of hydraulic engineering and river basin development;
6. critically judge and evaluate their own work and results, as well as the information of prior research or investigations;
7. adequately communicate methodologies, results, evaluations, conclusions and recommendations in written, oral and graphical form to a wide variety of audience;
8. be aware of the importance of hydraulic engineering to society and be able to co-operate within a multidisciplinary and interdisciplinary framework with due consideration of ethical and social aspects related to the application of their knowledge and skills;
9. have the skills to apply and integrate relevant concepts and methodologies in the area of hydraulic, hydrological and geotechnical engineering and research as well as applying computational principles within the context of hydraulic engineering;
10. have acquired sufficient skills in using information and communication technology for conducting studies and analyses, in addition to presentation and communication;
11. have adopted the academic attitude and learning skills to enhance and broaden the acquired knowledge and applications in an independent manner.

4.2 Coastal Engineering and Port Development

After successful completion of the programme graduates will be able to:

1. have advanced level of understanding of the hydraulics, coastal processes and nautical and logistic aspects and their interactions with the nearshore and offshore structure;
2. apply sophisticated design techniques using theoretical concepts of coastal hydraulics and various principles and approaches of coastal engineering design to advance the needs of society for shelter, infrastructure and a safe environment and be able to evaluate and implement the solutions in a multidisciplinary and interdisciplinary environment;
3. develop strategies to cope effectively with problems related to natural hazards (e.g. coastal floods) and shoreline erosion problems and understand the conflict between coastal developments and natural coastal processes;
4. apply hydraulic and nautical, logistic and economic theories in the planning and design of coastal and ports layout and port logistics;
5. develop an understanding of the application of modern analysis and design techniques to coastal problems and gain the expertise necessary to make effective engineering interventions in the coastal environment;
6. be equipped with various analytical and computational expertise necessary to solve problems in coastal and port engineering;
7. have the skills to undertake academic research that contributes to the better understanding of coastal and/or port engineering;
8. have developed the skills to undertake independent creative academic activities and research and the ability to extend them leading to new knowledge that addresses problems of national and international importance;
9. place a coastal engineering and/or port project in its environment (social, ecological and physical environment), be able to quantify and understand the interactions between the project and the environment, and is able to communicate the interactions with experts of a different background;
10. have developed the talents and skills for problem formulation and solutions synthesizing different fields of knowledge to formulate solutions to relevant technical problems using modern engineering tools;
11. have experienced different aspects of learning which are integrated through different teaching methods and through independent study experiences;
12. possess critical thinking skills, the ability of both independent and team problem-solving and the sense of engineering creativity and design;
13. have acquired sufficient skills in using information and communication technology for conducting research, studies and analyses, in addition to presentation and communication;
14. develop a sense of professionalism and an appreciation for the obligations of a professional engineer;
15. be aware of the professional and ethical issues encountered in engineering practice.

4.3 Hydroinformatics– Modelling and Information Systems for Water Management

After successful completion of the programme graduates will be able to:

1. have in-depth understanding of the information cycle in relation to the management of water based systems, and have a thorough awareness of the flow of information from data acquisition to modelling, to support for decision making;
2. have a critical understanding of the theories and concepts of physical, chemical and biological processes relating to the flow of water in the natural environment, including river basins, coastal waters and urban water systems, as necessary to generate safe and reliable models for water based systems;
3. master the theory and practice of different modelling paradigms, and, in particular, physically based and data driven modelling, and be able to integrate them in hydroinformatics systems applied to a wide variety of hydraulic, hydrological and environmental situations;
4. have an understanding of advanced and appropriate information and communication technologies and their application to manage information relating to water management;
5. to select and apply software tools available on the market, and critically assess their advantages and disadvantages in application to water resources management, hazard risk assessment and forecasting, environmental planning and asset management;
6. have a good knowledge of the relevant literature and the contemporary research questions in the field of Hydroinformatics;
7. make critical use of advanced theories and concepts in Hydroinformatics to research creative solutions for new problems and situations, either independently or within a team;
8. critically judge and evaluate their own work and results, as well as prior research or investigations carried out by others;
9. provide considered advice to managers and users of advanced Hydroinformatics tools;
10. appreciate and discuss the ethics and nature of the postmodern society and the role of water within it as a "right" and an "asset";
11. develop a range of personal and communication skills, including the use of appropriate information and communication technologies, for oral and written presentation of methodologies, results, evaluations, conclusions and recommendations to a wide variety of audiences;
12. be aware of the importance of the relationship of Hydroinformatics with related disciplines such as hydraulics, hydrology, ecology and information science, and be able to co-operate within a multidisciplinary and interdisciplinary framework;
13. have adopted the academic attitude and learning skills to enhance and broaden the acquired knowledge and application skills in a largely independent manner;
14. be aware of the professional and ethical issues encountered in Hydroinformatics practice directed towards issues facing developing countries and countries in transition.

4.4 Hydrology and Water Resources

After successful completion of the programme graduates will be able to:

1. have in-depth understanding of the current theories and concepts in both surface and subsurface hydrology, the relevant physical, chemical and biological process interactions between the hydrosphere, the lithosphere, the biosphere and the atmosphere, and have a thorough awareness of the natural and human-induced variability in space and time of hydrological systems;
2. apply and integrate the relevant physical, chemical, applied mathematical, computational and earth-scientific principles and concepts, and to use information and communication technology within a hydrological context;
3. master the major hydrological methodologies and applications with regard to both water quantity and water quality, including techniques for data collection, processing and analysis, and the application of catchment hydrological modelling and aquifer modelling techniques;
4. evaluate and analyse hydrological systems and processes at a wide range of scales in both space and time for the purpose of water resources assessment, natural hazards assessment and mitigation, and environmental planning and management;
5. have a good knowledge of the relevant literature and the contemporary research questions in the field of hydrology;
6. design and conduct hydrological research and experiments for both application and scientific purposes, either independently or within a team-based framework;
7. critically judge and evaluate their own work and results, as well as prior research or investigations carried out by others;
8. adequately communicate methodologies, results, evaluations, conclusions and recommendations in oral, written and graphical form to a wide variety of audience;
9. be aware of the importance of hydrology to society, the relationship of hydrology with related disciplines such as ecology, meteorology and climatology, and be able to co-operate within a multidisciplinary and interdisciplinary framework with due consideration of ethical and social aspects related to the application of their knowledge and skills; and
10. have adopted the academic attitude and learning skills to enhance and broaden the acquired knowledge and application skills in a largely independent manner.

4.5 Land and Water Development

After successful completion of the programme graduates will be able to:

1. have in-depth understanding and specific knowledge of:
 - a. the latest concepts and theories of irrigation, drainage, flood protection, land reclamation and consolidation technologies for sustainable development;
 - b. the cross-sectoral linkages comprehending wider aspects of society, economy and the environment;
2. use latest hydraulic engineering and hydrological methods to apply in planning, design and implementation of irrigation, drainage and flood protection schemes, independently or in a multidisciplinary team;

3. identify and cross-evaluate alternative land and water development options for areas under different land uses and assess their technical, economic, institutional and environmental feasibility;
4. engage in or advise developers, system managers and water users on the participatory development and management, as well as modernisation of irrigation, drainage and flood protection schemes for their planning, design, implementation, operation and maintenance, financing and performance assessment;
5. acquire knowledge and understanding of contemporary research issues in the field of land and water development;
6. formulate research questions, articulate research methodologies, develop study plans, and adequately communicate research results and conclusions in written and oral forms to a wide variety of audience.

4.6 Integrated River, Lowland and Coastal Development and Management Planning (joint specialization with Sriwijaija University)

After successful completion of the programme graduates will be able to :

1. understand in-depth the current concepts and theories to support a sustainable hydraulic development of integrated river, lowland and coastal with different types of land use;
2. understand in-depth the multi-disciplinary involvement in the integrated river, lowland and coastal sector with the wider aspects of society, economy and the environment;
3. master the respective major different hydraulic and environmental engineering aspects and methodologies (depending on their chosen specialization);
4. contribute to the planning, design, development and implementation (action plan for the realisation) of the hydraulic infrastructure for integrated river, lowland and coastal development and management schemes. Depending on their chosen specialization it can be river, coastal or irrigation infrastructure;
5. List contemporary research questions and the relevant literature in the field of integrated river lowland and coastal development;
6. advise developers, system managers and water users on the operation and maintenance aspects of the water management and river or sea flood protection schemes in the lowland;
7. formulate and conduct hydraulic and environmental engineering research, plan development and designs in the field of integrated river lowland and coastal development, experiments and tests for both practical and scientific purposes, either independently or within a team-based framework;
8. critically judge and evaluate their own work and results, as well as the information of prior research or investigations, plans and design;
9. adequately communicate methodology, research results, plans, designs, evaluations, conclusions and recommendations in written, oral and graphical form to a wide variety of audience;
10. formulate and evaluate a concept with its alternatives for integrated river lowland and coastal development for areas with different type of land use and assess the technical and economic feasibility, as well as the environmental sustainability of the proposed development and/or management plans;
11. enhance and broaden the acquired knowledge and application skills in a largely independent manner.

4.7 Learning objectives Agricultural Water Management for Enhanced Land and Water Productivity (joint specialisation with AIT)

After successful completion of the programme graduates will be able to:

1. have in-depth understanding and specific knowledge of:
 - the latest concepts and theories of irrigation, drainage, flood management, land reclamation and consolidation technologies for increased returns from land and water resources in a sustainable manner;
 - the cross-sectoral linkages between land and water development and wider aspects of society, economy and the environment;
2. use latest hydraulic engineering and hydrological methods to apply in planning, design, implementation and management of irrigation, drainage and flood protection schemes, independently or in a multidisciplinary team;
3. identify and cross-evaluate alternative land and water development options for areas under different land uses and assess their technical, economical, institutional and environmental feasibility;
4. engage in or advise the developers, system managers and water users on the participatory development, management and modernisation, including planning, design, implementation, operation and maintenance, as well as on modernisation of the irrigation, drainage and flood management schemes;
5. acquire knowledge and understanding of contemporary research issues in the fields of land and water development and agricultural water management;
6. formulate and conduct hydraulic and agronomic research, plan development and designs in the field of enhanced land and water productivity, experiments and tests for both practical and scientific purposes, either independently or within a team-based framework;
7. formulate research questions, articulate research methodologies, develop study plans, and adequately communicate research results and conclusions in written and oral forms to a wide variety of audience;
8. develop the academic attitude and learning skills to enhance and broaden the acquired knowledge and application skills in a largely independent manner.

4.8 Learning objectives of the Advanced Water Management for Food Production Program specialization, (joint specialisation with Nebraska)

After successful completion of the programme graduates will be able to:

1. understand in-depth the latest concepts and theories of irrigation, drainage, flood protection, land reclamation and consolidation technologies for food production;
2. describe the cross-sectoral linkages comprehending wider aspects of society, economy and the environment;
3. use latest hydraulic engineering and hydrological methods to apply in planning, design and implementation of irrigation, drainage and flood protection schemes, independently or in a multidisciplinary team;

4. identify and cross-evaluate alternative land and water development options for areas under different land uses and assess their feasibility; technologically, economically, and environmentally;
5. engage in or advise developers, system managers and water users on the participatory development and management, including operation and maintenance of the irrigation, drainage and flood protection schemes;
6. identify and develop available water resources for food production;
7. enhance the of on-farm irrigation systems through better design and management;
8. understand and formulate water management methodologies to enhance crop production with limited water supplies;
9. acquire knowledge and understanding of contemporary research issues in the field of land and water development and water for food;
10. formulate research questions, articulate research methodologies, develop study plans, and adequately communicate research results and conclusions in written and oral forms to a wide variety of audience.

4.10 Flood Risk management

After successful completion of the programme graduates will have:

1. a broad and cross-boundary scientific knowledge on flood risk management;
2. a comprehensive knowledge base and understanding of the current theory and practice relating to flooding and flood management;
3. the fundamental knowledge leading to the understanding of socio-economic issue related to flooding;
4. a broad scientific knowledge about conservation, restoration and management measures to overcome challenges imposed on water by humans and by climate change, and;
5. an extended knowledge on a basin-wide approach to flood risk management.

The acquired competencies (application of knowledge) include the ability to:

1. analyse the reciprocal relationships between the physical system, the institutional framework and the socio-economic environment, identifying future social and climatic pressures and needs and the consequent trends in system management;
2. apply specific practical skills, such as identifying the major physical processes in a given river basin or coastal zone and their interaction with the associated assets and receptors;
3. identify the links between all issues related to flooding in order to apply an integrated approach using the best tools to support decision making for the sustainable management of floods;
4. review scientific literature and carry out independent research (such as writing a state of the art paper based on research and practice literature);
5. apply sophisticated hydroinformatics and modelling tools and best practices to address the problems of flood risk management;
6. occupy an independent and responsible position as a flood risk professional;
7. communicate his/her knowledge and research results to the scientific and non-scientific communities (such as presenting papers/posters to scientific congresses, general lectures to policy makers and interested non-specialists);

8. acquire independently further knowledge and techniques, and
9. operate in a team.

4.11 Groundwater and Global Change - Impacts and Adaptation

After successful completion of the programme graduates will be able to:

1. explain in detail how groundwater systems function;
2. describe the interactions between groundwater systems, climate, surface waters and land use;
3. use modelling tools for climate and groundwater systems;
4. identify the consequences of global and climate change impacts for groundwater management under uncertainty;
5. plan groundwater-related adaptation solutions for global change.

Appendix B Examination Procedures

GENERAL RULES

Students taking part in an examination are expected to have taken notice of these procedures and are expected to understand the implied meaning of these procedures.

WRITTEN EXAMINATIONS

PROCESS:

1. the student brings his student card and displays it on his table;
2. the invigilator verifies the card and confirms attendance by the student by ticking the box of the student on the attendance list;
3. students hand in their exam papers at the end of the session; this is their own responsibility;
4. invigilators bring the exam papers to Planning Office (immediately after the exam);
5. Planning Officers verify which exam papers have been received and record this on a list;
6. the list produced by the Planning Officers serves as the evidence that the exam papers have been handed in;
 - a. if exam papers get lost and they have been recorded on the list of Planning Office, UNESCO-IHE has the responsibility to propose an adequate alternative assessment to the student.
 - b. if a student claims that an exam paper got lost and the exam paper is not recorded on the list of Planning Office, then the Institute considers the exam paper not to have been handed in by the student. There will be no alternative assessment proposed.

Invigilators: The invigilators (examination supervisors) ensure proper conduct of the examination and maintain order in the examination room. They will announce the beginning and the duration of the examination, and will warn the students 10 minutes before the ending of the examination.

Communication: During the examination, students are not allowed to exchange materials or to communicate with other students. If something is unclear, students have to inform the invigilator, who will contact the programme coordinator, the examiner or planning officer if necessary.

Attendance list: Students are considered to have taken part in an examination from the moment they receive the examination papers from the invigilators, whether or not they submit any answers.

Bags: Bags and carrying cases, including penholders, are to be placed along the side of the room before the start of the examination.

Exam paper: Answer and scratch paper will be provided to the students. Students provide the answers in clearly readable English, with proper indication of the question label. All answer papers must carry the student number and locker number of the student. Unreadable answers or unidentified answer papers may be discarded for assessment by the examiner.

Pen: Students are required to bring the necessary writing and drawing tools. The answer papers to be submitted must be written with a pen, a pencil is not allowed.

Dictionary: The use of a printed language dictionary without any additional written annotations is allowed (all languages are allowed). Invigilators are allowed to check the dictionaries for hand-written annotations during the exam (spot checks while they are walking around). Electronic dictionaries are not allowed.

Calculators: Only self contained calculators with a single-line display or dual-line display are allowed, provided that these devices are battery operated, that any audio functions are switched off, and that these devices are exclusively built for calculation purposes only and do not have internet access.

Cell phones: Use of cell phones is not allowed and must be switched off

Other materials: The use of materials other than listed above, including blank paper, texts, laptops, computing and communication devices, personal audio and video devices, of any kind, is not allowed.

Examiners may nevertheless allow students to use specified text matter or other effects in a so-called 'open book' examination. These materials shall not include previous or example examinations and solutions.

Toilet visit: Only one student at a time will be allowed by the invigilator to leave the examination room for a short visit to the lavatory, except during the first 15 and the last 15 minutes of the examination. Examination materials and requirements may not be taken outside the examination room. Before leaving the examination room, students have to hand over their cell phone to the invigilator.

Submission of exam papers: Students who finish the examination at least 15 minutes after the start and at least 15 minutes before the ending of the examination are allowed to submit their work to the invigilator and quietly leave the examination room.

Students have to ensure that all required papers are submitted to the invigilator. Papers cannot be submitted after the student has left the examination room.

ASSIGNMENT REPORTS AND INDIVIDUAL DISCUSSIONS

For designated subjects students have to submit an assignment report, which will be assessed as part of the subject examination. The examiner may discuss the assignment report with the student as part of the assessment.

The examiner will set a deadline for submitting assignment reports. The deadline cannot be set at a date after the examination period for the subject, as indicated in the academic calendar. Students submit assignments to either the lecturer or the responsible coordinator.

Appendix C - GRADING SYSTEMS used by partner institutes

1. Kwame Nkrumah University of Science & Technology (KNUST)

Grading scale of 0 to 100%, where 50% or higher implies a pass.

The minimum grade needed to have a postgraduate degree conferred upon an individual is a CWA of 55%.

CWA (Cumulative Weighted Average) = $\frac{\text{sum [credits x mark]}}{\text{sum of all credits}}$

Example:

Module	Credit	Mark obtained	Total Module mark
A	3	60	180
B	2	70	140
C	1	65	65
Total Credit of Student A	6		
Cumulative Mark			385

CWA= Cumulative Mark/Total Credit = $385/6 = 64.17$

2. Asian Institute of Technology

Grade	Grade Points	Description
A	4	Excellent
B+	3.5	
B	3	Good
C+	2.5	
C	2	Fair
D	1	Deficient
F	0	Fail
I		Incomplete

3. Universidad del Valle

0.0	Given when absent from the exam without valid reason, when blank exam is submitted, or when caught cheating.
1.0 - 2.9	Non-pass, resit needed
3.0	Acceptable
4.0	Good
5.0	Excellent

Degree is awarded when

- GPA for the taught part is 3.5 or higher, and
- a pass is obtained for the thesis. (pass / non-pass)

4. Sriwijaija University

Same system as used at UNESCO-IHE

5. Egerton University

70% and above	A (Excellent)
60-69%	B (Good)
50-59%	C (Average)...
0-49%	F (Fail)

Grading systems approved by the University Senate, with 50% as the pass mark.

6. BOKU

is using the Austrian grading system, which is a five step grading system ranging from (1,very good to 5, not sufficient). Grade 1 to 4 indicate a successful result.

The following grading scale is used:

Austrian grade	ECTS grade	Verbal
1 (sehr gut)	A/B	excellent/very good
2 (gut)	C	good
3 (befriedigend)	D	satisfactory
4 (genügend)	E	pass

6. Gent, Prague

ECTS		Gent University	UNESCO-IHE*		ICTP
A++ (exceptional only 1%)		19 or 20	10		100
A (top 5%)		18	9.2		90-100 A
A (top 10%)		17	8.8		
B (top 20%)		16	8.4		80-89 B
B (top 35%)		15	8		
C (top 50%)		14	7.6		70-79 C
C (top 65%)		13	7.2		
D (top 80%)		12	6.8		60-69 D
E (top 90%)		11	6.4		50-59 E
E (just pass)		10	6		
F (fail)		9	5.4		0-49 F
		8	4.8		
		7	4.2		
		6	3.6		
		5	3		

			4		2.4			
			3		1.8			
			2		1.2			
			1		0.6			
			0		0			

* UNESCO-IHE marks in the table were calculated from interpolation, with a score of 10 at Gent University equal to a 6.0 at UNESCO-IHE, a 20 at Gent University equal to a 10 at UNESCO-IHE and a 0 at Gent University equal to a 0 at UNESCO-IHE.

7. TU Dresden:

A = 1 "very good"

B = 2 "good"

C = 3 "satisfactory"

D = 4 "sufficient"

E = 5 "insufficient"

All courses have to be lower than 4 for a degree.

8. University of Ljubljana

10 excellent: outstanding results with negligible mistakes,

9 very good: high pass with minor mistakes,

8 very good: sound knowledge,

7 good: sound knowledge with major mistakes,

6 satisfactory: adequate knowledge suiting minimum criteria,

5 - 1 insufficient: failure, poor knowledge below minimum criteria.

Candidates with grades satisfactory (6) or more, have passed the examinations successfully.

The student has two grades per subject: separately theory and lab exercise (seminar work).

For thesis there are also two grade: written report and presentation, both should be more than

6. Finally we have one grade for thesis and common final grade of study (special formula).

9 TU-Catalonia

Scale from 0-10

MH Honors (is given on exceptional cases)

9.0 - 10.0 excellent

7.0 - 8.9 very good

5.0 - 6.9 satisfactory

4.0 - 4.9 marginal fail

0.0 - 3.9 fail

NP not examined

R recognition

10 University of Lisbon

A (excellent) 20-18

B (very good, with few errors) 17-16

C (good, with some errors) 15-14

D (satisfactory, with many errors) 13-12

E (sufficient) 11-10

11. University of Peace

Grades on a scale of 0-100, 70 being a passing grade, and 80 being the minimum grade for thesis or internship (final graduation work).

12 University of Oregon

The requirements for awarding a degree are the successful completion of 45 graduate level credits that meet the requirements of the program with no more than 9 credits as “blanket” credits in seminar or reading and conference classes, at least 6 credits of project or thesis. At least half of the credits must be in graduate stand-alone coursework. Up to 15 credits can be transferred into the program.

Appendix D MSc modules: names, credits & assessment methods

1. Urban Water and Sanitation programme

Water supply engineering

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)
UWS/01	Hydrology, Water supply and water demand management and G	5	75		25			
UWS/02	Chemistry and public health	5	65		35			
UWS/03	EPT, Microbiology and Integrated Urban Water	5	70		30			
UWS/WSE/04	Surface water treatment I	5	60		20		20	
UWS/WSE/05	Surface water treatment II	5	70		10		20	
UWS/WSE/06	Groundwater treatment and resources	5	70		15		15	
UWS/WSE/UWEM/07	Water transport and distribution	5	60		40			
UWS/WSE/08	Advanced water treatment and reuse	5	70		20		10	
UWS/09	International fieldtrip and fieldwork	5			100			
UWS/SE/UWEM/10	Industrial effluents treatment and residuals	5	60		25			15
WSE/HI/10b/e	Urban water systems	5	40		60			
UWS/WSE/UWEM/10	Water treatment processes and plants	5		60	40			
UWS/SE/11	Faecal sludge management	5	85		15			
UWS/WSE/11a	Advanced water transport and distribution	5	60		40			
UWS/WSE/11b	Decentralised water supply and sanitation	5	60		30	10		
UWS/12	Summer courses	1						
UWS/13	Groupwork Sint Maarten	5			80	20		
UWS/14	MSc research methodology and proposal development	9		100				
UWS/15	MSc thesis research and thesis writing	36		100				

Sanitary engineering

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)
UWS/01	Hydrology, Water supply and water demand management and G	5	75		25			
UWS/02	Chemistry and public health	5	65		35			
UWS/03	EPT, Microbiology and Integrated Urban Water	5	70		30			
UWS/SE/UWEM/04	Urban drainage and sewerage	5	60		40			
UWS/SE/05	Conventional wastewater treatment	5	80		20			
UWS/SE/06	Resource oriented wastewater treatment and sanitation	5	80		20			
UWS/SE/07	Wastewater treatment plants design and engineering	5	50	25	25			
UWS/SE/08	Modelling of wastewater treatment processes and plants	5	60		40			
UWS/09	International fieldtrip and fieldwork	5			100			
UWS/SE/UWEM/10	Industrial effluents treatment and residuals	5	60		25			15
WSE/HI/10b/e	Urban water systems	5	40		60			
UWS/WSE/UWEM/10	Water treatment processes and plants	5		60	40			
UWS/SE/11	Faecal sludge management	5	85		15			
UWS/WSE/11a	Advanced water transport and distribution	5	60		40			
UWS/WSE/11b	Decentralised water supply and sanitation	5	60		30	10		
UWS/12	Summer courses	1						
UWS/13	Groupwork Sint Maarten	5			80	20		
UWS/14	MSc research methodology and proposal development	9		100				
UWS/15	MSc thesis research and thesis writing	36		100				

The programme components, credits, and the nature of the examinations in the specialisation **Water Supply Engineering and Sanitary Engineering with KNUST** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)
KNUST	KN1	Module (KN) 1 Introduction to Environmental Sanitation	5	70		30			
	KN2	Module (KN) 2 Mathematical and research methods	4	70		30			
	KN3	Module (KN) 3 Environmental science and process technology	6	70		30			
	KN4	Module (KN) 4 Environmental quality	3	70		30			
	KN5	Module (KN) 5 water supply	2	70		30			
U-IHE	UWS/SE/06	Resource oriented wastewater treatment and sanitation	5	80		20			
	UWS/SE/07	Wastewater treatment plants design and engineering	5	50	25	25			
	UWS/SE/08	Modelling of wastewater treatment processes and plants	5	60		40			
		OR							
	UWS/WSE/06	Groundwater treatment and resources	5	70		15		15	
	UWS/WSE/UWEM/07	Water transport and distribution	5	60		40			
	UWS/WSE/08	Advanced water treatment and reuse	5	70		20		10	
	UWS/09	International fieldtrip and fieldwork	5			100			
	UWS/SE/UWEM/10	Industrial effluents treatment and residuals	5	60		25			15
	WSE/Hi/10b/e	Urban water systems	5	40		60			
	UWS/WSE/UWEM/10	Water treatment processes and plants	5		60	40			
	UWS/SE/11	Faecal sludge management	5	85		15			
	UWS/WSE/11a	Advanced water transport and distribution	5	60		40			
	UWS/WSE/11b	Decentralised water supply and sanitation	5	60		30	10		
UWS/12	Summer courses	1							
UWS/13	Groupwork Sint Maarten	5			80	20			
	UWS/14	MSc research methodology and proposal development	9		100				
U-IHE / K	UWS/15	MSc thesis research and thesis writing	36		100				

The programme components, credits, and the nature of the examinations in the specialisation **Sanitary and Environmental Engineering with Univalle** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)
Univalle	C1	C1 Chemistry of Environmental Pollution	5.13	50		20		30	
	C2	C2 Environmental Pollution Microbiology	5.13	x		x	x	x	
	C3	C3 Fundamentals of Environmental Processes	5.13	60		20		20	20
	C4	C4 Environmental and Development	5.13	35		30	35		
	C5	C5 Engineering Research Introduction	3.42			100		20	
U-IHE	UWS/WSE/04	Surface water treatment I	5	60		20		20	
	UWS/WSE/05	Surface water treatment II	5	70		10		20	
	UWS/WSE/06	Groundwater treatment and resources	5	70		15		15	
	UWS/WSE/UWEM/07	Water transport and distribution	5	60		40			
	UWS/WSE/08	Advanced water treatment and reuse	5	70		20		10	
	UWS/SE/UWEM/04	Urban drainage and sewerage	5	60		40			
	UWS/SE/05	Conventional wastewater treatment	5	80		20			
	UWS/SE/06	Resource oriented wastewater treatment and sanitation	5	80		20			
	UWS/SE/07	Wastewater treatment plants design and engineering	5	50	25	25			
	UWS/SE/08	Modelling of wastewater treatment processes and plants	5	60		40			
	UWS/09	International fieldtrip and fieldwork	5			100			
	UWS/SE/UWEM/10	Industrial effluents treatment and residuals	5	60		25			15
	WSE/Hi/10b/e	Urban water systems	5	40		60			
UWS/WSE/UWEM/10	Water treatment processes and plants	5		60	40				
UWS/SE/11	Faecal sludge management	5	85		15				
UWS/WSE/11a	Advanced water transport and distribution	5	60		40				
UWS/WSE/11b	Decentralised water supply and sanitation	5	60		30	10			
UWS/12	Summer courses	1							
UWS/13	Groupwork Sint Maarten	5			80	20			
Univalle	C9	Engineering research I (4 UVC)	6.84						
	C10	Engineering Research II (8 UVC)	13.68						
		MSc thesis (14 UVC)	23.94						

The programme components, credits, and the nature of the examinations in the specialisation **Urban Water Engineering and Management with AIT** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	
AIT		Watershed hydrology	3 (7.5)	x		x				
		Drinking water treatment	3 (7.5)	x						
		Wastewater treatment	3 (7.5)	x		x				
		Integrated water resources management	3 (7.5)	x		x				
U-IHE	UWS/SE/UWEM/04	Urban drainage and sewerage	2 (5.0)	60		40				
	UWS/UWEM/05	Asset management	2 (5.0)		60	40				
	WSM/06	Managing water organisations	2 (5.0)		60	40				
	UWS/WSE/UWEM/07	Water transport and distribution	2 (5.0)	60		40				
	WSE/Hi/08B/E	Urban flood management and disaster risk mitigation	2 (5.0)	40		60				
	UWS/09	International fieldtrip and fieldwork	2 (5.0)			100				
	UWS/SE/UWEM/10	Industrial effluents treatment and residuals	2 (5.0)	60		25			15	
	WSE/Hi/10b/e	Urban water systems	2 (5.0)	40		60				
	UWS/WSE/UWEM/10	Water treatment processes and plants	2 (5.0)		60	40				
			Total coursework	26 (65)						
		UWS/UWEM/11	MSc thesis proposal preparation	2.8 (7.0)			x	x		
AIT		MSc thesis work	19.2 (48)			x	x			
		Grand total (coursework + thesis)	48 (120)							

2. Environmental Science programme

Environmental Science and Technology

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
ES0123	Week 1 + Introduction to environmental science	15	70		30				
ES04	Integrated project environmental science	5			70	30			
ES05T	Industrial Resource Management & Cleaner Production	5	60		35	5			
ES06TM	Environmental systems analysis	5	40		40	20			
ES07T	Environmental engineering	5	75		25				
ES08T	Environmental monitoring and modelling	5	70		15		15		
ES09TMW	Foreign fieldtrip and fieldwork ES	5			50	50			
ES10TWL	Aquatic ecosystems: processes and applications	5			90	10			
	Electives:								
ES11T	Solid waste management	5	60		35	5			
ES11MW	Watershed and river basin management	5	70		30				
ES11X	IWRM as a tool for adaptation to climate change	5	70		30				
ES11L	Wetlands for livelihoods and conservation	5	40		40	20			
ES12	Summer courses	1			100				
ES13TMW	Groupwork ES	5			100				
ES14	MSc research methodology and proposal development	9			100				
ES15	MSc research	36			100				

Environmental Policy Making

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
ES0123	Week 1 + Introduction to environmental science	15	70		30				
ES04	Integrated project environmental science	5			70	30			
WM05	Water and environmental law	5	60		40				
ES06TM	Environmental systems analysis	5	40		40	20			
ES07M	Water and environmental policy making	5	70		30				
ES08MW	Environmental planning and implementation	5	55		45				
ES09TMW	Foreign fieldtrip and fieldwork ES	5			50	50			
ES10M	Environmental assessment for water related policies and develop	5	70		30				
	Electives:								
ES11T	Solid waste management	5	60		35	5			
ES11MW	MW: Watershed and river basin management	5	70		30				
ES11X	IWRM as a tool for adaptation to climate change	5	70		30				
ES11LM	Wetlands for livelihoods and conservation	5	40		40	20			
ES12	Summer courses	1			100				
ES13TMW	Groupwork ES	5			100				
ES14	MSc research methodology and proposal development	9			100				
ES15	MSc research	36			100				

Water Quality Management

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
ES0123	Week 1 + Introduction to environmental science	15	70		30				
ES04	Integrated project environmental science	5			70	30			
WM05	Water and environmental law	5	70		30				
ES06W	Water quality assessment	5	60		30		10		
ES07W	Constructed wetlands for wastewater treatment	5	60		40				
ES08MW	Environmental planning and implementation	5	55		45				
ES09TMW	Foreign fieldtrip and fieldwork ES	5			50	50			
ES10TWL	Aquatic ecosystems: processes and applications	5			90	10			
	Electives:								
ES11T	Solid waste management	5	60		35	5			
ES11MW	Watershed and river basin management	5	70		30				
ES11X	IWRM as a tool for adaptation to climate change	5	70		30				
ES11L	Wetlands for livelihoods and conservation	5	40		40	20			
ES12	Summer courses	1			100				
ES13TMW	Groupwork ES	5			100				
ES14	MSc research methodology and proposal development	9			100				
ES15	MSc research	36			100				

The programme components, credits, and the nature of the examinations in the specialisation **Environmental Science and Technology with Univalle** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)	
Univalle	C1	C1 Chemistry of Environmental Pollution	5.13	50		20		30			
	C2	C2 Environmental Pollution Microbiology	5.13	x		x	x	x			
	C3	C3 Fundamentals of Environmental Processes	5.13	60		20		20	20		
	C4	C4 Environmental and Development	5.13	35		30	35				
	C5	C5 Engineering Research Introduction	3.42			100		20			
U-IHE	ES04	Integrated project environmental science	5			70	30				
	ES05T	Industrial Resource Management & Cleaner Production	5	60		35	5				
	ES06TM	Environmental systems analysis	5	40		40	20				
	ES07T	Environmental engineering	5	75		25					
	ES08T	Environmental monitoring and modelling	5	70		15		15			
	ES09TMW	Foreign fieldtrip and fieldwork ES	5			50	50				
	ES10TWL	Aquatic ecosystems: processes and applications	5			90	10				
		Electives:									
	ES11T	Solid waste management	5	60		35	5				
	ES11MW	Watershed and river basin management	5	70		30					
	ES11X	IWRM as a tool for adaptation to climate change	5	70		30					
	ES11L	Wetlands for livelihoods and conservation	5	40		40	20				
	ES12	Summer courses	5			100					
ES13TMW	Groupwork ES	5			100						
Univalle		MSc thesis (14 UVC)	23.94								
			Total ECTS	113.5							

The programme components, credits, and the nature of the examinations in the specialisation **Environmental Technology for Sustainable Development with AIT** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
AIT		Environmental chemistry and laboratory	3 (7.5)	x		x				
		Environmental quality management	3 (7.5)	x		x				
		Any two course out of:								
		- Air pollution and management	6 (15.0)	x		x				
		- Solid waste management								
		- Environmental impact assessment								
		- Industrial waste abatement and management								
U-IHE	ES05T	Industrial Resource Management & Cleaner Production	2 (5.0)	60		35	5			
	ES06TM	Environmental systems analysis	2 (5.0)	40		40	20			
	ES07W	Constructed wetlands for wastewater treatment	2 (5.0)	60		40				
	ES08T	Environmental monitoring and modelling	2 (5.0)	70		15		15		
	ES09TMW	Foreign fieldtrip and fieldwork ES	5			50	50			
	ES10TWL	Aquatic ecosystems: processes and applications	2 (5.0)			90	10			
	ES11ETSuD	MSc research proposal development	2.8 (7.0)				100			
	ES12	Summer courses	2 (5.0)			100				
		Total coursework	26 (65)							
AIT		Elective	2 (5.0)	x		x				
		MSc thesis proposal preparation	2.8 (7.0)			x	x			
		MSc thesis work	19.2 (48)			x	x			
		Grand total (coursework + thesis)	50 (125)							

3. Water Science and Engineering programme

River Basin Development

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
WSE/02/c	Hydrology and hydraulics	5	80		20				
WSE/RBD/03/s	River basin hydraulics, geotechnics and remote sensing	5	75		25				
WSE/RBD/04/s	River morphodynamics	5	80		20				
WSE/RBD/05s	Data collection and analysis	5	70		30				
WSE/RBD/06/s	River Basin Development and EIA	5	50		50				
WSE/RBD/07/s	River structures	5	100						
WSE/RBD/08A/e	Planning and delivery of flood resilience	5		50		50			
WSE/09/c	Fieldtrip and fieldwork WSE	5						100	
WSE/RBD/10/e	Dams and hydropower	5	45+45		10				
WSE/11	Water sensitive cities	5		50		50			
WSE/HI/11/e	Hydroinformatics for decision support	5			100				
WSE/HERBD/11/e	Modelling and operation of river systems	5	60		40				
WSE/HECEPD/11/e	Flood protection in lowland areas	5	20	40	40				
WSE/LWDFS/11/e	Remote sensing, GIS and modelling for agricultural water use	5	15		75				
ES/11MW	Watershed and river basin management	5	70		30				
WSE/12/C	Summer courses / research methodology for WSE	1			100				
WSE/13/c	Groupwork WSE	5				100			
WSE/14/c	MSc research proposal development for WSE	9			100				
WSE/15	MSc research	36			100				

Coastal Engineering and Port Development

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
WSE/02/c	Hydrology and hydraulics	5	80		20				
WSE/CEPD/03/s	Introduction to coastal science and engineering	5	90		10				
WSE/CEPD/04s	Port planning and infrastructure design	5			100				
WSE/CEPD/05/s	Coastal systems	5	70		30				
WSE/CEPD/06/s	Coastal and port structures	5			100				
WSE/CEPD/07/s	Environmental aspects of coasts and ports	5	60		40				
WSE/CEPD/08A/e	Management of coasts and ports (International Port Seminar)	5				100			
WSE/CEPD/08B/e	Management of coasts and ports (ICZM)	5		100					
WSE/09/c	Fieldtrip and fieldwork WSE	5						100	
WSE/CEPD/10/e	Geotechnical engineering and dredging	5		60	40				
WSE/11	Water sensitive cities	5		50		50			
WSE/HI/11/e	Hydroinformatics for decision support	5			100				
WSE/HERBD/11/e	Modelling and operation of river systems	5	60		40				
WSE/HECEPD/11/e	Flood protection in lowland areas	5	20	40	40				
WSE/LWDFS/11/e	Remote sensing, GIS and modelling for agricultural water use	5	15		75				
ES/11MW	Watershed and river basin management	5	70		30				
WSE/12/C	Summer courses / research methodology for WSE	1			100				
WSE/13/c	Groupwork WSE	5				100			
WSE/14/c	MSc research proposal development for WSE	9			100				
WSE/15	MSc research	36			100				

Land and Water Development

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
WSE/02/c	Hydrology and hydraulics	5	80		20				
WSE/LWDFS/03/s	Principles and practices of land and water development	5	15		85				
WSE/LWDFS/04/s	Design aspects of irrigation and drainage systems	5	30		70				
WSE/LWDFS/05s	Tertiary unit design and hydraulics	5	40		60				
WSE/LWDFS/06/s	Socio-economic and environmental aspects of irrigation and drainage	5	30		70				
WSE/LWDFS/07/s	Conveyance and irrigation structures	5	35		65				
WSE/LWDFS/08/e	Management of irrigation and drainage systems	5	40		60				
WSE/09/c	Fieldtrip and fieldwork WSE	5						100	
WSE/LWDFS/10/e	Innovative water systems for agriculture	5	30		70				
WSE/11	Water sensitive cities	5		50		50			
WSE/Hi/11/e	Hydroinformatics for decision support	5			100				
WSE/HERBD/11/e	Modelling and operation of river systems	5	60		40				
WSE/HECEPD/11/e	Flood protection in lowland areas	5	20	40	40				
WSE/LWDFS/11/e	Remote sensing, GIS and modelling for agricultural water use	5	15		75				
ES/11MW	Watershed and river basin management	5	70		30				
WSE/12/C	Summer courses / research methodology for WSE	1			100				
WSE/13/c	Groupwork WSE	5				100			
WSE/14/c	MSc research proposal development for WSE	9			100				
WSE/15	MSc research	36			100				

Hydroinformatics

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
WSE/02/c	Hydrology and hydraulics	5	80		20				
WSE/Hi/03/s	Information technology and software engineering	5	50		50				
WSE/Hi/04/s	Modelling theory and Computational Hydraulics	5	55	25	20				
WSE/Hi/05s	Modelling and information systems development	5			100				
WSE/Hi/06/s	Computational Intelligence and Operational water management	5	55		45				
WSE/Hi/07/s	River basin modelling	5	100						
WSE/Hi/08A/e	River Flood Analysis and Modelling	5	50		50				
WSE/Hi/08B/e	Urban flood management and disaster risk mitigation	5	40		60				
WSE/09/c	Fieldtrip and fieldwork WSE	5						100	
WSE/Hi/10A/e	Flood risk management	5	30		70				
WSE/Hi/10B/e	Urban water systems	5	40		60				
WSE/11	Water sensitive cities	5		50		50			
WSE/Hi/11/e	Hydroinformatics for decision support	5			100				
WSE/HERBD/11/e	Modelling and operation of river systems	5	60		40				
WSE/HECEPD/11/e	Flood protection in lowland areas	5	20	40	40				
WSE/LWDFS/11/e	Remote sensing, GIS and modelling for agricultural water use	5	15		75				
ES/11MW	Watershed and river basin management	5	70		30				
WSE/12/C	Summer courses / research methodology for WSE	1			100				
WSE/13/c	Groupwork WSE	5				100			
WSE/14/c	MSc research proposal development for WSE	9			100				
WSE/15	MSc research	36			100				

Hydrology and Water Resources

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
WSE/02/c	Hydrology and hydraulics	5	80		20				
WSE/HWR/03/s	Hydrogeology	5	70		30				
WSE/HWR/04/s	Surface hydrology	5	70		30				
WSE/HWR/05/s	Water quality	5	70		30				
WSE/HWR/06/s	Tracer hydrology and flow systems analysis	5	100						
WSE/HWR/07A/s	Hydrological data collection and processing	5	60				40		
WSE/HWR/07B/s	Groundwater data collection and interpretation	5	40		60				
WSE/HWR/08/e	Integrated hydrological and river modelling	5			85	15			
WSE/09/c	Fieldtrip and fieldwork WSE	5						100	
WSE/HWR/10B/e	Applied groundwater modelling	5			100				
WSE/11	Water sensitive cities	5		50		50			
WSE/HI/11/e	Hydroinformatics for decision support	5			100				
WSE/HERBD/11/e	Modelling and operation of river systems	5	60		40				
WSE/HECEPD/11/e	Flood protection in lowland areas	5	20	40	40				
WSE/LWDFS/11/e	Remote sensing, GIS and modelling for agricultural water use	5	15		75				
ES/11MW	Watershed and river basin management	5	70		30				
WSE/12/C	Summer courses / research methodology for WSE	1			100				
WSE/13/c	Groupwork WSE	5				100			
WSE/14/c	MSc research proposal development for WSE	9			100				
WSE/15	MSc research	36			100				

The programme components, credits, and the nature of the examinations in the specialisation **Land and Water Development with Asian Institute of Technology** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
AIT		Watershed Hydrology	7.5	30+40		30				
		Hydrodynamics	7.5	40+50		10				
		Irrigation and Drainage Engineering	7.5	30+40		30				
		Integrated Water Resources Management	7.5	20+30		50				
U-IHE	WSE/LWDFS/04/s	Design aspects of irrigation and drainage systems	5	30		70				
	WSE/LWDFS/05s	Tertiary unit design and hydraulics	5	40		60				
	WSE/LWDFS/06/s	Socio-economic and environmental aspects of irrigation and dra	5	30		70				
	WSE/LWDFS/07/s	Conveyance and irrigation structures	5	35		65				
	WSE/LWDFS/08/e	Management of irrigation and drainage systems	5	40		60				
	WSE/09/c	Fieldtrip and fieldwork WSE	5						100	
	WSE/LWDFS/10/e	Innovative water systems for agriculture	5	30		70				
	WSE/LWD/11/e	MSc research proposal development for WSE	5			40+60				
AIT		MSc research work								

The programme components, credits, and the nature of the examinations in the specialisation **Land and Water Development with Sriwijajja University** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
Sriwijajja	1	Ecostatistics (PL611)	3							
	2	Lowland environmental science (PL612)	2							
	3	Environmental values & ethics (PL613)	2							
	4	Environmental law (PL614)	2							
	5	Environmental sociology (PL615)	2							
	6	Resource economics (PL626)	2							
	7	Research methods (PL627)	2							
	8	Environmental management system (PL636)	2							
	9	Integrated aspects of lowland management	3							
	10	Managing, organization and change in lowland schemes	3							
	11	Lowland hydrology	2							
	12	Soil and water data collection, monitoring and evaluation	2							
U-IHE	WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
	WSE/02/c	Hydrology and hydraulics	5	80		20				
	WSE/LWDFS/03/s	Principles and practices of land and water development	5	15		85				
	WSE/LWDFS/04/s	Design aspects of irrigation and drainage systems	5	30		70				
	WSE/LWDFS/05/s	Tertiary unit design and hydraulics	5	40		60				
	WSE/LWDFS/06/s	Socio-economic and environmental aspects of irrigation and drainage systems	5	30		70				
	WSE/LWDFS/07/s	Conveyance and irrigation structures	5	35		65				
	WSE/LWDFS/08/e	Management of irrigation and drainage systems	5	40		60				
	WSE/09/c	Fieldtrip and fieldwork WSE	5							100
Sriwijajja		Fieldtrips	3							
		Groupwork	5							
		MSc thesis work	12							
U-IHE		MSc thesis writing	24				100			

The programme components, credits, and the nature of the examinations in the specialisation **Coastal Engineering and Port Development with Sriwijajja University** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
Sriwijajja	1	Ecostatistics (PL611)	3							
	2	Lowland environmental science (PL612)	2							
	3	Environmental values & ethics (PL613)	2							
	4	Environmental law (PL614)	2							
	5	Environmental sociology (PL615)	2							
	6	Resource economics (PL626)	2							
	7	Research methods (PL627)	2							
	8	Environmental management system (PL636)	2							
	9	Integrated aspects of lowland management	3							
	10	Managing, organization and change in lowland schemes	3							
	11	Lowland hydrology	2							
	12	Soil and water data collection, monitoring and evaluation	2							
U-IHE	WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
	WSE/02/c	Hydrology and hydraulics	5	80		20				
	WSE/CEPD/03/s	Introduction to coastal science and engineering	5	90		10				
	WSE/CEPD/04s	Port planning and infrastructure design	5			100				
	WSE/CEPD/05/s	Coastal systems	5	70		30				
	WSE/CEPD/06/s	Coastal and port structures	5			100				
	WSE/CEPD/07/s	Environmental aspects of coasts and ports	5	60		40				
	WSE/CEPD/08A/e	Management of coasts and ports (International Port Seminar)	5				100			
	WSE/CEPD/08B/e	Management of coasts and ports (ICZM)	5		100					
WSE/09/c	Fieldtrip and fieldwork WSE	5							100	
Sriwijajja		Fieldtrips	3							
		Groupwork	5							
		MSc thesis work	12							
U-IHE		MSc thesis writing	24				100			

The programme components, credits, and the nature of the examinations in the specialisation **River Basin Development with Sriwijajaja University** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
Sriwijajaja	1	Ecostatistics (PL611)	3							
	2	Lowland environmental science (PL612)	2							
	3	Environmental values & ethics (PL613)	2							
	4	Environmental law (PL614)	2							
	5	Environmental sociology (PL615)	2							
	6	Resource economics (PL626)	2							
	7	Research methods (PL627)	2							
	8	Environmental management system (PL636)	2							
	9	Integrated aspects of lowland management	3							
	10	Managing, organization and change in lowland schemes	3							
	11	Lowland hydrology	2							
	12	Soil and water data collection, monitoring and evaluation	2							
U-IHE	WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
	WSE/02/c	Hydrology and hydraulics	5	80		20				
	WSE/RBD/03/s	River basin hydraulics, geotechnics and remote sensing	5	75		25				
	WSE/RBD/04/s	River morphodynamics	5	80		20				
	WSE/RBD/05s	Data collection and analysis	5	70		30				
	WSE/RBD/06/s	River Basin Development and EIA	5	50		50				
	WSE/RBD/07/s	River structures	5	100						
	WSE/RBD/08A/e	Planning and delivery of flood resilience	5		50		50			
WSE/09/c	Fieldtrip and fieldwork WSE	5						100		
Sriwijajaja		Fieldtrips	3							
		Groupwork	5							
		MSc thesis work	12							
U-IHE		MSc thesis writing	24				100			

The programme components, credits, and the nature of the examinations in the specialisation **Flood Risk Management** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
TU-Dresden		Flood Risk Management I	10	50		30+20				
		Flood Risk Management II								
		Meteorology and Hydrology	5	100						
		GIS and Remote Sensing								
		Climate change	5	50			50			
		Hydraulic Engineering	5	100						
		Hydromechanics								
		Ecology	5	75			25			
		Statistics	5	100						
		Geodesy		100						
U-IHE	WSE/HI/06/s	Computational Intelligence and Operational water management	5	55		45				
	WSE/HI/07/s	River basin modelling	5	100						
	WSE/HI/08A/e	River Flood Analysis and Modelling	5	50		50				
	WSE/HI/08B/e	Urban flood management and disaster risk mitigation	5	40		60				
	WSE/09/c	International Fieldtrip (12 days)	5						100	
	WSE/HI/10A/e	Flood risk management	5	30		70				
	WSE/LWDFS/10/e	Innovative water systems for agriculture	5	30		70				
	WSE/HI/11/e	Hydroinformatics for decision support	5			100				
WSE/LWDFS/11/e	Remote sensing, GIS and modelling for agricultural water use	5	15		75					
UPC		Implications of global warming on floods and droughts	3		40	60				
		Coastal flooding: impacts, conflicts and risks	7	100						
		Debris flow and flash floods: risk, vulnerability, hazard and resilience	6	40		55				5
	Applications of radar-based rainfall observations and forecasts in	3	100							
UL		Spatial planning for flood protection and resilience	5	20		80				
		Socio-economic and institutional framework of floods	5	25		75				
TUD/IHE/UPC/UL		MSc thesis work	30							

The programme components, credits, and the nature of the examinations in the specialisation **Land and Water Development with Nebraska University** are:

	Code	Module Name	UNL credits/ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
UNESCO-IHE	WSE/01/c	Week 1 + Introduction to Water Science and Engineering	5	55		45				
	WSE/02/c	Hydrology and hydraulics	5	80		20				
	WSE/LWDFS/03/s	Principles and practices of land and water development	5	15		85				
	WSE/LWDFS/04/s	Design aspects of irrigation and drainage systems	5	30		70				
	WSE/LWDFS/05s	Tertiary unit design and hydraulics	5	40		60				
	WSE/LWDFS/06/s	Socio-economic and environmental aspects of irrigation and drainage	5	30		70				
	WSE/LWDFS/07/s	Conveyance and irrigation structures	5	35		65				
	WSE/LWDFS/08/e	Management of irrigation and drainage systems	5	40		60				
University of Nebraska, Lincoln, USA		Field Course: Measurement Techniques in Hydrology and Irrigation	3 (5)							
		Research Methodology & Thesis Research Proposal	2 (14)							
		Plant-Water Relations	3 (5)							
		Groundwater Geology	3 (5)							
		Advanced Irrigation and Drainage Systems Engineering	3 (5)							
		Advanced Irrigation Management	3 (5)							
		Water Law, Planning and Policy	3 (5)							
		Masters Research Project	4 (28)				100			

The programme components, credits, and the nature of the examinations in the specialisation **Groundwater and Global Change - Impacts and Adaptation with TU-Dresden and University of Lisbon** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
IST Lisbon		Hydrogeology	4,5							
		Hydrology, Environment and Water Resources	6							
		Ocean and Atmospheric Physics	4,5							
		Integrated River Basin Management	4,5							
		Groundwater Pollution and Protection	6							
		Global Environmental Policies	4,5							
U-IHE	WSE/HWR/06/s	Tracer hydrology and flow systems analysis	5	100						
	WSE/HWR/07B/s	Groundwater data collection and interpretation	5	40		60				
	WSE/GRW/08/e	Groundwater adaptation to global change impacts	5	25		75				
	WSE/09/c	Fieldtrip and Fieldwork	5						100	
	WSE/HWR/10B/e	Applied groundwater modelling	5			100				
TU-Dresden	ES11X	IWRM as a Tool for Adaptation to Climate Change	5	70			30			
		Climate Systems and Climate Modelling	5							
		Soil Water	5							
		Study Project IWRM	10							
		Ecology (optional)	5							
		Advanced Watershed Management (optional)	5							
		Integrated Land Use Management in the Landscape (optional)	5							
		Drinking Water Supply (optional)	5							
	Water Quality and Water Treatment (optional)	5								
IST/IHE/TUD		MSc thesis work	30							

4. Water Management programme

Water Resources Management

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WM/1	Week 1 + principles of integrated water resources management	5	50		50				
WM/2	The water resources system	5	70		30				
WM/3	Water governance	5	50		50				
WM/4	Water economics	5	70		30				
WM/5	Water and environmental law	5	70		30				
WM/WRM/6	Water resources assessment	5	65		35				
WM/WRM/7	Water systems modelling	5	60			40			
WM/WRM/WCM/8	Water resources planning	5	65		40				
WM/9	International fieldwork	5			30	70			
WM/WRM/WCM/10	Institutional analysis	5			80	20			
ES/11/X	IWRM as a tool for adaptation to climate change	5	70			30			
WM/12	Summer course	1			100				
WM/13	IWRM Groupwork	5			100				
WM/14	MSc proposal +Research and academic skills development	9		100					
WM/15	MSc thesis research and thesis writing	36		100					

Water Conflict Management

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WM/1	Week 1 + principles of integrated water resources management	5	50		50				
WM/2	The water resources system	5	70		30				
WM/3	Water governance	5	50		50				
WM/4	Water economics	5	70		30				
WM/5	Water and environmental law	5	70		30				
WM/WCM/6	Water conflict management 1	5	50		40				10
WM/WCM/7	Water conflict management 2	5	50		40				10
WM/WRM/WCM/8	Water resources planning	5	60		40				
WM/9	International fieldwork	5			30	70			
WM/WRM/WCM/10	Institutional analysis	5			80	20			
WM/WSM/WCM/11	Urban water governance	5			100				
WM/12	Summer course	1			100				
WM/13	IWRM Groupwork	5			100				
WM/14	Research and academic skills development WM	9		100					
WM/15	MSc thesis research and thesis writing	36		100					

Water Services Management

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WM/1	Week 1 + principles of integrated water resources management	5	50		50				
WM/2	The water resources system	5	70		30				
WM/3	Water governance	5	50		50				
WM/4	Water economics	5	70		30				
WM/5	Water and environmental law	5	70		30				
WM/WSM/6	Managing water organisations	5		60	40				
WM/WSM/7	Environmental governance and water services	5	70		30				
WM/WSM/8	Financial management in the water sector	5	65		35				
WM/9	International fieldwork	5			30	70			
WM/WSM/10	Partnerships for water supply and sanitation	5		50	50				
WM/WSM/WCM/11	Urban water governance	5			100				
WM/12	Summer course	1			100				
WM/13	IWRM Groupwork	5			100				
WM/14	Research and academic skills development WM	9		100					
WM/15	MSc thesis research and thesis writing	36		100					

Water Quality Management

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
WM/1	Week 1 + principles of integrated water resources management	5	50		50				
WM/2	The water resources system	5	70		30				
WM/3	Water governance	5	50		50				
WM/4	Water economics	5	70		30				
WM/5	Water and environmental law	5	70		30				
ES/6/W	Water quality assessment	5	60		30		10		
ES/07/T	Environmental engineering	5	50		50				
ES/07/W	Constructed wetlands for wastewater treatment	5	60		40				
ES/08/MW	Environmental planning and implementation	5	55		45				
WM/9	International fieldwork	5			30	70			
ES/10/TWL	Aquatic ecosystems: processes and applications	5	80		10	10			
ES/11/MW	Watershed and river basin management	5	70		30				
WM/12	Summer course	1			100				
WM/13	IWRM Groupwork	5			100				
WM/14	Research and academic skills development WM	9		100					
WM/15	MSc thesis research and thesis writing	36		100					

Water Co-operation and Peace

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab report (%)	Home work (%)	Integrated in modules (%)
	UPEACE Foundation Course	3.21			100				
	General Course on the UN system	2.14			100				
	Environment, Conflicts and Sustainability	3.21			50	50			
	Water Security and Peace (concept, theories, and field course)	3.21			50	50			
	Management of Coastal Resources (concepts, theories and field course)	3.21			50	50			
WM03	Water governance	5							
WM04	Water economics	5	70		30				
WM05	Environmental and water law	5	70		30				
WM06	Water conflict management I	5	50	10	40				
WM07	Water conflict management II	5	50	10	40				
WM08	Elective module	5							
Special course	Research methodology and thesis proposal work	3							100
	Natural Resources Leadership Academy	3.21	25		25				50
	Applied Hydrology	3.21	25		25		25	25	
	Applied Field Problems/Technical and Academic Writing in Water Resources	7.49			25			50	25
	Conducting Collaborative Projects/Directed research in hydrology/ Seminar/Journal club	6.42			25			50	25
	Collaborative project/Directed research in water policy/ Seminar/Journal club	6.42				25		25	50
	Collaborative project/Elective courses/Seminar/Journal Club	2.14				25		25	50
	TOTAL	76.87							

Appendix E MSc thesis marking guidelines

Criterion 1	9.0 - 10.0	8.0 - 8.9	7.0 - 7.9	6.0 - 6.9	5.9 and below
	Excellent	Very Good	Good	Sufficient	Fail
Knowledge and understanding of the subject and answers to questions	An excellent and informative introduction, well-researched, with appropriate and key references. Evidence of critical thinking. Clear aims and objectives, within an overall context, which identifies knowledge gaps. Sets the scene for the research succinctly and elegantly.	Good project background, with reference to key literature. A logical framework that identifies the research objectives, but may lack some thoroughness, or comprise a limited series of research questions. It might be competent but a little mundane.	Covers the main areas, but has minor flaws in logic or omissions of important detail, or minor flaws in structure. Aims and objectives comprehensible, but maybe slightly over or under ambitious, and/or lacking in clarity or precision. Objectives may be unrealistic.	Generally lacks some coherence; may be poorly referenced, but includes at least some points relevant to the research. Aims and objectives no more than adequate.	Poorly structured, with significant omissions of key background literature. No logical progression. Fails to set the context of the project. Research question not developed into appropriate or testable hypotheses

Criterion 2		9.0 - 10.0	8.0 - 8.9	7.0 - 7.9	6.0 - 6.9	5.9 and below
		Excellent	Very Good	Good	Sufficient	Fail
Originality, analysis and interpretation	Methods	Well-chosen and entirely appropriate and often novel methods identified clearly. Clear and easy to follow procedures and techniques. Where appropriate, good site description, with informative maps, diagrams etc.	Appropriate actions and methods identified and detailed. Where appropriate, setting of research well described with relevant maps etc	Methodology generally sound but with some lapses in detail of methods, and/or proposed analysis. Maps or diagrams may be poorly produced, or not clear in the context of the research	Significant gaps in methods, or methods not always appropriate to the research questions, or very difficult to comprehend. Lapses in detail in parts of methodology. Maps may be absent or poorly produced.	Methodology vague and poorly detailed. No obvious understanding of methodology relevant to research theme. Maps etc may be poorly produced or absent.
	Results	These are well analysed and presented with clarity, with clear and comprehensive relationship to the research questions.	Results reported well and with clarity. Some minor lapses in summary of findings. Shows ability to address methodological short-comings	Results comprehensible, generally linking with the research questions. Figures and tables convey adequate meaning, providing a summary of at least some of the key findings.	Some obvious flaws in analysis, but the general essence of the key findings conveyed.	Difficult to follow the results and analysis. Presentation careless and poor summary of the key findings
	Discussion	Elegant and well structured, placing the results in the context of the international literature and demonstrating a clear understanding of their significance, and/or shortcomings. Show some new ideas and novel interpretation.	Identifies the key findings and relevance of these to some key literature. A well ordered sequence to the chapter to produce a logical framework.	Recognises some interesting findings, but may be limited in placing these into a wider context. At least some use of key literature. There will likely be some repetition with the results section.	Largely a repetition of the results section, with minimal context to wider understanding and relevant literature.	Fails to identify key findings and/or their wider significance. Little logical framework and lacking any individual ideas or interpretation.

Criterion 3	9.0 - 10.0	8.0 - 8.9	7.0 - 7.9	6.0 - 6.9	5.9 and below
	Excellent	Very Good	Good	Sufficient	Fail
Organisation, style, presentation and communication	Writing elegant and succinct. Uses precise language and correct terminology throughout. Figs and tables well laid out to a publishable quality with accurate and succinct legends.	A clear and well-written report that is technically proficient.	A generally well-written report that is understandable. Uses appropriate terminology. Occasional spelling or grammatical errors. Presentation generally neat	Language generally clear and uses correct terminology, but with some misunderstandings and lapses in grammar or spelling. Presentation and use of tables and figures may be sloppy.	Sentences and/or paragraphs poorly constructed. Language inexact or ambiguous. Contains numerous grammatical and spelling mistakes.

Criterion 4	9.0 - 10.0	8.0 - 8.9	7.0 - 7.9	6.0 - 6.9	5.9 and below
	Excellent	Very Good	Good	Sufficient	Fail
Creativity, independence, work planning and critical attitude	Student self-motivated and independent. Engages in intelligent discussion and responds well to suggestions.	Significant help may be given, but students show ability to learn from suggestions and develop ideas and research approaches accordingly.	Needs clear guidance and support, but gradually develops the required competencies.	A need to repeat instructions a number of times. Generally finds taking initiative difficult, and limited self-reliance.	Lacks motivation, or much ability to develop competencies. Shows little self reliance or interest in the topic.



MASTER PROGRAMME WM 2015-2017



Water Management

Overview of module descriptions and workloads

Studyguide - part 2



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Evers, J.G.

Module Name	Module Code	Credit Points
Principles of integrated water resources management	WM01	5

Target Group	Prerequisites
Young and mid-career professionals, engineers and (mid-level) decision makers interested in a basic and broad understanding of main issues in the water management context.	Preferably a relevant water science or management related BSc degree; some experience in the water sector; good command of the English language (reading, writing, speaking).

Assessment

%	Format	(Comment)
50	Written Exam (closed book)	
25	Assignment	GIS Assignment
25	Assignment	Annotated Bibliography Assignment

Learning Objectives

Upon completion of the module participants will be able to..

- Summarize the latest insights, context and concepts in integrated water management that are under debate in international and regional forums.
- Explain the main arguments for an integrated approach in the field of water management.
- Describe the major natural functions and human uses of river systems.
- Understand the concepts of Geographical Information Systems and apply them in practical examples relevant to water management.
- Explain what science is and what scientific research entails including distinguishing the main methodological approaches (Research Path)



Topics and Learning Activities

TOPIC: Introduction to the Module

DESCRIPTION: Basic introduction to the module

Learning Activities:

lecture

TOPIC: Integrated Water Resources Management

DESCRIPTION: Context, developments, perspectives, issues and debates in Integrated Water Resources Management. Water Resources: green water vs. blue water; catchment yield. Water Demand: demand projections; demand management; elasticity of water demand; the value of water. Water allocation. Water governance.

Learning Activities:

Lectures

TOPIC: Introduction to GIS

DESCRIPTION: Explain the basic concepts of GIS (raster, vector, projections, geospatial analysis. Use a GIS for(1) Thematic mapping(2) Basic data processing and editing(3) Basic geoprocessing and analysis(4) DEM processing and catchment delineation. Find open source software and open access data

Learning Activities:

Lectures, workshops and exercises

TOPIC: Research and Academic Skills Development (Research Path)

DESCRIPTION: What is Science?; Different Approaches to Scientific Methodology; Referencing; Plagiarism; Critical Reading.

Learning Activities:

Lectures, workshops

Lecturing Material

- Principles of Integrated Water Resources Management, UNESCO-IHE Lecture Notes.
- Introduction to GIS, Reader on GIS. UNESCO-IHE Lecture Notes.
- Other handouts and relevant articles.

Scientific software

QGIS, Endnote



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Evers, J.G.

Module Name		Module Code		Credit Points						
Principles of integrated water resources management		WM01		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
	Introduction to the module			2				2	2	Evers
								0	0	
1	Principles of IWRM							0	0	
1.1	Water Resources.	4						4	12	Van der Zaag
1.2	Water Demand	4						4	12	Van der Zaag
1.3	Water Allocation	4						4	12	Van der Zaag
1.4	Water Governance	4						4	12	Van der Zaag
1.5	Emerging Issues	4						4	12	Van der Zaag
								0	0	
2	GIS							0	0	
2.1	Introduction GIS	2						2	6	Van der Kwast / Wenninger
2.2	GIS for thematic mapping		2	2				2	4	Van der Kwast / Wenninger
2.3	Basic data processing and editing		2	2				2	4	Van der Kwast / Wenninger
2.4	Basic geo-processing and analysis		3	2				2	5	Van der Kwast / Wenninger
2.5	DEM processing and catchment delineation		3	2				2	5	Van der Kwast / Wenninger
								0	0	
3	WM Research Path							0	0	
3.1	What is Science?	4						4	12	Wehn / Zwartveen / Irvine
3.2	Different Approaches to Scientific Methodology	4						4	12	Wehn / Zwartveen / Irvine
3.3	Critical reading				4			4	8	Wehn
3.4	Referencing & Plagiarism			4				4	4	Darvis
3.5	Annotated Bibliography assignment		15					0	15	
	Exam		3					0	3	
	Total	30	28	14	4	0	0	48	140	

(c) UNESCO-IHE 2015/2017-WM01: Principles of integrated water resources management



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Susnik, J.

Module Name	Module Code	Credit Points
The water resources system	WM02	5

Target Group	Prerequisites
Young and mid-career professionals, engineers and (mid-level) decision makers interested in understanding the bio-physical hydrological system as a sound basis for water management.	A relevant water science or management related BSc degree; some experience in the water sector; good command of the English language. Good working knowledge of MS Excel is essential, as is basic mathematics. Knowledge of scientific units and unit conversion is preferable. Basic knowledge of integrated water resources management is essential.

Assessment

%	Format	(Comment)
70	Written Exam (closed book)	The exam will cover all of the elements taught in this course.
10	Assignment	Assessed assignment on evaporation.
10	Assignment	Assessed assignment on rating curve analysis.
10	Assignment	Assessed assignment on water quality analysis.

Learning Objectives

Upon completion of the module participants will be able to..

- 1. Understand and describe the key bio-chemo-physical processes that determine water quantity and quality within a general water resources system
- 2. Apply basic knowledge of the hydrological cycle, the water balance, precipitation, evapotranspiration, surface water discharge and groundwater movement to make a water balance and analyse rainfall and surface water and groundwater flows of water resources systems
- 3. Apply knowledge of basic chemistry and biology to analyse and explain eutrophication, stratification and the distribution of nutrients and ecological communities along water resources systems, and to relate these processes to water quality
- 4. Combine understanding and knowledge of water quantity (see objective 2) and water quality (see objective 3) to analyse a range of problems and potential solutions in water resources management
- 5. Measure basic water quality parameters and evaluate records with rainfall and flow data
- 6. Have a better fundamental appreciation of the entire water resources system, recognising that quantity and quality issues affect each other



Topics and Learning Activities

TOPIC: Introduction to Water Resources Systems

DESCRIPTION: Basic concepts for understanding a water resources system are introduced. Emphasis is placed on the idea of the system - this is, all elements in a water resources system should be considered as a whole. A case study is used to elaborate on the concepts and to introduce particular water quality and quantity problems.

Learning Activities:

Interactive lecture about water resources systems with a case example on the Nile Basin.

TOPIC: Water quantity

DESCRIPTION: Surface water hydrology: Hydrological cycle and water balance. Precipitation and evaporation. Principles of hydrology of surface and groundwater systems, hydrology of lakes and reservoirs including introduction to reservoir water balance and operations. Analysis of hydro-climatic data (e.g. precipitation, river flows), discharge rating curve and reservoir operation. Groundwater hydrology: Hydrogeology, groundwater zones, groundwater balance, hydraulic head, pressure head, elevation head, groundwater recharge and discharge, groundwater pollution

Learning Activities:

The surface water hydrology part includes five lectures and three workshops in which the participants apply the theory and analyse precipitation and flow data and make water balances. The groundwater hydrology part includes two lectures and one workshop in which the participants apply the theory to calculate groundwater head, discharge and velocity.

TOPIC: Water Quality

DESCRIPTION: pH, BOD, nutrients, heavy metals, anaerobic waters, eutrophication, bio-accumulation

Learning Activities:

The water quality part includes 3 lectures and a 2 workshops in which the participants apply the theory to analyse stratification, eutrophication and bio-accumulation, lab visit

TOPIC: Ecology

DESCRIPTION: In a case study on the Nile river and lakes/reservoirs, knowledge about water quality and quantity is used to analyse real life problems in the Nile basin

Learning Activities:

Lecture on ecology

An exercise the participants are asked to form a view on the environmental state of a river and the effects of human interventions in the river basin

Lecturing Material

- P.J.M. de Laat, Y.A. Mohamed. M.L. Mul, and J.W. Wenninger. 2010. Hydrology: An introductory course. UNESCO-IHE Lecture Notes.
- Y. Mohamed, P.J.M. de Laat, and L. Kewzi. Workshop Hydrology. 2010. UNESCO-IHE Lecture Notes.
- J.C. Nonner. 2006. Introduction to Hydrogeology. UNESCO-IHE Lecture Notes Series. Taylor and Francis, Leiden.
- Water Quality, Kelderman. UNESCO-IHE Lecture Notes.
- Power point presentations.
- Selected journal articles.

Scientific software

MSExcel



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Susnik, J.

Module Name		Module Code		Credit Points						
The water resources system		WM02		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction to the Water Resources System							0	0	
1.1	Introduction to module	1						1	3	J. Susnik
1.2	Introduction to Water Resources System	3						3	9	J. Susnik
2	Water Quantity							0	0	
2.1	Concepts of hydrology, hydrological cycle, water balance	2		2				4	8	Y. Mohamed and J. Susnik
2.2	Precipitation	2		4				6	10	Y. Mohamed and J. Susnik
2.3	Evaporation and Transpiration	2		4				6	10	Y. Mohamed and J. Susnik
2.4	Surface water resources	2				2		4	12	Y. Mohamed and J. Susnik
2.5	Groundwater resources	4		4				8	16	T. Stigter
2.6	Reservoir water balance and operation	2						2	6	Y. Mohamed
3	Water Quality							0	0	
3.1	pH, BOD, anaerobic waters and stratification	2		4				6	10	P. Kelderman
3.2	Nutrients and Eutrophication	2		4				6	10	P. Kelderman
3.3	Heavy metals and bio-accumulation	2						2	6	P. Kelderman
3.4	Laboratory session			4				4	4	F. Krus
4	Ecology (Case studies Water quality and quantity)							0	0	
4.1	Fresh water ecology	2						2	6	K.Irvine
4.2	Case study	2	4					2	10	K.Irvine
5	Exam			3				3	3	
	Research methodology classes	2	2					2	8	
Total		30	6	29	0	0	2	61	131	

(c) UNESCO-IHE 2015/2017-WM02: The water resources system



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Kemerink, J.S. (Jeltsje)

Module Name	Module Code	Credit Points
Water governance	WM03	5

Target Group	Prerequisites
Young mid-career professionals who are 1) working at middle and upper level in an organization in the water sector, 2) employed in policy making institutions in the water sector or 3) working for organizations engaged in management of water resources and water services.	Good English command to read and discuss academic articles; willingness to engage in social science theory and new conceptual frameworks; ability to read and discuss academic articles and book chapters in English; willingness to engage in cross-disciplinary discussions and applications.

Assessment

%	Format	(Comment)
50	Written Exam (open book)	
20	Assignment	Within this group assignment the students will critically analyze scientific articles and identify and describe the context, purpose, perspective and arguments given by the authors. This will be presented in class followed by a plenary discussion on the articles.
30	Assignment	Within this individual assignment the students will critically analyze shifts in governance and present their findings in an essay. Students can choose to select a particular country and study the shifts within the water resources or water services over time (e.g. 50 years) or they can opt for analyzing a particular shift (e.g. private sector involvement, introduction of water permit system) in-depth.

Learning Objectives

Upon completion of the module participants will be able to..

- Identify and analyse actors and decision making processes related to water governance
- Distinguish and explain main discourses and theories on water governance
- Identify context, purpose, perspective and arguments of scientific papers on water governance
- Compare and contrast different scientific papers, case studies and theories on dynamic and political nature of water governance



Topics and Learning Activities

TOPIC: Introduction to water governance

DESCRIPTION: Discussing and analysing various definitions on water governance.
Analysing concepts related to water governance (e.g institutions, policies, organizations).
Discussing different modes of governance and analysing shifts in governance.
Deconstructing the notion on 'good governance'.

Learning Activities:

Lectures, tutorials, debate, self-study

TOPIC: Politics of Water Governance

DESCRIPTION: Defining politics and analyzing the political nature of water governance processes.
Identifying actors in decision-making processes and discussing the concept of participation.
Discussing and analysing water governance processes at three political levels:
Everyday politics, Politics of policy & Global politics.

Learning Activities:

Lectures, case studies, tutorials, debate, film, self-study

TOPIC: Research methodology

DESCRIPTION: Critical reading of scientific articles

Learning Activities:

Lectures, workshop, exercise

Lecturing Material

- Boelens, R., M. Zwartveen, and D. Roth (2005) Legal complexity in the analysis of water rights and water resources management, London: Rutgers University Press
- Castro J.E. (2007) Water Governance in the twentieth-first century. *Ambiente & Sociedade* 10(2): 97-118.
- Cleaver, F. (1999) Paradoxes of Participation: Questioning Participatory Approaches to Development *Journal of International Development* 11(4): 597-612.
- Rap, E. (2006) The Success of a Policy Model: Irrigation Management Transfer in Mexico. *Journal of Development Studies* 42 (8): 1301- 1324
- Swyngedouw E. (1997) Power, nature, and the city. The conquest of water and the political ecology of urbanization in Guayaquil, Ecuador, 1880-1990
- *Environment and Planning* 29:311-332
- additional materials (powerpoint sheets etc.)

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Kemerink, J.S. (Jeltsje)

Module Name		Module Code		Credit Points						
Water governance		WM03		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Concepts of Water Governance							0	0	
1.1	Introduction to the Module		1					0	1	<i>Kemrinc</i>
1.2	Social-Nature	2						2	6	<i>Kooy/van der Zaag</i>
1.3	Water governance: an introduction	4						4	12	<i>Kemerink</i>
1.5	Shifts in Governance	3						3	9	<i>Schwartz & Tutusaus</i>
1.6	Research methodology		5					0	5	<i>Evers</i>
2	Politics of Governance							0	0	
2.1	Politics: an introduction	4						4	12	<i>Rusca</i>
2.3	Everyday politics	4						4	12	<i>Guest lecture/Margreet Zwarteveen</i>
2.5	Politics of policy: promotion of policy models	4						4	12	<i>Rap</i>
2.6	Global politics	4						4	12	<i>Kooy</i>
3	Tutorials			10				10	10	<i>Several</i>
4	Assignment		45					0	45	
5	Exam		3					0	3	
Total		25	54	10	0	0	0	35	139	

(c) UNESCO-IHE 2015/2017-WM03: Water governance



WATER MANAGEMENT

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Jiang, Y.

Module Name	Module Code	Credit Points
Water economics	WM04	5

Target Group	Prerequisites
Young and mid-career professionals, engineers and (mid-level) decision makers interested in water (resources) economics.	Preferably a relevant water science or management related BSc degree; Some experience in the water sector; Good command of the English language.

Assessment

%	Format	(Comment)
30	Assignment	
70	Written exam (closed book)	

Learning Objectives

Upon completion of the module participants will be able to..

- Describe the principles of economics and the relevance of economics to water management
- Discuss and compare different economic perspectives/approaches with respect to water management
- Characterize and explain water resource issues using economic concepts and theory
- Describe the economic efficiency perspective for addressing water scarcity and allocation
- Conduct simple cost-benefit analysis and policy analysis of water-related decision-making
- List and review economic instruments for water management
- Describe economic methods and techniques for estimating the value of water in different uses



Topics and Learning Activities

TOPIC: Introduction to water economics

DESCRIPTION: This section provides an overview of the water economics module, synthesizes water issues and management agenda, introduces economics principles and economist role, highlights the relevance of economics to water management under emerging water crisis while stimulating interests and economic thinking.

Learning Activities:

Lecture, assigned reading, guided group discussion

TOPIC: Understanding water demand & supply

DESCRIPTION: This section introduces the economic concepts of demand and supply, its graphic presentation, economic meaning, driving factors, types of change and measure, and its relevance to water management

Learning Activities:

Lecture, assigned reading, group exercise

TOPIC: Characterizing water use issues within socio-economic context

DESCRIPTION: This section characterizes water and use issues within socio-economic context, covering economic categorization of different socio-economic goods and their potential management issues including externality, socio-economic conception of water and management challenges.

Learning Activities:

Lecture, assigned reading, group exercise/workshop

TOPIC: Economic approaches to water management

DESCRIPTION: This section introduces the economic approach to water resource management including water scarcity and optimal allocation, water trading and pricing, policy analysis for water supply and demand management, and benefit-cost analysis

Learning Activities:

Lecture, assigned reading, group exercise/workshop

TOPIC: The economic value of water

DESCRIPTION: This section explains the economic value of water and relevance to water management, introduces different approaches to valuing water in different use.

Learning Activities:

Lecture, assigned reading, group exercise/workshop

TOPIC: The role of economics in water management: synthesis and reflection

DESCRIPTION: This section synthesizes, reflects, and discusses the role of economics in water management

Learning Activities:

Lecture, assigned reading, group exercise/workshop

TOPIC: Role play

DESCRIPTION: This section presents a game mimicking water resources management in the real world with involvement of different groups of stakeholders. Course participants will be divided into different groups representing those stakeholders, and will be guided to interact to find solutions to and gain insights into water management

Learning Activities:

group exercise

Lecturing Material

- Lecture PPTs by Dr. Y. Jiang
- Journal papers, government reports
- Water Resource Economics: The Analysis of Scarcity, Policies, and Projects. Griffin, R. C. (2006). MIT Press, Cambridge, MA, USA.
- Principles of Economics (6th edition). Mankiw, N.G. (2012). South-Western Gengage Learning, United Kingdom.
- Environmental & Natural Resource Economics (9th edition). Tietenberg, T., Lewis, L. (2012). Pearson, Amsterdam, the Netherlands.

Scientific software

Ravila simulation game



WATER MANAGEMENT

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Jiang, Y.

Module Name		Module Code		Credit Points						
Water economics		WM04		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction to water economics							0	0	
1.1	Introduction to module			1				1	1	Jiang
1.2	Water issues and management agenda		2	2				2	4	Jiang
1.3	Principles of economics, economist role and the relevance of economics to water man	2		2				4	8	Jiang
2	Understanding demand and supply							0	0	
2.1	Economic concepts of demand and supply	2		4				6	10	Jiang
2.2	Empirics of water demand and supply	2		2				4	8	Jiang
3	Characterizing water and use issues in socio-economic context							0	0	
3.1	Typology of goods in economics	2		2				4	8	Jiang
3.2	Socio-economic conception of water		3	2				2	5	Jiang
4	Economic approaches to water management							0	0	
4.1	Resource scarcity	1		3				4	6	Jiang
4.2	Tradable water rights, markets	2		2				4	8	Guest Lecturer
4.3	Water pricing	2	2	2				4	10	Guest Lecturer/Jiang
4.4	Application of economic instruments		2	4				4	6	Jiang
4.5	Policy analysis of water demand and supply			4				4	4	Jiang
4.6	Benefit-cost analysis	2		4				6	10	Guest Lecturer/Jiang
5	The economic value of water	4						4	12	<i>Jiang</i>
6	The role of economics in water management: synthesis		4	4				4	8	<i>Guest Lecturer/Jiang</i>
7	Ravilla rople play			21				21	21	<i>Graas/Masih</i>
	Group assignment		12					0	12	<i>Jiang</i>
	Exam		3					0	3	
Total		19	28	59	0	0	0	78	144	

(c) UNESCO-IHE 2015/2017-WM04: Water economics



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Jaspers, F.G.W.

Module Name	Module Code	Credit Points
Water and environmental law	WM05	5

Target Group	Prerequisites
Students of the Masters of Science Programmes of Water Management and Environmental Science and Technology . Practitioners with a relevant Bachelor's degree in a water related discipline	Preferably a relevant water science and engineering related bachelor's degree or equivalent; affinity with water management; good command of English.

Assessment

%	Format	(Comment)
70	Written Exam (closed book)	Open Questions
30	Assignment	Assignment contract design (Workshop)

Learning Objectives

Upon completion of the module participants will be able to..

- critically investigate and grasp different dimensions of water and environmental law (including principles, rights, instruments, organizations) from local to global level.
- obtain proficiency in the review of contrasting legal arguments.
- practise treaty writing and contract writing skills.
- integrate legal knowledge within their existing water and environmental knowledge that try to address key issues of water sharing under the equity articles of the UN Watercourses Convention.



Topics and Learning Activities

TOPIC: 1. International Water and Environmental Law

DESCRIPTION: 1.1 International water and environmental law and law making bodies (the UN) 1.2 What is international law? Where does water and environment fit in? 1.2.1 Sources of international law with a focus on water and environmental law 1.2.2 How is international law made/ how were the water conventions and climate law negotiated/ being negotiated? 1.2.3 Elements of a treaty, introduction to key concepts 1.2.4 How effective is international (water and environmental) law 1.2.5 How are disputes addressed? 1.3 International water law 1.3.1 Principles of water law 1.3.2 Evolution of water law 1.3.3 The Watercourses Convention and the organizations it recommends 1.3.4 The UNECE Water Law 1.3.5 The RAMSAR Convention on Wetlands 1.3.6 The ILC groundwater rules 1.3.7 The Human Right to Water and Sanitation 1.4 International environmental law 1.4.1 Principles of environmental law 1.4.2 The Climate Change Convention and the Conference of the Parties 1.4.3 Mitigation and a focus on forests/energy 1.4.4 Adaptation and a focus on water related adaptation 1.5 Other international law 1.5.1 Investment treaties and implications for water and environmental contracts 1.5.2 Trade agreements and implications for water and environmental contracts 1.6 Trans-boundary water and environmental law and related basin organizations 1.6.1 Legal issues in trans-boundary water governance 1.6.2 The EU Water Framework Directive and its organization 1.6.3 The Nile Water Agreements and organization 1.6.4 The Mekong Agreements and organization

TOPIC: 2. National water and environmental law

DESCRIPTION: 2.1 Introduction to legal concepts 2.2 Legal principles (including spatial planning law) in national water and climate change 2.3 Legal instruments for water quality management 2.4 Centralization, decentralization and subsidiarity: risks and advantages of each 2.5 Customary and statutory water and environmental rights, including rights of indigenous peoples 2.6 National river basin organizations; organizations for implementing climate change 2.7 National jurisprudence on water and environment 2.8 National dispute resolution issues

TOPIC: 3. Contract Management

DESCRIPTION: 3.1 Contract law 3.2 Case study contract management on water related issues 3.3 Case study contract management for the Clean Development Mechanism or Reducing Emissions from Deforestation and Forestation Degradation 3.4 Group work contract law

TOPIC: 4. Trans-boundary water management

DESCRIPTION: 4.1 Water and benefit sharing from international rivers: hydro-solidarity 4.2 Shared vision development

Lecturing Material

- F.G.W. Jaspers - Chapters in Water and Environmental Resources Law, UNESCO-IHE Lecture Notes.
- F.G.W. Jaspers - Role Play International Rivers, UNESCO-IHE Lecture Note.
- F.G.W. Jaspers - Introduction in Contract Management, UNESCO-IHE Lecture Note.
- J. Gupta - International Water Law and Institutions, UNESCO-IHE Lecture Note.
- J. Gupta - International Environmental Law, UNESCO-IHE Lecture Note.
- P. van der Zaag e.a - Legislation of International Waters, UNESCO-IHE Lecture Note.
- Various inputs from guest lecturers.

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Jaspers, F.G.W.

Module Name		Module Code		Credit Points						
Water and environmental law		WM05		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	International Water Law							0	0	
1.1	Introduction International Water Law	2						2	6	Gupta
1.2	International Water Law	4		2				6	14	Gupta
1.3	International Environmental Law	4		2				6	14	Gupta
1.4	Case studies Environment / Forestry			4				4	4	Gupta
2	National Water Law							0	0	
2.1	Intro National Water Law	2						2	6	Jaspers
2.2	Legal Instruments	2						2	6	Jaspers
2.3	River Basin Organizations (Intro)	4		2				6	14	Jaspers
2.4	Water Rights	4		2				6	14	Jaspers
2.5	Case: Customary Water Rights			4				4	4	Van der Zaag
2.6	Water Quality Management Regulations	4		4				8	16	Hendry
3	Contract Management							0	0	
3.1	Contract Law	2		2				4	8	Jaspers
3.2	Contract Management Workshop			4				4	4	Jaspers
	Assignment		16					0	16	
	Exam		3					0	3	
	Total	28	19	26	0	0	0	54	129	

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WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Shubber, Z.S.

Module Name	Module Code	Credit Points
Water Conflict Management I	WCM06	5

Target Group	Prerequisites
<p>Current and future water managers, decision-makers and others involved in water management wanting to broaden their scope in water management. Professionals involved in dispute resolution wanting to broaden the scope of their activities to include water.</p> <p>Students need to have a first degree in a relevant subject (economics, social sciences, law, engineering, biology etc.) and preferably several years of relevant working experience.</p>	<p>Knowledge and appreciation of the principles of integrated water resources management, the water resources system and water governance.</p>

Assessment

%	Format	(Comment)
50	Written Exam (closed book)	
10	Skills assessment	Skills assessment with two measurements - at start of module and at end of module
40	Assignment	Annotated bibliography

Learning Objectives

Upon completion of the module participants will be able to..

- Explain, discuss and analyze the basic concepts of conflict management and conflicts related to water.
- Discuss and analyze, from a conflict and cooperation perspective, cases of water sharing and use among different actors at different levels and from different sectors.
- Apply management skills in conflict transformation, strategic planning, and water governance.
- Identify, explain and analyze the elements of a negotiation process applied to the management of a water conflict.
- Prepare, organize, engage in negotiation processes related to shared water resources with different stakeholders.



Topics and Learning Activities

TOPIC: Introduction to theoretical concepts and frameworks of conflict

DESCRIPTION: A one day lecture will provide the basic theoretical background to understand the concepts and frameworks that apply to conflict.

Learning Activities:

Lecture and interactive discussions.

TOPIC: Alternative dispute resolution approaches

DESCRIPTION: The spectrum of alternative dispute resolution approaches, focusing on negotiation techniques and styles, are presented during a two day lecture. The various components of a negotiation process (trust, interests, alternatives, options, criteria & standards, communication, relationship, agreement) will be studied and key skills for successful conflict resolution (active listening, open ended questions, identification of positions and interests, the use of standards).

Learning Activities:

Exercises and a role play will be used to help the participants practice the skills they learn.

TOPIC: Design and implement conflict resolution processes

DESCRIPTION: This lecture provides an opportunity to learn about current and leading-edge ways to work effectively in contentious water situations. It offers a place to practice new skills that are applicable from the individual level to the societal level and across a range of real-life situations. Successful multi-party negotiations require profound transformations in the way participants conceptualize the issues at hand. Those involved can often point to the precise moment when thinking altered dramatically - the `aha!` moment - where emphasis shifted from individuals thinking only in terms of their own agenda to also understanding the needs of the other. Traditional conflict resolution models define these moments in rational terms - `people come to agreement when it is in their interest to agree.` Even overlooking the tautological nature of this argument, `rationality` simply often does not hold sway if the conflict involves even a modicum of real emotion. To really understand the process of transformation, and the settings most conducive to inducing these shifts, then, one may do well to look outside of the field of conflict resolution as defined in modern, academic terms. When one thinks of the situations most analogous to settings conducive to transformative thinking, the world of spiritual transformation rises as potentially the most appropriate. Every spiritual tradition in the world, after all, is devoted to precisely this process of transformation: to aid individuals in moving from a focus on their own immediate wants and desires, to addressing more their obligations to society, humanity, and to the divine.

TOPIC: International Negotiation Processes

DESCRIPTION: International negotiation processes, multilateral negotiations between ten parties, debrief of multilateral negotiations, unilateral bargaining on a water problem, cultural aspects and personal behavior in negotiation.

Learning Activities:

Managing international negotiation processes on water issues is a vital skill for those who have to represent and defend the interests of their organization. Knowing how to go from A to B in a cooperative process is as important as being a specialist on water issues and other dossiers. This four day lecture intends to confront the theory and practice of bargaining, help students to get a better understanding in handling procedures/processes & people/parties & positions/products, while not forgetting about power/perception and some other factors in negotiation such as, for example, the context in which negotiations are undertaken. On the first day, the phenomenon of negotiation will be defined, while bilateral negotiation will be practiced. On the second day strategy and tactics will be dealt with. Various aspects related to the behavior of a negotiator (skills, styles and cultural aspects) will also be covered. On the third day, multilateral negotiations will be studied. Role plays will be organized and will be concluded on the fourth day. A single text on disaster relief issues will be drafted and debriefed. The objective of this exercise will be for the students to get as close to reality as possible. By using Clingendael's Workbook, students will be provided with exercises and negotiation literature. Participants will have to be aware of the fact that there will be some homework for day two and three, handed out on day one.

TOPIC: Final role play

DESCRIPTION: In this role play participants simulate a conflict on an transboundary water body.

Learning Activities:

Participants simulate a conflict on an transboundary water body. The participants will be assigned roles in the delegations of different stakeholders concerned with the management of this water body (governments, NGO representatives, professional networks, local governments, etc). Different negotiation rounds will be simulated. Feedback will be provided during and at the end by teachers and participants themselves.

TOPIC: Annotated bibliography

DESCRIPTION: The students will develop an annotated bibliography on a topic related to cases of water sharing or disputes relating to water, from a list provided, and submit it at the end of the module. The annotated bibliography will be a stepping stone for the Essay assignment of the WCM II module.

Lecturing Material

- Alternative Dispute Resolution, a focus on a negotiation technique; Ms. Lena Salame.



- Getting to Yes; R. Fisher and W. Ury (Random House, London, 1991).
- Sharing Waters, Sharing Benefits; UNESCO.
- Workbook of International Negotiation; The Clingendael Institute.

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Shubber, Z.S.

Module Name		Module Code		Credit Points						
Water Conflict Management I		WCM06		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction			2				2	2	Shubber
2	Introduction to conflict theory	4		2				6	14	Mirumachi
3	Alternative dispute resolution approaches	6		6				12	24	Salame
4	Design and implement conflict resolution processes	8		20				28	44	Wolf
5	International negotiation processes	6		18				24	36	Perlot
6	Final role play			3				3	3	Shubber
7	Annotated bibliography		16					0	16	Shubber
	Exam		3					0	3	
Total		24	19	51	0	0	0	75	142	

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WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Management
Module Coordinator: Mohamed, Y.A.

Module Name	Module Code	Credit Points
Water resources assessment	WRM06	5

Target Group	Prerequisites
Young and mid-career professionals, managers, engineers and technicians interested in water resources management in general, and in particular the assessment of quantity and quality of water resources. Processing and validation of both ground and remote sensing data is a key part of the module.	Successful completion of WM1, WM2 or equivalent is strongly recommended. Affinity with quantitative approaches is required. Good command of English.

Assessment

%	Format	(Comment)
65	Written Exam (closed book)	GW resources assessment 10%; WQ assessment 15%; Water using activities 15%; Water accounting 25%
35	Assignment	Surface Water Resources Assessment 15%; GW resources assessment 5%; Water accounting 15%

Learning Objectives

Upon completion of the module participants will be able to..

- Describe different types of water resources data, generated from ground and RS measurements.
- Apply diverse methods of data processing and data validation for water resources assessment.
- Quantify the different components of the water resources spectrum (rainfall, river flow, groundwater), and assess availability and access at different scales.
- Describe and apply different methods of water quality monitoring and assessment.
- Analyse and quantify multiple uses of water for: agriculture, hydropower, domestic, environment and other uses
- Apply water accounting techniques as a quick method for assessing water resources, water use, and water productivity in a river basin context.



Topics and Learning Activities

TOPIC: Water resources assessment

DESCRIPTION: # Water Resources data: Different types of water resources data, monitoring, validation, archiving, and dissemination.

Surface water resources assessment: time series analysis of WR data, including: flow duration curves, statistical distribution and trend analysis, extreme value analysis (floods and droughts).

Groundwater resources assessment: Defining sustainable yield, occurrence of groundwater and investigation methods, methods of groundwater abstraction.

Water quality monitoring and assessment: requirements for WQ assessment; WQ parameters; WQ monitoring program; Pollution; WQ assessment.

Estimation of water resources data in un-gauged basins and regionalization.

Learning Activities:

The learning activities include lectures and workshops in class, exercises and tutorial, and field visits to the "Water Management Centre", The Netherlands, Lelystad, and to Deltares, Delft.

TOPIC: Water using activities

DESCRIPTION: Agricultural water demand, crop water requirement, net irrigation requirement, yield analysis, domestic water use, hydropower water demand, environmental water requirement.

Learning Activities:

The learning activities include lectures and workshops in class, as well as exercises.

TOPIC: Water accounting

DESCRIPTION: Introduction to remote sensing data for water resources management; Satellite image processing; Catchment water balance in GIS environment; Water productivity and water valuation; Water accounting.

Learning Activities:

The learning activities include lectures and workshops in class, as well as exercises.

Lecturing Material

- Guide to Hydrological Practices: Volume I - Hydrology - From Measurement to Hydrological Information, WMO No 168, 2008.
- Water Resources Assessment Hand Book for review of national capabilities, 1997 (WMO, UNESCO)
- Water accounting at river basin scale, Mohamed, 2013. UNESCO-IHE lecture notes.
- Introduction to Hydrogeology, Johannes C. Nonner, 2012, Taylor and Francis/CRC Press/Balkema
- Molden, D., 1997. Accounting for Water Use and Productivity, SWIM Paper 1, International Irrigation Management Institute, 1 Colombo, Sri Lanka.
- Lectures-Power point presentations

Scientific software

CROPWAT, ArcGIS, QGIS, IHA and spreadsheets.



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Management
Module Coordinator: Mohamed, Y.A.

Module Name		Module Code		Credit Points						
Water resources assessment		WRM06		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction to WRA	2						2	6	Mohamed
2	Water Resources Assessment							0	0	
2.1	Water resources data (case study)	2		2				4	8	Masih
2.2	Surface water resources assessment	4		4				8	16	Mohamed
2.3	Groundwater resources assessment	4		4				8	16	Stigter
2.4	Water quality assessment	6						6	18	Kelderman
2.6	WRA in un-gauged basins	2		2				4	8	Masih
3	Water use activities	4			2			6	16	Graas
4	Water accounting							0	0	Mohamed/Bastiaanssen
4.1	GIS/RS applications in WRA	2		2				4	8	
4.2	Processing of spatial data (Land use, precipitation, evapotranspiration, runoff)	2		2	2			6	12	
4.3	Computation of catchment water balance	2		2	2			6	12	
4.4	Water accounting at different scales	2		2	2			6	12	
5	Field visit \\\'water management center\\\'					6		6	6	
6	Exam					3		3	3	
Total		32	0	20	8	9	0	69	141	

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WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Schwartz, K.H.

Module Name	Module Code	Credit Points
Managing water organisations	WSM06	5

Target Group	Prerequisites
Young and mid-career professionals with an interest in strategic and operational management of water supply and sanitation organisations (including regulators).	Preferably experience in the water sector. A bachelors degree or equivalent. Basic PC-computer knowledge. Good command of English language.

Assessment

%	Format	(Comment)
60	Oral Exam	Based on an extensive case study of a water utility and its context, the students will develop a strategy plan for that organization based on the topics learned in the module
20	Assignment	Research assignment: Students will develop a small research project based on a given research question. The students will develop these assignments by undertaking interviews with Dutch water organizations
20	Assignment	Students will have to develop and reflect on strategic plans in the different phases of a simulation game

Learning Objectives

Upon completion of the module participants will be able to..

- Relate academic debates concerning water supply and sanitation provisioning to the management of water organizations
- Explain the position and strategy of a water organization in relation to its institutional environment.
- Diagnose challenges for a water organization in relation to its context and develop strategic plans accordingly, including the management of change.
- Apply leadership and influence skills in managing organizations
- The course is built up of three blocks. The first block focuses on understanding the water services sector in which a water organization develops. During this block the regulatory and policy context of water organizations is elaborated upon. During the second block, the module focuses on specific elements of organizational management. This includes strategic management, change management, human resources management and customer management. The third part of the modules focuses on management skills of the individual. In particular the topic of leadership is examined



Topics and Learning Activities

TOPIC: The Water Supply and Sanitation Sector

DESCRIPTION: Policy analysis, Regulatory Models, Public Sector Reform,

TOPIC: Water Organisations at Work

DESCRIPTION: Strategic Management, Performance Analysis (including benchmarking), Human Resources Management, Customer Management (billing/collection and commercial losses)

TOPIC: Management Skills in a Water Organization

DESCRIPTION: Leadership and managing teams

Lecturing Material

- Students will be provided a list of articles that are required reading. It should be noted that students are expected to read and understand a considerable number of articles during this module. In addition, the module will make use of power point presentation, case studies and a simulation game.

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Schwartz, K.H.

Module Name		Module Code		Credit Points						
Managing water organisations		WSM06		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
	Sector overview	3						3	9	Schwartz
	Performance	1		2				3	5	Schwartz
	Policy Analysis	3						3	9	Schwartz
	Regulatory Models							0	0	Guest lecturer
	Public Sector Reform	3						3	9	Schwartz
	Strategic Management	3						3	9	Schwartz
	Water Utility Simulation Game	1	7					1	10	Tutusaus/Schwartz
	Benchmarking	1						1	3	Tutusaus
	Benchmarking Game			4				4	4	Tutusaus
	Change Management	3						3	9	Mels
	Human Resources Management	3						3	9	Guest Lecturer
	Customer Management	3						3	9	Blokland
	Water Utility Research Assignment	1	23					1	26	Tutusaus/Schwartz
	Leadership and Influence	6						6	18	Guest Lecturer
	Introduction Exam	1						1	3	Tutusaus
Total		32	30	6	0	0	0	38	132	

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ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water quality management
Module Coordinator: Kelderman, P.

Module Name	Module Code	Credit Points
Water quality assessment	ES06W	5

Target Group	Prerequisites
Young and mid-career professionals (scientists, consultants, decision makers) with a background in Water management or Environmental science.	Preferably a bachelors degree in chemistry, chemical engineering, biology, environmental science, hydrology, geography or equivalent. Basic knowledge in computer operations (MS-Windows; Office). Good command of English.

Assessment

%	Format	(Comment)
60	Written Exam (closed book)	Topics: Surface water quality monitoring; Data handling; Groundwater quality monitoring.
15	Assignment	Groupwork: presentation on Case study - design of a sustainable water quality monitoring programme in a specific river basin in a developing country
10	Lab Report	Written individual report on field/labwork.
15	Assignment	Written individual report on Exercise - GIS Water quality model of the Scheldt river basin.

Learning Objectives

Upon completion of the module participants will be able to..

- Describe different water pollutant groups, their risks and fates, and ways of modelling these fates
- Describe and apply the different tools, criteria and assessment methods for successful monitoring of surface waters in river basins
- Describe and apply groundwater quality monitoring concepts
- Design sustainable water quality monitoring programmes for river basins



Topics and Learning Activities

TOPIC: Water quality monitoring

DESCRIPTION: Water quality variables.

Natural water quality and pollution variables.

The monitoring cycle. Items of the monitoring programme: why, what, where, how, how often. Physico-chemical and biological water quality monitoring.

Basic concepts and applications of Aquatic Ecotoxicology in Water quality monitoring.

Monitoring in the EU Water Framework Directive.

Workshop: Recent trends in Water Quality monitoring: use of mobile phones; GIS; low cost instruments such as sensors; case studies and examples.

Exercise: optimization of water quality monitoring programmes. Group work: design of a river basin monitoring network.

Practical field&lab work: sampling, preservation, field analyses; Quality control in the laboratory.

Learning Activities:

Lectures, exercises, workshop, group work, lab and fieldwork

TOPIC: Optimization of water quality monitoring networks

DESCRIPTION: Design of a water quality monitoring network: objectives; requirements; cost, etc. Compliance checks. Dimension of a network; consistency, representativity. QA/QC; optimization and modernization; relevant trends. Different steps in optimization programmes.

Case studies and examples. Classroom exercise monitoring in an Ugandan wetland.

Learning Activities:

Lectures; classroom exercise

TOPIC: Data analysis and presentation

DESCRIPTION: Use of statistics in water quality monitoring. Statistical tests: z-test; t-test, confidence intervals, etc. Hypothesis setting. Non-parametric statistics. Applications: minimum sampling frequency; significant differences between data sets, correlation between variables, etc.

Introduction to more advanced techniques such as ANOVA and FACTOR analysis.

Presentation of data.

Hands-on computer exercises

Learning Activities:

Lectures, workshops, exercises

TOPIC: Groundwater quality monitoring

DESCRIPTION: Basics of hydrogeology. Pollutants reactions and transport in groundwater. Design of a groundwater monitoring network; surveys; design and installation; locations; monitoring frequency; optimization.

Learning Activities:

Lectures

TOPIC: Water quality modelling

DESCRIPTION: Introduction to Modelling: types of models and model components.

BOD-DO modelling in a river.

Spatial-Dynamic Modelling of nitrate in the Scheldt Catchment, using a GIS based nutrient model. Modelling point and non-point sources. In-class exercise.

Learning Activities:

Lectures, computer exercises

TOPIC: Field trips

DESCRIPTION: (Liable to change): half-whole day visit(s) to water quality monitoring and modelling Institutions.

Learning Activities:

Field trips

Lecturing Material

- P. Kelderman (2011) - Water quality and monitoring. UIHE lecture notes LN5/11/1.
- C.A.M. van Gestel (2014) - Handout Aquatic Ecotoxicology.
- P. Kelderman and A. Houben- Michalkova - Hand outs on network design and its optimization.
- P. Kelderman (2014) - Handout Design of a Water Quality Monitoring Network in a River Basin.



- P. Kelderman (2014) - Handout Data handling and presentation.
- J. van der Kwast (2014) - Exercises Water Quality Assessment using GIS-based modelling
- J. van der Kwast (2014)- Handout Introduction to Modelling/Nitrate modelling in the Scheldt basin.
- G.F. Kruis and P. Kelderman (2012) - Handout Fieldwork water quality monitoring and Laboratory QA/QC. Febr. 2012.
- J.W.A. Foppen (2014) - Handout groundwater quality monitoring.
- Compiled power point slides on all above topics; exercise materials; additional materials: relevant info, field trips materials, etc.

Scientific software

Excel, GIS



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water quality management
Module Coordinator: Kelderman, P.

Module Name		Module Code		Credit Points						
Water quality assessment		ES06W		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Water Quality Monitoring							0	0	
1.1.	Introduction			3				3	3	<i>Kelderman</i>
1.2.	Water quality monitoring and assessment	11		4	8			23	53	<i>Kelderman, van Gestel, Houben, Kruis</i>
1.3.	Case study water quality monitoring						4	4	12	<i>Kelderman, Houben</i>
1.4.	Workshop - New trends			4				4	4	<i>Alfonso, Gettel</i>
2	Data analysis and presentation	6		6				12	24	<i>Kelderman, van Dam</i>
3	Water Quality Modelling			2	8			10	18	<i>van der Kwast/Kelderman</i>
4	Groundwater quality monitoring	6		2				8	20	<i>Foppen</i>
6.	Design of water quality monitoring network					8		8	8	
	Exam		3					0	3	
	Total	23	3	21	16	8	4	72	145	

(c) UNESCO-IHE 2015/2017-ES06W: Water quality assessment



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Conflict Management
Module Coordinator: Shubber, Z.S.

Module Name	Module Code	Credit Points
Water Conflict Management II	WCM07	5

Target Group	Prerequisites
Current and future water managers, decision-makers and others involved in water management wanting to broaden their scope in water management. Professionals involved in dispute resolution wanting to broaden the scope of their activities to include water. Students need to have a first degree in a relevant subject (economics, social sciences, law, engineering, biology etc.) and preferably several years of relevant working experience.	Knowledge and appreciation of the principles of integrated water resources management, the water resources system and water governance.

Assessment

%	Format	(Comment)
40	Assignment	Essay
10	Skills assessment	Skills assessment
50	Written Exam (closed book)	Exam

Learning Objectives

Upon completion of the module participants will be able to..

- Explain, discuss and analyse the basic concepts of conflict management and conflicts related to water.
- Critically analyze cases of water sharing and use among different actors at different levels and from different sectors, from a conflict and cooperation perspective.
- Identify, explain and analyze particular elements of a negotiation process applied to the management of a water conflict.
- Explain and discuss the advantages of mediation processes, and prepare, organize and engage in them as a party and as a mediator for the resolution of shared water disputes.
- Apply a set of skills and tools required for water conflict management through a negotiation process.



Topics and Learning Activities

TOPIC: Introduction

DESCRIPTION: This module focuses on various processes of conflict resolution. In particular it teaches the students how to design and manage a mediation process as well as other processes that can be used in transboundary water management. It ends with a role play in which the students design and manage the processes, using the skills they have acquired. The module also presents relevant case studies. Students are also required to write an essay on a relevant topic.

Learning Activities:

During the first half of the day, the module, its structure and objectives will be introduced to the students.

The expectations of the students will be collected and discussed.

The profiles of the various trainers and visiting lecturers will be presented.

TOPIC: Enhancing negotiation and conflict resolution skills

DESCRIPTION: The lectures will build on the negotiation skills developed in the first module. They will go more in depth on certain aspects of negotiation and deal with issues such as: the various types of water conflicts; common errors and success-factors in negotiations; preparing for negotiations; the notion of adaptive negotiator; developing a negotiation strategy and confidence building initiatives.

Learning Activities:

The lectures will focus on a more in-depth understanding of prevention and resolution of international water disputes, as well as the actual potential role that the participants could play in such processes. There will be a role play with a water crisis erupting and the government having to conduct crisis-management including a press conference.

TOPIC: Mediation techniques applied to water issues

DESCRIPTION: Environmental and water conflicts often involve more than two parties and are multi-layered in content, therefore it is crucial to suit the process to the conflict at hand (Negotiation, Mediation, Public participation, Facilitation, Consensus Building, or any combination thereof). Mediation is among the processes, well suited for two or more parties and multi-issues, which are involved in environmental and water conflicts when engaging in the attempt to resolve local, regional and international conflicts. It is important that the parties in dispute over water enter the suitable process voluntarily, knowing that if they reach an agreement, they will be accountable for its implementation. Mediation plays an important role in national and international conflicts.

Learning Activities:

The lecture will focus both on theory of negotiation and mediation and the analytic tools necessary to become a successful negotiator and mediator. The mediator has to learn to assess the conflict, identify the interests of the parties, identify other stake holders (other countries, international organizations, etc.), and conduct the mediation process.

TOPIC: Cases of transboundary water conflicts or cooperation

DESCRIPTION: Presentation of case studies on transboundary water conflicts or cooperation.

Learning Activities:

Relevant case studies will be presented and discussed in class.

TOPIC: Final role play

DESCRIPTION: The purposes of the game are to make participants aware of the various aspects (technical, managerial, political) related to the management of transboundary waters; the complexity of applying integrated and participatory approaches in decision making; the complexity of managerial, technical and human aspects of negotiations, consensus building, stakeholder participation and dialogue processes in relation to the management of water resources.

Learning Activities:

The actors in the game have personal and confidential instructions outlining their goals and, partly, how they relate to other actors. The instructions also contain strategic information, regarding available means, goals to be achieved, alliances to be created etc. Consensus building is the key and will require strong focus on confidence and relationship building and strategies to deal with conflicting goals. The creativity of each actor to seek innovative solutions will be essential. Debriefing will take place during and immediately after the formal negotiations.

TOPIC: Essay

DESCRIPTION: The students will be required to write an essay on a topic related to water conflict management based on relevant scientific literature. They will have to submit it after the end of the module. For the students who followed WCM I, the essay will be based on their work for the annotated bibliography. The essay will have to include the following elements: introduction of the topic defining a precise problem statement, research question or hypothesis; review presenting the main ideas and issues on the debate, i.e. outlining the different positions or view points and interests at stake; discussion in which they give their own point of view on the topic; a conclusion; and a reference list and bibliography.

Learning Activities:

To formulate a relevant and well-defined topic for an essay, and a related well-defined objective. To identify, select, read, process, and analyse relevant research papers and scientific literature on a selected topic. To write a well-structured and coherent scientific text, and present a



summary to fellow students and staff.

Lecturing Material

- Negotiation and Mediation, Theory and Skill. Workbook. The Israel Center for Negotiation and Mediation, Haifa.

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Conflict Management
Module Coordinator: Shubber, Z.S.

Module Name		Module Code		Credit Points						
Water Conflict Management II		WCM07		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction			2				2	2	Shubber
2	Enhancing negotiation skills	12		12				24	48	TBC
3	Mediation techniques applied to water issues	6		12				18	30	Kowarsky
4	Case studies			6				6	6	TBC
5	Final role play			14				14	14	Bring
	Essay		30					0	30	Shubber
	Exam		3					0	3	Shubber
Total		18	33	46	0	0	0	64	133	

(c) UNESCO-IHE 2015/2017-WCM07: Water Conflict Management II



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Resources Management
Module Coordinator: Graas, S.

Module Name	Module Code	Credit Points
Water systems modelling	WRM07	5

Target Group	Prerequisites
Young and mid-career professionals, managers, engineers and technicians dealing with or interested in various aspects of water resources modelling.	Affinity with quantitative approaches is required. Good command of English.

Assessment

%	Format	(Comment)
60	Written Exam (open book)	Based on two selected journal articles.
40	Presentation	Boased on one of the models developed in the module.

Learning Objectives

Upon completion of the module participants will be able to..

- Describe the procedure of the modelling protocol.
- Name and explain type of models used in different case studies.
- Build water resources models that simulate water management systems.
- Clearly present the results of the water system models.
- Critically analyse model outcomes.



Topics and Learning Activities

TOPIC: Water system modelling - Concepts

DESCRIPTION: Introduction to water system modelling concepts, including procedure in the modelling protocol, different types of models (prescriptive vs descriptive, stochastic vs conceptual, lumped vs distributed), calibration and validation procedures, performance indicators and available software packages.

Learning Activities:

Lectures supported by ppt and book chapters.

TOPIC: Water system modelling - Practice

DESCRIPTION: Application of 3 different models. A hydrological model (HBV); a water allocation model (Waflex) and a hydraulic model (Mike-11) will be build and tested after which the output will be analysed and interpreted. The developed models will increase the understanding of the participants in the possible applications of water system modelling within the concept of integrated river basin management. One of the models has to be chosen to be presented and critically discussed during an oral exam.

Learning Activities:

Interactive computer workshops.

TOPIC: Paper discussion

DESCRIPTION: Read two journal articles on the topic (selected by the lecturers) which are discussed during a session. The discussion will focus on the relevance of the modelling theory applied to the article in question, to appreciate the advantages of modelling for water resources management and to be able to understand, analyse and interpret model results.

Learning Activities:

Discussion.

TOPIC: Fieldtrip

DESCRIPTION: A relevant organisation will be visited where the use of quantitative data, monitoring and models for their work will be illustrated.

Learning Activities:

Excursion.

TOPIC: Case studies

DESCRIPTION: Several guest lecturers will come and share their experience with respect to modelling water systems.

Learning Activities:

Lectures supported by ppt (and hand-outs).

Lecturing Material

- Loucks, D.P. and Van Beek, E. 2005. Water Resources Systems Planning and Management, UNESCO-publishing.
To be studied: Chapter 2,3,9 and 11.
- Mul, M.L. – Spreadsheet modelling, UNESCO-IHE Lecture Notes.
- Other handouts: Selected background reading.
- Software applications: HBV, WAFLEX (MS Excel), MIKE 11.

Scientific software

HBV, WAFLEX, MIKE 11



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Resources Management
Module Coordinator: Graas, S.

Module Name		Module Code		Credit Points						
Water systems modelling		WRM07		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Water system modelling - Concepts							0	0	
1.1	Why model	2						2	6	Graas
1.2	Modelling process	4						4	12	Graas
1.3	Calibration and Uncertainty analysis	2						2	6	Masih
1.4	Types of models	2						2	6	Masih
1.5	Examples of Software Packages for Water Systems Modelling	2						2	6	Popescu
1.6	Explanation assignment and Q&A session		2					0	2	Graas, Masih, Popescu
2	River Basin Simulations - Practice							0	0	
2.1	HBV (rainfall-runoff)				12			12	24	Masih
2.2	Waflex (water allocation)				12			12	24	Graas
2.3	Mike 11 (flood)				12			12	24	Popescu
3	Paper discussion	4						4	12	Graas, Masih
4	Field trip					8		8	8	Graas, Smits
5	Case studies							0	0	
5.1	Land use modelling & optimisation			4				4	4	Yong
5.2	New data sources for modelling			4				4	4	Alfonso
6	Exam		3					0	3	
Total		16	5	8	36	8	0	68	141	

(c) UNESCO-IHE 2015/2017-WRM07: Water systems modelling



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: WM - WSM
Module Coordinator: Schwartz, K.H. (Klaas)

Module Name	Module Code	Credit Points
Environmental Governance and Water Services	WSM07	5

Target Group	Prerequisites
Mid-career professionals dealing with planning and management aspects of water supply and sanitation infrastructure, working for municipalities, ministries, water and sewerage agencies or consulting firms.	Preferably a relevant water science or engineering related bachelor's degree or equivalent and some relevant experience.

Assessment

%	Format	(Comment)
50	Assignment	
50	Oral Exam	

Learning Objectives

Upon completion of the module participants will be able to..

- Discuss the components that make up the urban water cycle and urban water systems
- Explain and employ the basic ecological and social science perspectives of integrated urban water management
- Discuss the potential impacts of climate change and anthropogenic impacts on the urban water cycle
- Discuss the interactions between the urban water cycle and the broader hydrological cycle
- Analyze the complexities and conflicts involved in integrated management of urban water systems



Topics and Learning Activities

TOPIC: The Urban Water Cycle

DESCRIPTION: The first block of topics introduces the main concepts of the urban water cycle, urban water systems and integrated urban water management.

Learning Activities:

Lectures and fieldvisits

TOPIC: Urban Water Systems and the Broader Hydrological Cycle

DESCRIPTION: The second block of topics places the urban water system a broader context. This context includes developments like climate change, anthropogenic impacts and urban-rural linkages. Urban-rural linkages, Climate Change, Anthropogenic Impacts, Adaptation and Resilience of Urban Water Systems

Learning Activities:

Lectures and fieldvisits

TOPIC: Complexities and Conflicts of Integrated Urban Water Management

DESCRIPTION: The third block concerns the complexities and conflicts surrounding the integrated management of urban waters.

Learning Activities:

Lectures and fieldvisits

Lecturing Material

- Power point presentations.
- Field visits.
- Articles

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: WM - WSM
Module Coordinator: Schwartz, K.H. (Klaas)

Module Name		Module Code		Credit Points						
Environmental Governance and Water Services		WSM07		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Urban Water Cycle	1						1	3	Bichai
2	Urban Water Systems	4						4	12	Bichai
3	Urban-Rural Linkages	6	4					6	22	Guest Lecturer
4	Climate Change and Water Services	4						4	12	Bichai
5	Anthopogenic Impacts on Water Services	4	4				4	8	28	Bichai
6	Adaptation and Urban Water System	4		4				8	16	Bichai
7	Resilience opf Urban Water Systems	4		4				8	16	Bichai
8	Fieldvisit 1					8		8	8	Bichai
9	Fieldvisit 2					8		8	8	Bichai
10	Fieldvisit 3					8		8	8	Bichai
11	Fieldvisit 4					8		8	8	
12	Exam							0	0	
Total		27	8	8	0	32	4	71	141	

(c) UNESCO-IHE 2015/2017-WSM07: Environmental Governance and Water Services



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Bruggen, J.J.A. van

Module Name	Module Code	Credit Points
Constructed wetlands for wastewater treatment	ES07W	5

Target Group	Prerequisites
Programme target group	Programme prerequisites

Assessment

%	Format	(Comment)
60	Written Exam (closed book)	
40	Assignment	

Learning Objectives

Upon completion of the module participants will be able to..

- assess the value of wetlands and explain the use of natural and constructed wetlands for the treatment of wastewater;
- describe the concept of wastewater treatment by wetlands;
- design and operate a wetland treatment system.



Topics and Learning Activities

TOPIC: Introduction on natural wetlands

DESCRIPTION: what are wetlands, where are wetlands, wetland ecology, biodiversity, economics. The role of wetlands in the catchment: general aspects, hydrological aspects, wetlands as buffers and the role in relation to climate.

Learning Activities:

lectures, and video presentations.

TOPIC: Natural wetlands for wastewater treatment

DESCRIPTION: the basic principles, the advantages and disadvantages, the risks. Examples in a temperate climate and examples in the tropics.

Learning Activities:

lectures, and video presentations.

TOPIC: Constructed wetlands for wastewater treatment

DESCRIPTION: the different types, the design and criteria for design. Advantages and disadvantages. Constructed wetlands in The Netherlands, the tropics and the rest of the world.

Learning Activities:

lectures, and video presentations, field trip

TOPIC: Integrated wetland production systems

DESCRIPTION: theory, examples, advantages, disadvantages, economics, nutrient flows. Modelling of integrated production systems. Field visits.

Learning Activities:

lectures, and video presentations, assignment

Lecturing Material

- Lecture notes and case studies

Scientific software

None



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Bruggen, J.J.A. van

Module Name		Module Code		Credit Points						
Constructed wetlands for wastewater treatment		ES07W		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction into the module	1						1	3	
2	Wetlands	8	2					8	26	
3	Wastewater treatment aspects	6						6	18	
4	Natural wetlands for water treatment	4						4	12	
5	Constructed wetlands	14						14	42	
6	Integrated production systems	6						6	18	
7	design					16		16	16	
8	Exam		3					0	3	
Total		39	5	0	0	16	0	55	138	

(c) UNESCO-IHE 2015/2017-ES07W: Constructed wetlands for wastewater treatment



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Raj, E.R. (Eldon)

Module Name	Module Code	Credit Points
Environmental engineering	ES07T	5

Target Group	Prerequisites
Programme target groups (MSc and short course participants) having background in Environmental Sciences, Chemical or Civil Engineering	- Basic knowledge in mathematics, including calculus, linear algebra and differential equations - Strong fundamentals in chemistry and biology - Fundamental understanding of different physical, chemical and biological processes of environmental significance - Confidence to solve problems involving chemical kinetics and design of bioprocesses - Ability to work in a group and contribute to specific assignments

Assessment

%	Format	(Comment)
50	Written Exam (closed book)	Wastewater Treatment and Air Pollution Control
25	Written exam (closed book)	Environmental Process Technology
25	Assignment	Water Treatment and Biological Odour Control

Learning Objectives

Upon completion of the module participants will be able to..

- Describe different biological processes and their engineering applications for wastewater treatment;
- Categorize different air pollutants and distinguish the different physico-chemical and biological air pollution control techniques for particulate and gaseous contaminants;
- Apply basic thermodynamic principles to determine reaction rates of environmental processes under a given set of operating conditions;
- Describe the different water treatment methods and with the help of simple examples, evaluate the performance of water treatment plants; and
- Solve problems pertaining to the design and operation of different environmental systems.



Topics and Learning Activities

TOPIC: Water treatment

DESCRIPTION: Water is playing an essential role in relation with the environment and in this module it is shown, how man can actively intervene in its pollution. Man is using several simple and advanced techniques to produce reliable drinking water from groundwater and surface water. The participant will be able to learn the following aspects: (i) Water treatment methods, and (ii) water treatment processes and plants.

Learning Activities:

Lectures, laboratory, assignments

TOPIC: Wastewater treatment

DESCRIPTION: To limit environmental pollution, wastewater has to be treated. An overview of basic processes available for the treatment of domestic and industrial wastewater, with special emphasis on natural processes and systems that can be applied, is taught under the topic wastewater treatment. The following topics will be covered; (i) Anaerobic reactors, (ii) Waste stabilization ponds, (iii) Activated sludge process, (iv) UASB reactor, (v) Photo-bioreactors, and (vi) Design and problem solving tutorials.

Learning Activities:

Lectures, tutorials, laboratory and field trip

TOPIC: Environmental process technology

DESCRIPTION: For a better understanding of water and wastewater treatment the principles of mass balances, reaction kinetics and reactor design are discussed in environmental process technology (EPT). During this lecture, the following topics will be covered; (i) Mass balance analysis, (ii) Ideal batch reactors, (iii) Plug flow reactor, (iv) Stirred tank reactor, (v) Tracer responses in reactors, (vi) Continuous flow reactors with recycle, (vii) Thermodynamics of environmental processes, and (viii) Problem solving tutorials.

Learning Activities:

Lectures, Tutorials for solving problems

TOPIC: Air pollution control

DESCRIPTION: Air pollution and atmospheric air quality in developing countries has been a topic of major concern due to rapid industrialization. The nature of damages caused to human health and the environment due to air pollutants is worsening every year. Therefore, it is important to develop effective technologies for the management and control of air pollution. The following topics will be covered; (i) Classification of air pollutants, (ii) Air pollution control systems: particulate control & gaseous contaminants, and (iii) Biological odour control systems.

Learning Activities:

Lectures, tutorials and field trip

Lecturing Material

- Lecture notes on Water Treatment and assignments topics
- Lecture notes Wastewater Treatment + Tutorials
- Lecture notes on EPT, Problem solving in class
- Lecture notes on Air Pollution Control and powerpoint presentations
- Field trip guidelines and power point from Ecofyt
- Assignment topics, as power point presentations and discussions
- Text book on "Air Pollution Prevention and Control: Bioreactors and Bioenergy" by Christian Kennes and Maria C. Veiga (Wiley).
- Text book titled "Wastewater Engineering: Treatment and Reuse" by George Tchobanoglous, Franklin L. Burton and H. David Stensel (Metcalf and Eddy)
- Text book titled "Chemical Reaction Engineering" by O. Levenspiel

Scientific software

None



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Raj, E.R. (Eldon)

Module Name		Module Code		Credit Points						
Environmental engineering		ES07T		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
	Water Treatment	3			16			19	41	Jan Peter Buiteman, Peter Kelderman
	Wastewater Treatment	9			16	8		33	67	Raj, vBruggen, Kelderman, Vossenber
	Environmental Process Technology	8						8	24	Peter van der Steen
	Air Pollution Control	3	1					3	10	Eldon R. Rene
	Exam							0	0	
	Total	23	1	0	32	8	0	63	142	

(c) UNESCO-IHE 2015/2017-ES07T: Environmental engineering



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Resources Management and Water Conflict Management
Module Coordinator: Cauwenbergh, N.J.M. van

Module Name	Module Code	Credit Points
Water resources planning	WRM08	5

Target Group	Prerequisites
Young and mid-career professionals, managers, engineers and technicians who have the ambition to judge, participate in and guide multi-disciplinary water resources planning studies.	Understanding of the water resources physical system. Understanding of water use for agriculture, water supply, hydropower and environment. Understanding of water governance. Computer literacy. Good command of English.

Assessment

%	Format	(Comment)
60	Written Exam (closed book)	
40	Assignment	This includes assignments and exercises

Learning Objectives

Upon completion of the module participants will be able to..

- Explain basic concepts and notions in water resources planning.
- Describe major steps in the participatory and integrated water resources planning process.
- Identify and apply tools and models, such as stakeholder integration, environmental impact assessment (EIA), decision support systems, role plays and water system models, while engaging in water resources planning activities.
- Develop alternative water management strategies and compare and evaluate them by applying multi-criteria analysis.
- Discuss water resources planning and implementation in basins for specific context with special attention to basins in a developing country context.



Topics and Learning Activities

TOPIC: Introduction to Water Resources Planning:

DESCRIPTION: Principles of integrated water resources planning. Common notions used in planning (e.g. water resources system analysis, water policy, national/river basin/project plans, strategy, measures, scenarios, robustness, with and without project, sustainability). Planning scales and approaches. Introduction to the case studies used in the module. Introduction to planning and strategy development by using the LIBRA Role Play.

Learning Activities:

The learning activities include lectures, exercises, assignments and role play simulation game using LIBRA model. There will be a field trip to a relevant Institution in the field of water resources planning.

TOPIC: Framework of analysis for Water Resources Planning:

DESCRIPTION: Comprehension of frameworks used in water resources planning with focus on key steps in the planning process, such as situation and function analysis including multi-level stakeholder and water sector analysis, planning objectives and criteria, scenario and strategy development, role of modelling in water resources planning, evaluation (screening) of alternatives and strategies and multi-criteria analysis. Importance of stakeholder participation in the planning process, opportunities and limitations. Tools and methods for stakeholder participation in key steps of the planning process including participatory decision support systems. Negotiation and compensation in group decision making. Plan implementation and evaluation. The evolution of and experience with participatory and integrated planning methods will be demonstrated through case study examples.

Learning Activities:

The learning activities include lectures, exercises and assignments, interactive (computer) workshops, use of decision support system (Altaguax DSS). There will be a field trip to a relevant Institution in the field of water resources planning.

TOPIC: Environmental Assessment:

DESCRIPTION: Environmental impacts of water resources development projects, principles and methods of environmental impact assessment, introduction to strategic environmental assessment (SEA), environmental impact assessment (EIA) and its application in water resources planning.

Learning Activities:

The learning activities include lectures, exercises and assignments and group discussions.

TOPIC: Experiences in the water resources planning in the global south:

DESCRIPTION: Case studies and discussion on practices, challenges and opportunities for water resources planning in the global south.

Lecturing Material

- D. P. Loucks, E. van Beek, J. R. Stedinger, J. P. M. Dijkman, and M. T. Villars. 2005. Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications. UNESCO Publishing, Paris.
- J.C. Heun and N. Van Cauwenbergh – Participatory Integrated Water Resources Planning: Framework for Analysis and Stakeholder integration, UNESCO-IHE Lecture Notes.
- L. C. Beevers and H. Clouting - Environmental Assessment: Environmental Impact Assessment (EIA) & Strategic Environmental Assessment (SEA), UNESCO-IHE Lecture Notes.
- CapNet and GWP (2005). Integrated Water Resources Management Plans: Training manual and operational guide. http://www.cap-net.org/sites/cap-net.org/files/Manual_english.pdf.
- Software: LIBRA River Basin Planning Simulation, Excel Spreadsheets, Altaguax DSS, Expert Choice (MCA).
- Other Handouts: Examples of case studies, Selected background reading.

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Water Resources Management and Water Conflict Management
 Module Coordinator: Cauwenbergh, N.J.M. van

Module Name		Module Code		Credit Points						
Water resources planning		WRM08		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction to Module and Framework for analysis	10	5	12				22	47	Van Cauwenbergh
2	Models, methods and tools for Water Resources Planning:							0	0	
3	Use of models in WRP	4						4	12	Masih
4	LIBRA role play and MCA			10				10	10	Heun / Masih
5	Environmental Impact Assessment	4	5	8				12	25	Clouting / Vis
6	Experience in water resources planning in the global south-case studies and dis	4	16	12				16	40	van Beek / Douven/ Guest lecture
7	Field Trip					7		7	7	Masih and Hofstra
8	Exam		3					0	3	
Total		22	29	42	0	7	0	71	144	

(c) UNESCO-IHE 2015/2017-WRM08: Water resources planning



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Tutusaus Luque, M. (Mireia)

Module Name	Module Code	Credit Points
Financial management in the water sector	WSM08	5

Target Group	Prerequisites
Staff from water organisations and other related sector institutions, who are interested in financial management of water related enterprises.	Preferably a relevant water science, economics or finance related bachelor degree; Some experience in the water sector; Good command of the English language.

Assessment

%	Format	(Comment)
65	Written Exam (open book)	
20	Assignment	In this assignment you will work in groups to develop a business plan proposal to finance the construction and operation of a water infrastructural project. For this assignment you will need to identify funding and financing possibilities based on a business case provided to you.
15	Assignment	In this assignment you will analyse the financial position of a water organization and, based on that analysis, provide feedback to different interest groups such as shareholders, donors, lenders and consumers on the financial position of the utility, the attractiveness for creditors and investors or management practice

Learning Objectives

Upon completion of the module participants will be able to..

- Differentiate financial trends in the water sector through a historical perspective
- Analyze the financial position of a water organisation through an analysis of financial statements.
- Define project finance and identify risks allocation in the development of a (finance) project
- Develop business case for a water related project by selecting appropriate financing mechanisms and developing a risk profile
- Recognize and implement financial controlling tools to the specific needs of a water organization



Topics and Learning Activities

TOPIC: Finance in the water sector into perspective

DESCRIPTION: During these sessions we introduce and debate increasingly prominent discussions related to finance in the water sector such as: the peculiarity of the water sector, the balancing social and commercial objectives and the increased relevance of innovative financing mechanisms in the sector such as blended finance

Learning Activities:

lecture, article discussion

TOPIC: Finance analysis and accounts management

DESCRIPTION: In order for participants to relate to ongoing discussions in the sector, during these sessions we cover the basics of accounting and bookkeeping, identification of financial statements to elaborate in more detail on the analysis of these statements in order to assess the financial situation of a (water) organization

Learning Activities:

lecture, exercise, assignment

TOPIC: Project finance

DESCRIPTION: Provided the capital required for water infrastructure development and the nature of the sector, project finance has increasingly gained strength as an opportunity to create funding and financial possibilities. In these sessions we discuss the basics of project finance, the elements of a business plan, the building factors of a business case, the development of project finance contractual arrangements, risk mitigation and distribution

Learning Activities:

lecture, exercise, assignment

TOPIC: Financial control and integrity

DESCRIPTION: During these sessions we discuss the importance of financial control, pricing, costing and its relevance and relations to integrity

Learning Activities:

lecture, exercise, assignment

Lecturing Material

- Lecture notes, Powerpoint presentations.
- Related scientific articles (to be defined at the beginning of the course)
- Reference books.

Scientific software

Financial modelling (based on Excel)



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Tutusaus Luque, M. (Mireia)

Module Name		Module Code		Credit Points						
Financial management in the water sector		WSM08		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction to Financial Management	6						6	18	Tutusaus
2	Finance and accounts management	10		4				14	34	Guest lecturer
3	Water pricing and costing	5		4				9	19	Tutusaus
4	Project Finance	10		4				14	34	Guest Lecturer
5	Integrity in the water sector	4						4	12	Evers
6	Project Finance, group exercise	2	10					2	16	
7	Individual assignment	2	6					2	12	
8	Exam		3					0	3	
Total		39	19	12	0	0	0	51	148	

(c) UNESCO-IHE 2015/2017-WSM08: Financial management in the water sector



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Evers, J.G. (Jaap)

Module Name	Module Code	Credit Points
Environmental planning and implementation	ES08MW	5

Target Group	Prerequisites
Young and mid-career professionals (scientists, decision-makers) with a background in environmental management, water management and / or watershed management.	Affinity with environment policy and enforcement, development economics, and preferably experience in water management arena. Good command of English.

Assessment

%	Format	(Comment)
55	Written Exam (closed book)	- Globalization of water - Environmental Planning, Spatial Planning - Environmental Policy & Enforcement - Environmental Assessment (EIA-SEA)
30	Assignment	Environmental Economics
15	Assignment	Policy Plan Analysis

Learning Objectives

Upon completion of the module participants will be able to..

- Explain the concept and importance of sustainable development into environmental planning and management
- demonstrate basic knowledge on the principles, processes and methods of environmental assessment (EIA-SEA) and be able to apply them in water related plans, programmes and projects
- Apply and discuss economic valuation methods and policy instruments for environmental policy
- Apply basic theories behind policy enforcement, monitoring and evaluation to master effective environmental policies
- Use environmental information systems to support planning and management



Topics and Learning Activities

TOPIC: Globalization of Water

DESCRIPTION: Water footprints, inter dependencies of various sectors

Learning Activities:

Face-to-face lecture, role plays, exercises, case studies group work, presentations

TOPIC: Environmental Planning Process, Spatial planning

DESCRIPTION: Planning processes, theory of environmental planning, land use planning, issue of scale and its importance, watershed planning

Learning Activities:

Face-to-face lecture, role plays, exercises, case studies group work, presentations

TOPIC: Environmental Assessments (EIA/SEA)

DESCRIPTION: introduction of environmental and social impact assessment for projects, plans and programme, and its application in water development programmes and projects.

Learning Activities:

Face-to-face lecture, role plays, exercises, case studies group work, presentations

TOPIC: Environmental Economics

DESCRIPTION: Economic valuation methods, and economic tools for the management of natural (water) resources

Learning Activities:

Face-to-face lecture, exercises, Assignment

TOPIC: Environmental Policy Implementation

DESCRIPTION: Constraints in policy implementation, Monitoring, setting indicators etc

Learning Activities:

Case studies, Exercises, groupwork

Lecturing Material

- Lecture Notes
- Additional Reading Materials
- Lecture powerpoint slides

Scientific software

None



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Evers, J.G. (Jaap)

Module Name		Module Code		Credit Points						
Environmental planning and implementation		ES08MW		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Globalization of Water	2		4				6	10	Hoekstra
2	Environmental Planning	10	8					10	38	Hamdard, Evers
3	Environmental Economics	6	8					6	26	Bijlsma
4	Environmental Assessment (EIA/SEA)	2		4				6	10	Hamdard
5	Environmental Policy Implementation & Monitoring	10		8				18	38	Hofstra, Guest lecture
6	design					8		8	8	Hamdard
7	Exam		3					0	3	
Total		30	19	16	0	8	0	54	133	

(c) UNESCO-IHE 2015/2017-ES08MW: Environmental planning and implementation

WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Tutusaus Luque, M. (Mireia)

Module Name International fieldwork	Module Code WM09	Credit Points 5
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Target Group	Prerequisites
<p>This module is required for all participants in the Water Management programme. Participants of the WQM specialisation may choose to participate in the fieldtrip of the Environmental Science. In this case, they will also follow the Environmental Science Groupwork.</p>	<p>Bachelor's degree. Basic computer skills (MS-Windows, Office) Good English command. Basic knowledge of IWRM and EU FWD.</p>

Assessment

%	Format	(Comment)
30	Presentation	A presentation on the research questions and methodology. After a brief literature review, the research questions and methodology on a given theme of the Andarax basin will be formulated and presented by the group. The methodology will be carried out during the fieldwork in the Andarax basin. Pass / Fail
40	Presentation	A preliminary presentation on the initial findings and results of the problem analysis will be given at the end of the first week in the Andarax basin. Pass / Fail
30	Assignment	A report will have to be submitted describing, presenting and analysing a water management issue in the Gardiana basin. Pass / Fail

Learning Objectives

Upon completion of the module participants will be able to..

- Compare the different water management perspectives and uses in practice in Spain and Portugal. Issues that will be elaborated upon during the fieldwork include Multiple uses for and multiple sources of water; Up and downstream water issues; Institutional framework and implementation of the EU WFD; Public and private water supply; Conventional and alternative waste water treatment and reuse; Large Dams and transboundary river basin issues; Ancient vs modern irrigation and water supply systems; Non conventional water resources: desalination and wastewater reuse; Formal and informal decision making processes.
- Formulate a problem statement
- Collect and analyse data from field measurements and interviews
- Develop a problem analysis



Topics and Learning Activities

TOPIC: General info

DESCRIPTION: During two weeks, students will visit institutions and stakeholder groups in the Andarax and Guadiana basins in Spain and Portugal. The purpose of these visits is to familiarize students with technical (physical, chemical, biological and engineering) and non-technical (legal, social, economic, cultural, financial, institutional and managerial) aspects of water management and the interactions between them.

TOPIC: Problem analysis of Andarax basin

DESCRIPTION: The fieldwork in the Andarax basin is linked with the Water Management groupwork in August. As such, the fieldwork fulfills a double role. Students are asked to develop a clear problem analysis for a given water management theme in the Andarax basin. This problem analysis feeds into the groupwork where an integrated management plan for the Andarax basin will be developed.

Prior to going to the Andarax basin, participants will prepare for the fieldwork through literature review, lectures and discussion. On the basis of these activities, the group will formulate research questions and methodology to accomplish a thorough problem analysis. During the fieldwork in the Andarax basin, data will be collected during the visits to various institutions and stakeholder groups. This means that participants have to ask questions, ask for data, collect information, etc., that will be used for the problem analysis.

TOPIC: Fieldwork

DESCRIPTION: Good water management is founded on reliable data. The person making measurements has the responsibility of ensuring that raw data of an acceptable quality is collected. During this fieldwork a number of discharge measurements and physicochemical water quality parameters will be determined at selected points by direct measurements. The data collected will be analysed to gain insight into the topography (land use, geology, users, etc.), hydrology and water quality of the catchment, and identifying some of the mechanisms that determine this water quantity and quality.

TOPIC: Guadiana - Large infrastructure and transboundary issues

DESCRIPTION: The visits in the Guadiana basin focus on the issues related to transboundary water management and the design, implementation and governance of large dams. Both Spanish and Portuguese water managers will comment on the established (or absence of) collaboration on management of quantity and quality of water flowing across the Spanish/Portuguese border. Negotiation and conflict resolution in place will be discussed with experts. Authorities and stakeholders will comment on technical, socio-economic and governance issues of the dam and its relation to upstream and downstream development.

Lecturing Material

- Please visit <http://www.altaguax.org/> for relevant literature

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Tutusaus Luque, M. (Mireia)

Module Name International fieldwork										Module Code WM09		Credit Points 5
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)		
	International fieldwork		60			80		80	140	Various		
Total		0	60	0	0	80	0	80	140			

(c) UNESCO-IHE 2015/2017-WM09: International fieldwork



WATER MANAGEMENT

MASTER PROGRAMME

Academic Year: 2015-2017
Specialization: WM / WCP
Module Coordinator: Shubber, Z.S. (Zaki)

Module Name	Module Code	Credit Points
Research methodology and thesis proposal work	WM09WCP	3

Target Group	Prerequisites
This module is for the participants in the Water Cooperation and Peace programme.	: Knowledge on water governance, conflict management and scientific methods. Good communication skills in English language.

Assessment

%	Format	(Comment)
30	Presentation	A presentation on the research questions and methodology. After a brief literature review, the research questions and methodology on the theme of conflict in the Andarax basin will be formulated and presented by the group. The methodology will be carried out during the fieldwork in the Andarax basin. Pass / Fail
40	Presentation	A preliminary presentation on the initial findings and results of the problem analysis will be given at the end of the first week in the Andarax basin.
30	Assignment	A report with a formulated research question, an outline of the research methodology used during the field trip (data collection and analysis from field measurements and interviews), an outline of the problem analysis, and recommendations for suitable research methods. Propose an outline for a research Proposal based on this work.

Learning Objectives

Upon completion of the module participants will be able to..

- Formulate a problem statement and research question
- Collect and analyse data from field measurements and interviews
- Collect and analyse data from field measurements and interviews
- Compose an outline for a research proposal underpinned by the above work to conduct a Master of Science Thesis.



Topics and Learning Activities

TOPIC: General info

DESCRIPTION: Study concepts on scientific research and different research methods (e.g. field data collection and interviewing techniques), refreshing knowledge and skills on water balance, institutional analysis and conflict management gained in earlier modules. Expedite various research topics available in the water management MSc handbook and discuss the selected topics with respective lecturers. Participate in the field trip and conduct a short research work to develop an in-depth problem analysis.

TOPIC: Fieldwork

DESCRIPTION: During six days field work, students will visit institutions and stakeholder groups in the Andarax basin in Spain. In addition to specific assignment on problem analysis around water conflict theme, these field visits familiarize students with technical (physical, chemical, biological and engineering) and non-technical (legal, social, economic, cultural, financial, institutional and managerial) aspects of water management and the interaction between them. Good water management is founded on reliable data. The person doing the data collection (both from primary and secondary sources) has the responsibility of ensuring that raw data of an acceptable quality is collected. During this fieldwork a number of interviews will be conducted, discharge measurements and physicochemical water quality parameters will be determined at selected points by direct measurements. The data collected will be analysed to gain insight into the topography (land use, geology, users, etc.), hydrology and water quality of the catchment, and identifying some of the mechanisms that determine this water quantity and quality, and identifying water management issues.

TOPIC: Problem analysis of Andarax basin

DESCRIPTION: The fieldwork in the Andarax basin provides an opportunity for the students to in the Andarax basin. This problem analysis feeds into the groupwork done by the Water Management students in August where an integrated management plan for the Andarax basin will be developed. Prior to going to the Andarax basin, participants will prepare for the fieldwork through literature review, lectures and discussion. On the basis of these activities, the students will formulate research questions and methodology with a focus on conflict to support the problem analysis. During the fieldwork in the Andarax basin, data will be collected during the visits to various institutions and stakeholder groups. This means that participants have to ask questions, ask for data, collect information, etc. that will be used for the detailed problem analysis.

Lecturing Material

- Please visit <http://www.altaguax.org/> for relevant literature

Scientific software

None



WATER MANAGEMENT

MASTER PROGRAMME

Academic Year: 2015-2017
 Specialization: WM / WCP
 Module Coordinator: Shubber, Z.S. (Zaki)

Module Name		Module Code		Credit Points						
Research methodology and thesis proposal work		WM09WCP		3						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
Activities		2	20	12	0	48	0	62	86	
Total		2	20	12	0	48	0	62	86	

(c) UNESCO-IHE 2015/2017-WM09WCP: Research methodology and thesis proposal work



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Elective
Module Coordinator: Smit, H. (Hermen)

Module Name	Module Code	Credit Points
Institutional analysis	WRM10	5

Target Group	Prerequisites
Young and Mid-career professionals who are 1) working at middle and upper management level in an organization in the water sector, 2) employed in policy making institutions in the water sector or 3) working for organizations engaged in management of water resources and water services.	Mandatory: High level of ability to read and discuss academic articles and book chapters in English; willingness to engage in social science theory and analytical frameworks. Preferred: completion of the Water Governance module.

Assessment

%	Format	(Comment)
60	Assignment	The Final Assessment is done by way of a written essay. In the essay the participant is expected to use and critique the frameworks for institutional analysis which we discussed in class.
20	Assignment	2 reading assignments
20	Presentation	Presentation (group assignment)

Learning Objectives

Upon completion of the module participants will be able to..

- Analyze the role of institutional arrangements in water management.
- Summarize and compare different approaches to institutional analysis linked to different schools of thought.
- Apply these approaches to better understand how water resources and the control thereof are distributed in specific water management cases.



Topics and Learning Activities

TOPIC: Approaches to Institutional Analysis

DESCRIPTION: This week we discuss what institutional arrangements are and why institutional analysis can be useful. Further we discuss different frameworks for analysis of institutional arrangements to better understand how water resources and the control thereof are distributed.

Learning Activities:

Different approaches to do institutional analysis will be elaborated upon through presentations and tutorials about related scientific articles. One session will be organized to discuss and contrast different approaches to institutional analysis. In the second week two groups will do an institutional analysis using different predetermined frameworks. Both groups will present their analysis. The presentations will be followed by a debate to discuss the opportunities and limitations of the different frameworks used.

TOPIC: Shaping institutions

DESCRIPTION: In this week we discuss how institutions are materially and culturally shaped. Moreover we will zoom in on the phenomena of isomorphism and legal pluralism in the institutional landscape.

Learning Activities:

Lectures will be given on the material and cultural shaping of institutions and on institutional isomorphism and legal pluralism.

TOPIC: Essay assignment

DESCRIPTION: In week 3 the focus is on writing the final essay in which participants use and critique the frameworks for institutional analysis which we discussed in class.

Learning Activities:

The case study assignment will be introduced in a lecture and presentation during the second week of the module. During the third week of the module a session is organised in which questions about the essay assignment are answered.

Lecturing Material

- Students will be provided a list of articles that are required reading. It should be noted that students are expected to read and understand a considerable number of articles (approximately 15). A selection of references is presented below:
- Cleaver, F. 2012. Development through bricolage: Rethinking institutions for natural resources management. Routledge. ISBN 978-1-84407-869-1. 224 pp.
- Leach, M., Mearns, R. and Scoones, I. 1999. Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management, *World Development*, 27(2), pp. 225-247.
- Ostrom, E. 2010. Analyzing Collective Action. *Agricultural Economics* 41(1), pp. 155-166.
- Zwartveen, M., Udas, P.B. and Delgado J.V. 2010. Gendered dynamics of participation in water management in Nepal and Peru: Revisiting the linkages between membership and power. In: Berry, K.A. and Mollard, E. (eds.) *Social participation in water governance and management: Critical and global perspectives*. London, Earthscan: pp 69-92.

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Elective
Module Coordinator: Smit, H. (Hermen)

Module Name		Module Code		Credit Points						
Institutional analysis		WRM10		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction to the Module	1						1	3	Kemerink
2	Institutional Analysis	2						2	6	Smit
3	Institutional Analysis and Development Framework: Ostrom	2						2	6	Van Learhoven
4	Critical institutionalism	2						2	6	Cleaver
5	Knowing knowledge, Why concepts matter	4						4	12	Zwarteveen
6	Institutional Isomorphism	2						2	6	Schwartz
7	Legal Pluralism	2						2	6	Kemerink
8	Case Water User Associations	2						2	6	Kemerink
9	Presentations case analysis and debate			4				4	4	Smit and Kemerink
10	Gender and Institutions	2						2	6	Zwarteveen
11	Institutional Fussyness	2						2	6	Schwartz
12	Socio-technical shaping of institutions	2						2	6	Smit and Zwarteveen
13	Doing Institutional analysis - From Theory to Practice	2						2	6	Smit
14	Assignments		60					0	60	Kemerink and Smit
15	Tutorials			4				4	4	
Total		25	60	8	0	0	0	33	143	

(c) UNESCO-IHE 2015/2017-WRM10: Institutional analysis



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Schwartz, K.H. (Klaas)

Module Name	Module Code	Credit Points
Partnerships for Water Supply and Sanitation	WSM10	5

Target Group	Prerequisites
Professional staff active in water related institutions, such as governmental bodies, NGOs, consultancy firms, research institutions and water utilities. Future professionals, such as promising bachelor students.	Preferably a water science, economics or management related bachelor degree; Experience in the water sector; Good command of the English language.

Assessment

%	Format	(Comment)
30	Assignment	
20	Skills assessment	
50	Oral Exam	

Learning Objectives

Upon completion of the module participants will be able to..

- Explicate the rationale for partnerships in the water sector.
- Describe and explain the historical evolution of partnerships in the water sector.
- Recognise and explain different partnership forms present in the water sector, including PPPs, WOPs, partnerships between formal utility and small scale informal providers, partnerships between a water utility and a knowledge institution and partnerships specifically targeting sanitation.
- Assess the suitability of the different type of partnerships in a given context
- Differentiate between stages of the partnering cycle and anticipate challenging aspects in each stage
- Apply skills necessary for successfully manage the partnership process in different stages, such as:
 - o Creation/procurement process
 - o Contract/agreement design and negotiation
 - o Governance and conflict resolution
 - o Project planning, implementation, monitoring, evaluation and reporting
 - o Partnership exit strategy



Topics and Learning Activities

TOPIC: The rationale of partnerships in the water sector

Learning Activities:

lecture, assigned reading

TOPIC: Historical evolution of partnerships and emerging scene

Learning Activities:

lecture, assigned reading

TOPIC: - Characteristics, functionality and suitability of different type of partnerships in the water sector

Learning Activities:

lecture, assigned reading, case studies, assignment

TOPIC: Different stages of the partnering cycle, main processes, challenges and necessary skills to successfully manage the partnership

Learning Activities:

lecture, assigned reading, case studies, assignment

Lecturing Material

- Students will be provided a list of references that are required reading

Scientific software

None

WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Schwartz, K.H. (Klaas)

Module Name		Module Code		Credit Points						
Partnerships for Water Supply and Sanitation		WSM10		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1.	Introduction							0	0	
1.1	Introduction to the course	1		1				2	4	Pascual
1.2	Rational for partnerships	2		2				4	8	Pascual
1.3	Historical evolution of partnerships in the water sector	2						2	6	Schwartz
2	Partnerships' diversity in the water sector							0	0	
2.1	PPP typology and key issues	2		1				3	7	Wolters (Aquanet)
2.2	PPP cases from a multinational private operator	5		1				6	16	Mateos (Suez)
2.3	Partnerships for sanitation	2						2	6	Van Beukel (Safi Sana)
2.4	Peer support linked to investments	2		2				4	8	Pascual
2.5	GWOPA and Water operator partnerships	2		1				3	7	Perkins (GWOPA)
2.6	10 years of Dutch WOPs' experience	2						2	6	Veenstra (VEI)
2.7	WOPs' assignment	1	5	2				3	10	Pascual
3.	Partnership management							0	0	
3.1	Partnerships management and partnering skills	3		2				5	11	Pascual
3.2	Partnership contract negotiation	2	3	1				3	10	Wolters (Aquanet) and Pascual
3.3	Partnerships conflict management	3		2				5	11	Mels and Pascual
3.4	Partnerships planning, monitoring and evaluation	4		3				7	15	Oliviera and Pascual
3.5	Partnerships and capacity development	3		2				5	11	Pascual
4.1	Simposium or Seminar			4				4	4	Pascual and guest lecturers
Total		36	8	24	0	0	0	60	140	

(c) UNESCO-IHE 2015/2017-WSM10: Partnerships for Water Supply and Sanitation



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Gettel, G.M.

Module Name	Module Code	Credit Points
Aquatic ecosystems: processes and applications	ES10TWL	5

Target Group	Prerequisites
Programme target group (Participants in the programmes at IHE) and qualified short course participants	Programme prerequisites (BSc in a topic appropriate to UNESCO-IHE programme) and basic knowledge of aquatic ecology.

Assessment

%	Format	(Comment)
80	Assignment	The scientific report serves as the exam and the bulk of the grade for this course.
10	Assignment	The peer review will comprise 10% of the grade for this course.
10	Presentation	Students will prepare a short and informal group presentation that puts what they have learned about aquatic ecosystems in a broader context.

Learning Objectives

Upon completion of the module participants will be able to..

- Conduct laboratory techniques used for basic limnological studies. Specifically, you will be able to measure physical-chemical properties, chlorophyll a concentration in seston and periphyton; measure and calculate primary production and community respiration, measure nutrient concentration and turbidity, calculate and measure ash free dry mass, and perform zooplankton counts.
- Develop a research question based on the experimental design.
- Analyze data using either statistical or modeling techniques to answer your research question.
- Produce a report in the format of a scientific article that presents your research question, the data supporting it, and a discussion of your results, including a review of relevant literature.
- Critically analyze your colleagues work in the form of a professional peer review.



Topics and Learning Activities

TOPIC: Eutrophication in shallow-lake ecosystems

DESCRIPTION: A mesocosm experiment will be used to analyse the effects of eutrophication in shallow lakes and to familiarise participants with techniques that are common in ecological research. Ample attention will be paid to the development of a critical scientific approach, including study design, statistical analysis and data presentation. Lectures on ecological processes and human impacts on aquatic ecosystems will provide the necessary theoretical background, including introductory limnology, principles of primary production and bottom-up and top-down control, and benthic and pelagic primary production.

Learning Activities:

Students will conduct laboratory experiments to generate a data set, which they will analyze using appropriate tools. Students will then write a scientific report and perform a peer review.

TOPIC: Fundamental Limnological Laboratory Skills

DESCRIPTION: Laboratory analysis of physical-chemical and ecological characteristics including nutrients, phytoplankton, zooplankton, and primary production will be performed.

Learning Activities:

Laboratory work in the first week of the module will be performed.

TOPIC: Data analysis

DESCRIPTION: Students will analyse data using the necessary statistical approaches, including ANOVA and post-hoc tests (e.g. Tukey), regression, and non-parametric tests as required.

Learning Activities:

Data analysis draws largely on previously taught skills, but some guidance in R will be provided.

TOPIC: Report Writing

DESCRIPTION: Skills in writing a scientific report, including developing a research question, the structure of Introduction, Methods and Materials, Results, and Discussion sections of a scientific report are described.

Learning Activities:

A few short lectures with discussion are given, papers are assigned for reading, and a peer review process on drafts helps students develop these skills.

TOPIC: Critical understanding of literature and graph interpretation

DESCRIPTION: Students are asked to interpret graphs and do a critical reading exercise as part of lecture tutorials. These examples come from the required reading.

Learning Activities:

In-class activities.

Lecturing Material

- A minimum of four papers from the primary scientific literature will be assigned as required reading for the course. A additional four scientific papers from the primary literature are required from the student's own choosing. Background reading of basic limnology from text books is encouraged to fill any knowledge gaps as needed.

Scientific software

The use of Excel is required for this course. Statistical analysis of data is required, and for this using R is highly encouraged. Modeling with Stella is possible depending on the interest of the individual student.



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Gettel, G.M.

Module Name		Module Code		Credit Points						
Aquatic ecosystems: processes and applications		ES10TWL		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
	Lecture	14						14	42	Gettel, Irvine
	Laboratory Work				16			16	32	Gettel, Irvine
	In-class activity (data analysis, group work)			44				44	44	Gettel, Irvine
	Paper Writing and Review		20					0	20	Gettel, Irvine
Total		14	20	44	16	0	0	74	138	

(c) UNESCO-IHE 2015/2017-ES10TWL: Aquatic ecosystems: processes and applications



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Kooy, M.E.

Module Name	Module Code	Credit Points
Urban water governance	WSM11	5

Target Group	Prerequisites
The module is elective, and therefore open to all students within the WM stream, but it will build on key concepts introduced in the Water Governance core module and the Institutional Analysis module. Students who have not taken these previous models will be expected to do additional reading to familiarize themselves with necessary terms and concepts. This module is run on the style of a seminar class. Students will be required to do the majority of work (reading, assignments) outside of class. Class time will then be used to discuss and debate what students have learned through self-study.	Mandatory: High level of ability to read and discuss academic articles and book chapters in English; willingness to engage in social science theory and new conceptual frameworks; willingness to engage in cross-disciplinary discussions and applications. Preferred: completion of the Institutional Analysis module. Overall, you must be an enthusiastic, engaged, and reflexive student who is keen to explore new ideas and concepts, and how these ideas relate to water.

Assessment

%	Format	(Comment)
30	Assignment	Students will have 3 pre-class written assignments (videos to watch, podcasts to listen to, articles to read) in relation to Topics 1, 2, 3.
40	Group work	Students will have 2 group work assignments in relation to Topics 3 and 4
30	Assignment	Students will write a final essay to apply the concepts discussed in class

Learning Objectives

Upon completion of the module participants will be able to..

- Course Goal: The aim of this module is to introduce participants to the challenges and opportunities of the future Urban World. Specifically, we explore what this implies for the ecological and social sustainability of urban waters: access, allocation, quality, and security of piped and non-piped supply, wastewaters, surface/groundwater, bottled waters, flood waters/water related disasters. The module places specific emphasis on the politics of these flows, and therefore understands UWG as a deeply political process rather than a technocratic/managerial activity. To this end, the module aims to provide participants with analytical skills to diagnose and explain, rather than operational toolkits or blueprints with which to intervene and manage.
- The module content reflects IHE's commitment to having participants engaging with the real-life problems of water in urban contexts, but seeks to offer new perspectives and concepts with which to understand the issues and problems. Specifically, in the module we look at how to understand the cities of the global South, how to understand urbanization as a process occurring at a global scale, and then the implications of these understandings for the politics of water (access, allocation, equity). By the end of the module, students will understand the current urban context in various regions of the Global South, will be familiar with existing debates in urban development and the implications for urban waters, and will be able to analyze the politics of urban water flows. Class lectures and activities spend time identifying and discussing the politics of the urban, and the ways in which urban waters are enrolled in the production of uneven urban environments.
- Learning Objective 1. Define key terms: the "urban", "urban waters", "governance", according to assigned readings, learning activities, and class lectures;
- Learning Objective 2. Identify implications of the above definitions for urban water governance (how to define and diagnose; identify stakeholders);



- Learning Objective 3. Analyze the ways in which urban waters channel the politics of the city in presented case studies



Topics and Learning Activities

TOPIC: What is the urban future?

DESCRIPTION: What conditions characterize current and future urban conditions, in terms of ecological sustainability and social equity

Learning Activities:

lecture, assigned reading

TOPIC: What is the urban?

DESCRIPTION: How do we define the urban as something more than a spatial category, and what does thinking about the urban as a process imply for thinking about water?

Learning Activities:

lecture, assigned reading

TOPIC: What is the Southern urban?

DESCRIPTION: What is a southern urbanism; what conditions characterize processes happening in the global South; how do we need to think - and intervene - in Southern cities differently than in the North?

Learning Activities:

lecture, assigned reading, group assignment

TOPIC: What is urban water governance?

DESCRIPTION: What are the implications for how we rethink the urban, and southern cities, for how we think about governing water in cities?

Learning Activities:

lecture, assigned reading, group work

Lecturing Material

- Students will be provided a list of articles that are required reading.

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Kooy, M.E.

Module Name		Module Code		Credit Points						
Urban water governance		WSM11		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction to the module	1						1	3	Kooy
2	Refresher: water governance	1						1	3	Kooy
3	Urban futures	2						2	6	Kooy
4	What is the urban?	2						2	6	Kooy
5	Case study: planetary urbanization	2						2	6	TBD
6	What is the Southern urban?	2						2	6	Kooy
7	Case study: water in the southern city	2						2	6	TBD
8	The politics of water in the southern city	3						3	9	Kooy
9	What then is urban water governance	2						2	6	Kooy
10	What then is urban water governance	2						2	6	Kooy
11	Tutorial		1					0	1	
	Individual and group assignments		48					0	48	
	Essay assignment		30					0	30	
Total		19	79	0	0	0	0	19	136	

(c) UNESCO-IHE 2015/2017-WSM11: Urban water governance



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Resources Management & Water Quality Management
Module Coordinator: Jiang, Y.

Module Name	Module Code	Credit Points
Watershed and river basin management	ES11MW	5

Target Group	Prerequisites
Young and mid-career professionals (scientists, decision-makers) with a background in water management, environmental management, and / or watershed management.	Affinity with hydrology, development economics, agronomy or geography (preferably a relevant water science or engineering related bachelor degree or equivalent) and preferably experience in watershed and/or river basin management. Good command of English.

Assessment

%	Format	(Comment)
70	Written Exam (closed book)	
30	Assignment	role play presentation & writing report

Learning Objectives

Upon completion of the module participants will be able to..

- describe the main natural and anthropogenic interactions at a watershed scale; and how they can be aggregated to river basin scale
- describe the role of water in sustaining different land uses, including ecosystems
- understand the watershed planning and management approaches, specifically in terms of soil and water management
- explain temporal and spatial scales issues in hydrology
- characterize the fundamental economic issues in watersheds and river basins and the role of economic valuation of aquatic ecosystem services in watershed and river basin management



Topics and Learning Activities

TOPIC: Introduction

DESCRIPTION: This section introduces watershed and river basin management

Learning Activities:

Lecture, group exercise/workshop

TOPIC: Biophysical processes and anthropogenic interactions

DESCRIPTION: This section overviews biophysical processes and interactions with human activities in watersheds and river basins, covering soil & water management, watershed hydrology and human interventions, environmental flow, and groundwater management

Learning Activities:

Lecture, group exercise/workshop

TOPIC: Watershed and river basin planning

DESCRIPTION: This section describes the planning process of watershed and river basin management, including technical and participatory tools to support planning processes

Learning Activities:

Lecture, group exercise/workshop

TOPIC: Watershed economics

DESCRIPTION: This section introduces and characterises the fundamental economic issues in watersheds and river basins, explain the relevance and role of economics and economic valuation in watershed and river basin management

Learning Activities:

Lecture, group exercise/workshop

TOPIC: Watershed and river basin management

DESCRIPTION: This section synthesizes the institutional aspects in watershed and river basin management, explains transboundary interdependencies and cooperation, and presents a case study of watershed and river basin management in the real world

Learning Activities:

Lecture, group exercise/workshop

TOPIC: Role play game

DESCRIPTION: This group exercise uses hydrological simulation game as a decision support tool to help understand the interdependency of different stakeholders and the importance of communication and cooperation to effective watershed and river basin management

Learning Activities:

group exercise, presentation, report writing

TOPIC: Field trip

Lecturing Material

- Lecture Notes
- Role play reading materials
- Lecture powerpoint slides
- Additional reading materials

Scientific software

None



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Resources Management & Water Quality Management
Module Coordinator: Jiang, Y.

Module Name		Module Code		Credit Points						
Watershed and river basin management		ES11MW		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction	1						1	3	Jiang
2	Biophysical processes and anthropogenic interactions							0	0	
2.1	Soil & Water Management	4		4				8	16	Van der Zaag
2.2	Watershed hydrology and human interventions	4		4				8	16	Masih
2.3	Environmental flow allocation	4		4				8	16	Irvine
2.4	Groundwater Management	4		4				8	16	Guest Lecturer
3	Watershed economics							0	0	
3.1	Economic issues in watersheds and river basins	2						2	6	Jiang
3.2	Payment for watershed services	2		4				6	10	Jiang
3.3	Game theory	4		4				8	16	Gues lecturer
4	Watershed and river basin planning and management							0	0	
4.1	Planning process	2		2				4	8	Evers
4.2	Watershed and river basin management	4						4	12	Evers
4.3	Case study			4				4	4	Guest lecturer
5	Role-play SHA-RIVA		12					0	12	Masih
6	Field trip					5		5	5	Jiang
	Exam		3					0	3	
Total		31	15	30	0	5	0	66	143	

(c) UNESCO-IHE 2015/2017-ES11MW: Watershed and river basin management



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Ruijter van Steveninck, E.D. de

Module Name	Module Code	Credit Points
IWRM as a tool for adaptation to climate change	ES11X	5

Target Group	Prerequisites
Programme target group (Participants in the programmes at IHE) and qualified short course participants.	Programme prerequisites (BSc in a topic appropriate to UNESCO-IHE programme) and basic knowledge of water management.

Assessment

%	Format	(Comment)
30	Presentation	
70	Written exam (closed book)	

Learning Objectives

Upon completion of the module participants will be able to..

- describe the expected impacts of climate change on water resources and water use sectors in relation to (other) human activities
- identify the consequences of the predicted impacts of climate change and climate variability for integrated water resources management
- integrate climatic change conditions at different time and spatial scales into (risk) management in the water sector
- justify decisions on adaption to the impacts of climate change under uncertainty



Topics and Learning Activities

TOPIC: IWRM, climate change and the hydrological cycle.

DESCRIPTION: Introduction into the concept of IWRM. The climate system and the causes of climate change and variability. Impacts of climate change on the hydrological cycle. Integrating IWRM and climate change.

Learning Activities:

Lectures and exercises.

TOPIC: Climate change: impacts and adaptation.

DESCRIPTION: Impacts of climate change on the environment and on water use sectors. Adaptation measures and economic aspects.

Learning Activities:

Lectures and exercises.

TOPIC: Vulnerability and adaptation under uncertainty.

DESCRIPTION: What determines vulnerability to climate change. Adaptation strategies how to adapt under a high level of uncertainty.

Learning Activities:

Lectures and exercises.

TOPIC: Institutional aspects and stakeholder participation.

DESCRIPTION: The importance of involving stakeholders in water management and climate change adaptation and strategies on involving stakeholders.

Learning Activities:

Lecture and role play.

TOPIC: Multi sector/multicriteria decision making.

DESCRIPTION: Modelling effects of climate change on water resources using Climateland as a case study.

Learning Activities:

Lecture and computer/modelling exercise. Oral presentation.

TOPIC: Country presentations

DESCRIPTION: Presentations by participants covering impacts of climate change and adaptation measures in their countries/regions.

Learning Activities:

Presentations by participants.

TOPIC: Field trip to Dordrecht.

DESCRIPTION: Adaptation to climate change in an urban setting.

Learning Activities:

Field trip.

Lecturing Material

- Lecture notes, power point presentations, background materials

Scientific software

WEAP.



ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Ruijter van Steveninck, E.D. de

Module Name		Module Code		Credit Points						
IWRM as a tool for adaptation to climate change		ES11X		5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	IWRM, climate change and the hydrological cycle	6		6				12	24	de Ruyter, van Dorland, Maskey
2	Climate change: impacts and adaptation	17		7				24	58	de Ruyter, van der Meulen, de Fraiture,
2.b	Climate change: impacts and adaptation (2)							0	0	Pathirana, Popescu, Stigter, Jiang
3	Vulnerability and adaptation under uncertainty	4		2				6	14	Bresser, de Ruyter
4	Institutional aspects and stakeholder participation			6				6	6	Kemerink
5	Multi sector/multicriteria decision making			26				26	26	Venneker/Wenninger
6	Country presentations			4				4	4	Gersonius, van der Meulen
7	Field trip					6		6	6	
8	Examination			3				3	3	
Total		27	0	54	0	6	0	87	141	

(c) UNESCO-IHE 2015/2017-ES11X: IWRM as a tool for adaptation to climate change



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Susnik, J.

Module Name	Module Code	Credit Points
IWRM Groupwork	WM13	5

Target Group	Prerequisites
This module is required for all participants in the Water Management programme. Participants of the WQM specialisation may, however, choose to participate in the group work of the Environmental Science.	Bachelor's degree. Basic computer skills (MS-Windows, Office) Good English command. Participation in the WM Fieldwork.

Assessment

%	Format	(Comment)
65	Assignment	Thematic report based on fieldwork in the Andarax Basin (during the International Fieldwork).
35	Assignment	Integrated report on water management plan for the Andarax basin.

Learning Objectives

Upon completion of the module participants will be able to..

- Develop a final problem analysis on specific problems relating to water management in the Andarax Basin.
- Design approaches for mitigating the specific problems in the Andarax Basin.
- Evaluate the different approaches and argue for a preferred approach to mitigate identified problems.
- Integrate different approaches (targeted at different themes/problems) into a basin-wide integrated water management plan.
- Present and argue for the integrated water management plan.



Topics and Learning Activities

TOPIC: Introduction to the Module

DESCRIPTION: The Groupwork is based on the Andarax basin in southern Spain. As such, the Groupwork is a continuation of the Fieldwork undertaken in June. Information and data collected during the fieldwork forms the basis for the 3-week groupwork. In the introduction session the activities in the module are introduced.

Learning Activities:

Lecture

TOPIC: Fine-tune Andarax Problem Analysis

DESCRIPTION: Prior to developing an integrated plan, students finalize and present the problem analysis that was started during the international fieldwork in June.

Learning Activities:

Lecture and group work

TOPIC: Options and Multi-criteria Analysis

DESCRIPTION: Based on the problem analyses, the groups will propose possible approaches/solutions to mitigate the identified problems. In addition, the groups present an approach to analyze the different solutions and identify a preferred solution.

Learning Activities:

Lecture and group work

TOPIC: Integrated Water Management Report

DESCRIPTION: In this report, an integrated plan will be presented aimed to mitigate the problems identified by the different thematic groups.

Learning Activities:

Group work

Lecturing Material

- Please visit <http://www.altaguax.org/> for relevant literature

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Susnik, J.

Module Name IWRM Groupwork		Module Code WM13		Credit Points 5						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	Introduction Groupwork	1						1	3	Schwartz
2	How to write an IWRM plan	3						3	9	Susnik
3	Presentations thematic groups			2				2	2	Various
4	Introduction Integrated Groups	1						1	3	Susnik/Tutusaus
5	Draft Presentations Integrated Groups			2				2	2	Various
6	Groupwork		126					0	126	
7	Final Presentations Integrated Groups			4				4	4	Various
Total		5	126	8	0	0	0	13	149	

(c) UNESCO-IHE 2015/2017-WM13: IWRM Groupwork



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: All WM
Module Coordinator: Kooy, M.E. (Michelle)

Module Name	Module Code	Credit Points
MSc preparatory course and thesis research proposal	WM14	9

Target Group	Prerequisites
This module is available to all WM participants. It is also open to participants of the WQM specialisations who started under the Environmental Science programme.	The successful completion of at least 8 of the first 11 modules of the Water Management Programme.

Assessment

%	Format	(Comment)
100	Presentation	The MSc research proposal needs to be approved by the mentor and the professor before the student can actually start the research work.

Learning Objectives

Upon completion of the module participants will be able to..

- Concisely define the intended research topic, state precise aims and objectives, describe the research methodology, argue expected relevance and justification, and identify boundary conditions and self- or externally imposed limitations
- List available literature and replicate main arguments expounded in the literature on the specified research topic
- Demonstrate analytical problem-analysis skills and the ability to distil the strategic issues to be addressed in the research phase
- Plan, using the project management approach, the research process in weekly time-steps and indicate essential milestones, targets and indicators, required human, financial and other resources, deliverables and perceived threats and constraints at each stage of the research project
- Develop and formulate the research proposal in a clearly written, well argued and convincing report, submitted within a set deadline
- Successfully present and defend individual work, cross-reference it to and critically evaluate it in light of contemporary thinking in a specific field of study



Topics and Learning Activities

TOPIC: Research topic delineation, literature review, Problem analysis, Strategy development

- Project plan

DESCRIPTION: The initial research topic of study will be selected in a consultative process with a mentor, the MSc coordinator and a WM professor.

Learning Activities:

Reading, discussing

TOPIC: Proposal development and formulation

DESCRIPTION: Research is likely to be based primarily on a review of selected literature, to a limited extent other methods of data gathering and analysis may also be applied (e.g. interviews, laboratory and field work, computer modelling, expert consultations, etc). One hour weekly meetings with the tutor form the main stay of the proposal development process. It is however expected that the MSc candidate will be self-motivated and pro-active, taking all necessary initiatives to reach the set target in a timely fashion.

Learning Activities:

Writing of the proposal.

TOPIC: Presentation and defence

DESCRIPTION: The resulting proposal will be presented in written form and orally defended before an audience of critical peers and a panel of staff members.

Learning Activities:

Presentation of the proposal.

Lecturing Material

- MSc thesis Protocol - WM programme
- How to write an MSc thesis – Wendy Sturrock

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: All WM
 Module Coordinator: Kooy, M.E. (Michelle)

Module Name		Module Code		Credit Points						
MSc preparatory course and thesis research proposal		WM14		9						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
	MSc preparatory course	16	8					16	56	Rusca
	writing proposal		196					0	196	
Total		16	204	0	0	0	0	16	252	

(c) UNESCO-IHE 2015/2017-WM14: MSc preparatory course and thesis research proposal



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Kooy, M.E. (Michelle)

Module Name	Module Code	Credit Points
MSc thesis research work	WM15	36

Target Group	Prerequisites
This module is available to all WM participants.	The successful completion of at least 8 of the first 11 modules of the Water Management Programme.

Assessment

%	Format	(Comment)
100	Oral Exam	Assessment is done by public examination of the MSc Thesis. For this purpose an examination committee will be formed for each MSc candidate.

Learning Objectives

Upon completion of the module participants will be able to..

- Conduct research including the formulation of research questions and hypotheses, the selection and application of adequate research methodologies and techniques and the formulation of well-founded conclusions and recommendations
- Guarantee scientific integrity and independence in content and process, giving due credit to sources and ideas used
- Apply critical and creative thought processes, using standard as well as innovative
- Argue the applicability, relevance and significance of research results to the field of Integrated Water Resources Management
- Clearly and systematically communicate, argue and defend findings in oral and written presentation to a an audience of critical peers



Topics and Learning Activities

TOPIC: MSc Research

DESCRIPTION: MSc research consists of individual work by the candidate, but may be set within the context of a larger research or project activity. Occasionally, the specific MSc research project can be a combined effort of more than one MSc candidate. The project may be carried out at the UNESCO-IHE facilities, third-party facilities or within the home-country context (the so-called Sandwich construction). Weekly coaching is available from the assigned UNESCO-IHE mentor and monthly contact with the supervising professor is encouraged. Responsibility for initiating these contacts lies with the candidate. Additional on-site third-party coaching is recommended when research is carried out at third-party facilities or in a sandwich construction.

TOPIC:

Lecturing Material

- ...

Scientific software

None



WATER MANAGEMENT

MASTERS PROGRAMME

Academic Year: 2015-2017
 Specialization: Core Programme
 Module Coordinator: Kooy, M.E. (Michelle)

Module Name		Module Code		Credit Points						
MSc thesis research work		WM15		36						
Nr	Topic	Lecture	Assignment	Workshop /Case study Role play /Exercise Lab session	Labwork /Sessie + Prepare /Report	Fieldtrip / Fieldwork	Design exercise	SUM: contact hours	SUM: workload hours	Lecturer(s)
1	MSc Research		1008					0	1008	
Total			0008	0	0	0	0	01008		

(c) UNESCO-IHE 2015/2017-WM15: MSc thesis research work