UNESCO-IHE
Institute for Water Education

MASTER PROGRAMME UWS 2015-2017

General description UNESCO-IHE

Study guide - part 1

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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 a 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 B2choose 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 UWS 2015-2017

UWS Programme description UNESCO-IHE

Study guide - part 1

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Introduction UWS programme

The UWS MSc Programme is directed predominantly at civil, environmental and (bio)chemical engineers working in water supply and wastewater companies, municipal authorities, government ministries and consulting companies dealing with water supply, sanitation and integrated urban water cycle management.

The programme offers the following three specializations covering three sub-domains:

Water Supply Engineering (WSE): this specialization emphasizes water quality and the design and operational aspects of drinking water treatment, transport, and distribution.

Sanitary Engineering (SE): this specialization deals with sanitation with special emphasis on the urban poor, and with wastewater and sludge treatment process design, operation and engineering of related infrastructure including urban drainage and sewerage, centralized and decentralized systems and land-based and engineered treatment plants.

Urban Water Engineering and Management (UWEM): this specialization deals with various aspects of the urban water environment and addresses the challenges of design, engineering and delivery of essential water and wastewater infrastructure, services and management.

WSE and SE are offered both fully at UNESCO-IHE, and as double degree programmes in cooperation with partners in Ghana (KNUST) and Colombia (Univale).
UWEM is only offered as a joint degree programme together with AIT Bangkok.

Learning objectives UWS programme

The overall objective of the UWS programme is to educate the students to adequately evaluate, design, develop and manage the (urban) water cycle, thereby contributing to sustainable development. A fter successful completion of the programme, UWS graduates will have achieved the following learning outcomes:

Knowledge and understanding

1. Understanding the required basic chemical, physical, (micro)biological principles commonly applied in the field of water supply and sanitation;

2. Demonstrating knowledge of relevant theories and contemporary developments in the chosen specialisation;

3. Being able to interpret the broader scientific-, engineering- and socio-economic framework covering the urban water cycle;

Applying knowledge and understanding

4. Demonstrate disciplinary knowledge, engineering skills and academic capabilities independently and within a multidisciplinary context;

5. Select and apply suitable methods and techniques for assessment, planning, design, rehabilitation, operation and maintenance;

6. Formulate the questions to identify suitable approaches, and to pose original models, tests and/or engineering solutions;

7. Collect, analyse, prioritise and structure required data and information;

8. Contribute to theoretical, methodological or application development and integrate these within the respective discipline;

Making judgements

9. Identify original ideas and approaches from the literature or other sources and evaluate the potential for application, integration or further development;

10. Prepare a research plan, including the description of the approach and the realisation of the research;

11. Critically assess own investigation results, implementation feasibility and risks, and to reflect on the ethical and socio-economic aspects connected with application;

Communication

12. Clearly report and orally communicate results, the underpinning reasoning, knowledge and assumptions;

13. Actively promote the relevant issues and raise awareness amongst non-specialist audiences;

Learning skills

14. Extend and enhance own knowledge, insight and skills in an autonomous manner;

15. Conduct independent academic research in a subsequent post-graduate (i.e. PhD) programme.

Specialisations

The programme offers the following three specializations covering three sub-domains:
Urban Water Engineering and Management This specialization deals with various aspects of the urban water environment and addresses the challenges of design, engineering and delivery of essential water and wastewater infrastructure, services and management.

UWEM is offered only as a joint degree specialisation in cooperation with AIT.

The programme starts at AIT in August where students take 4 first semester courses. In January of the following year the students travel to UNESCO-IHE where they stay until August of the second year to follow the modules 4 till 10, followed by their MSc thesis proposal preparation. In August of the second year, the students return to AIT to do their MSc thesis research, co-supervised by UNESCO-IHE staff.

Sanitary Engineering This specialization deals with sanitation with special emphasis on the urban poor, and with wastewater and sludge treatment process design, operation and engineering of related infrastructure including urban drainage and sewerage, centralized and decentralized systems and land-based and engineered treatment plants.
SE is also offered only as a double degree specialisation in cooperation with Univalle, Colombia and KNUST, Ghana.

Students following the Double Degree option with Univalle join the Delft programme in January (Module 4). Students following the Double Degree option with KNUST join the Delft programme in March (Module). They all may go back for their thesis work after Module 12 (Group work), co-supervised by both partners.

Water Supply Engineering This specialization emphasizes water quality and the design and operational aspects of drinking water treatment, transport, and distribution.
WSE is also offered only as a double degree specialisation in cooperation with Univalle, Colombia and KNUST, Ghana.

Students following the Double Degree option with Univalle join the Delft programme in January (Module 4). Students following the Double Degree option with KNUST join the Delft programme in March (Module). They all may go back for their thesis work after Module 12 (Group work), co-supervised by both partners.

Sanitary Engineering

This specialisation aims at educating professionals to develop rational approaches towards sustainable waste management via pollution prevention, appropriate treatment and resources recovery and reuse as well as participation in masterplanning, feasibility studies and technology selection. It enables graduates to deal
with the process technology, engineering and design aspects of wastewater collection and treatment, sludge treatment, disposal and reuse, and solid waste collection, transport, treatment and disposal in urban agglomerations. The module primarily targets professionals working in water and sewerage utilities, consulting firms, industries, municipal assemblies and ministries.

After successful completion of the Sanitary Engineering (SE) specialisation within the UWS Programme, graduates will be able to:

Knowledge and understanding

1. explain the role of sanitation in urban water cycle and its relation to public health and environment;

2. understand relevant physical, chemical and biological processes and their mutual relationships within various sanitation components;

3. name wastewater quality criteria and standards, and explain their relation to public health, environment and urban water cycle;

4. classify various categories of wastewater and predict their effect on treatment process;

5. understand hydraulic concepts and their relationship to urban drainage and sewerage networks;

6. understand the principles of mathematical modelling applied in the field of sanitation;

Applying knowledge and understanding

7. develop rational approaches towards sustainable waste(water) management via pollution prevention, appropriate treatment, resources recovery and re-use on both centralized and decentralized level;

8. prepare conceptual engineering and process design of sanitation components;

9. apply modern tools for technology selection and carry out modelling of sanitation components;

10. define and critically analyse, assess and evaluate various urban drainage and sewerage schemes, and wastewater, sludge and solid waste treatment process technologies;

Water supply engineering

The Water Supply Engineering specialisation aims at educating professionals dealing with engineering aspects of drinking water sources, treatment and distribution in an integrated approach. These professionals are engineers and scientists working for water authorities, consulting companies, and educational and research institutions dealing with water supply. The programme pays attention to the choice of suitable technologies and tools, ranging from low-cost to advanced, in a problem-oriented way. As such, it is appealing both to the developing- and newly industrialised countries.

The main objective of the Water Supply Specialisation is to educate the participants to adequately evaluate, develop and manage part of the water cycle starting from the raw water source and ending at the consumer's tap.

After successful completion of the Water Supply Engineering (WSE) specialisation within the UWS programme, graduates will be able to:

Knowledge and understanding

1. describe the structure of drinking water supply systems, including water transport, treatment and distribution;

2. understand occurring physical, chemical and biological phenomena and their mutual relationships, within water supply systems;

3. name water quality criteria and standards, and explain their relation to public health, environment and urban water cycle;

4. distinguish between various water quality concepts and predict their effect on treatment process;

5. understand hydraulic concepts and their relationship to water transport in treatment plants, pipelines and distribution networks;

6. understand the principles of mathematical modelling applied in water supply;

Applying knowledge and understanding

7. design and to rehabilitate raw water abstraction, transport, treatment and distribution processes and systems;

8. propose methods for operation and maintenance of water supply systems;

9. evaluate options for centralised and urban systems versus decentralized and rural systems;

10. use statistical and modelling tools for simulating, prediction of performance and operation of water supply system components;

11. understand water supply engineering within a watershed context

Urban Water Engineering and Management

This specialisation aims at engineers who wish to develop into generalists rather than specialists. As the programme broadly covers the urban water cycle, graduates from this specialisation will normally work in any organisation dealing with urban water engineering and management, or with one or more distinct elements of the water cycle (storm water drainage, or water and wastewater services).

The programme will provide students with advanced knowledge to deal with contemporary problems and issues of the urban water environment and offer practical experience in using tools and techniques to address the challenges of delivery of essential water and wastewater services and management of the urban water cycle and associated engineered systems. Furthermore, the program will develop a set of core academic and personal skills in students which will prepare them for a variety of employment opportunities
and/or further research in the broader area of urban water engineering and management.

Urban Water Engineering and Management Specialisation

After successful completion of the Urban Water Engineering and Management (UWEM) specialisation within the UWS Programme, graduates will be able to:

Knowledge and understanding

1. describe 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 climatic and hydrologic uncertainties and/or extremes, work within a data-constrained environment and institutional limitations;

3. understand water infrastructure/asset planning, financing and management, and utility management;

4. understand the principles of mathematical modelling applied in the field of urban water 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.

Applying knowledge and understanding

1. 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 and drainage systems;

2. identify, articulate, analyse and solve problems of the urban water cycle and systems, integrating theory and applications;

3. collect, summarise, analyse and interpret technical data/materials in a structured form to

gain knowledge on urban water system design and operation and maintenance;

4. critically assess the need for continued-education and research on planning, design, maintenance and management of urban water systems;

5. apply 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.

UWS Programme Overview 2015-2017

			WSE Water Supply Engineering	SE Sanitary Engineering	UWEM Urban Water Engineering and Management
	1	.....-18/10 19/10-25/10	Week ONE Introduction (ALL)		at AIT *(August 2013 onwards)* watershed hydrlogy, drinking water treatment, Wastewater treatment and integrated water resource mamagement
	1	26/10-01/11 02/11-08/11	Hydrology, Water supply and water demand management and GIS (UWS/01)		
	2	09/11-15/11 16/11-22/11 23/11-29/11	Chemistry and public health (UWS/02)		
	..	30/11-06/12	Examination Week		
	3	07/12-13/12 14/12-20/12	EPT, Microbiology and Integrated Urban Water Management (UWS/03)		
	..	21/12-27/12 28/12-03/01	Free Period		
	3	04/01-10/01	(UWS/03) *continue..*		
Students Univalle/AIT Enter	4	11/01-17/01 18/01-24/01 25/01-31/01	Surface water treatment I (UWS/WSE/04)	Urban drainage and sewerage (UWS/SE/UWEM/04)	
	..	01/02-07/02	Examination Week		
	5	08/02-14/02 15/02-21/02 22/02-28/02	Surface water treatment II (UWS/WSE/05)	Conventional wastewater treatment (UWS/SE/05)	Asset management (UWS/UWEM/05)
Students KNUST Enter	6	29/02-06/03 07/03-13/03 14/03-20/03	Groundwater treatment and resources (UWS/WSE/06)	Resource oriented wastewater treatment and sanitation (UWS/SE/06)	Managing water organisations (=> WSM06)
	..	21/03-27/03	Examination Week		
	7	28/03-03/04 04/04-10/04 11/04-17/04	Water transport and distribution (UWS/WSE/UWEM/07)	Wastewater treatment plants design and engineering (UWS/SE/07)	Water transport and distribution (UWS/WSE/UWEM/07)
	8	18/04-24/04 25/04-01/05 02/05-08/05	Advanced water treatment and reuse (UWS/WSE/08)	Modeling of wastewater treatment processes and plants (UWS/SE/08)	Urban flood management and disaster risk mitigationn (=> WSE/HI/08B/e)
	..	09/05-15/05	Examination Week		
	9	16/05-22/05 23/05-29/05 30/05-05/06	International fieldtrip and fieldwork (UWS/09)		
	10	06/06-12/06 13/06-19/12 20/06-26/06	**Industrial effluents treatment and residuals management - (UWS/SE/UWEM/10)** - or - Water treatment processes and plants - (UWS/WSE/10) - or - Urban water systems - (WSE/HI/10B/e) - or - A module from another Programme		
			Click HERE TO CHOOSE YOUR MODULE 10 + 11 (2015-2017)		
	11	27/06-03/07 04/07-10/07 11/07-17/07	Advanced water transport and distribution - (UWS/WSE/11a) - or - Decentralised water supply and sanitation - (UWS/WSE/11b) - or - Faecal sludge management - (UWS/SE/11) - or - A module from another Programme		MSc preparatory course and thesis research proposal (UWS/UWEM/11)
	..	18/07-24/07	Examination Week		
	12	25/07-31/07	Click here to choose your summer course (UWS12)		
	13	01/08-07/08 08/08-14/08 15/08-21/08	Groupwork Sint Maarten (UWS/13)		
	..	22/08-28/08	Examination Week		
	..	29/08-04/09	Free		
Univalle and KNUST leave	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 (UWS/14)		at AIT
	..	10/10-16/10	Examination Week		
	15	17/10/15 .... 16/04/16	MSc thesis research work(6 months) (UWS/15)		
	..	17/04-23/04 24/04-30/04	Final Examination Week(s) - Diploma awarding 26/04/2017		

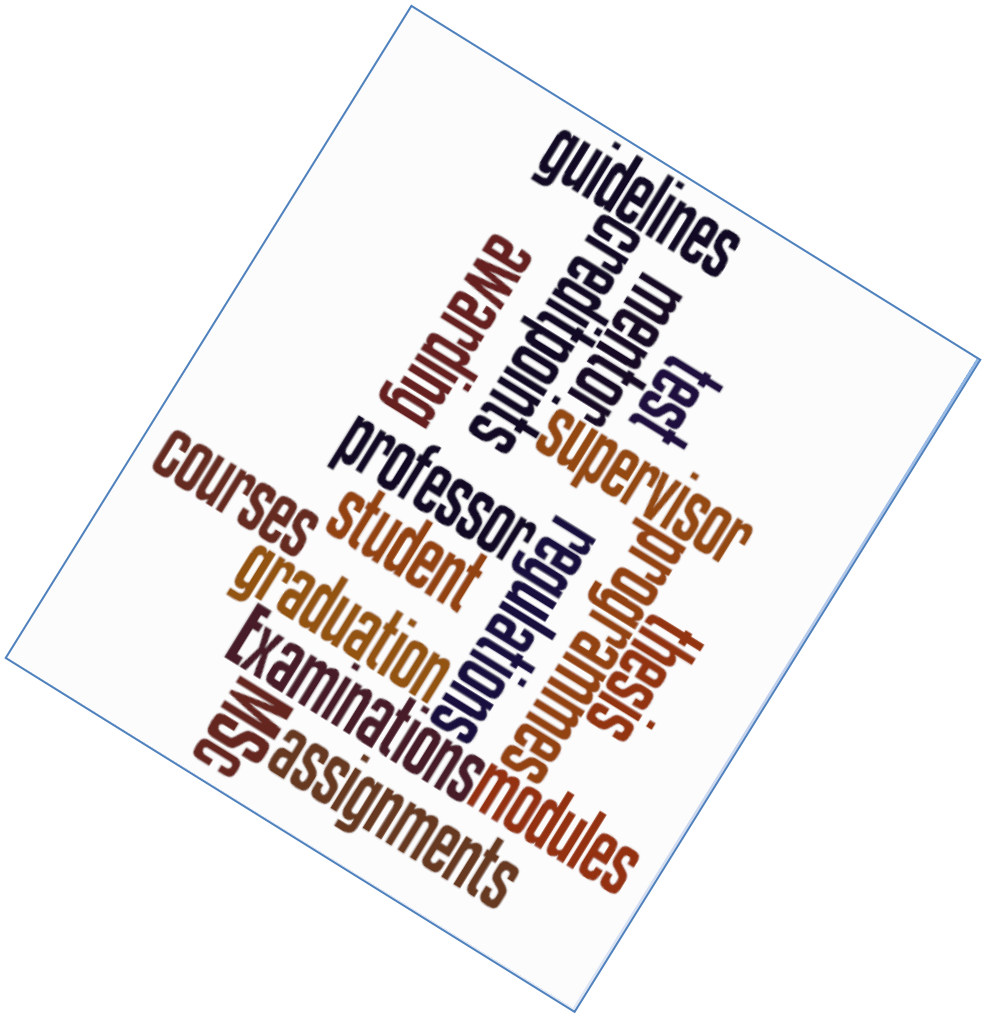
UNESCO-IHE
Institute for Water Education

MASTER PROGRAMME UWS 2015-2017

Exam regulations UNESCO-IHE

Study guide - part 1

UNESCO-IHE
Institute for Water Education



Education and Examination Regulations for cohort 2015– 2017

For the Master Programmes in:

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

and
the short and online courses which are part of these programmes

Approved by the Rectorate of UNESCO-IHE, 8 October 2015

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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 (*Wet op Hoger Onderwijs en Wetenschappelijk Onderzoek*);
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: • 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: *examen*);
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
	• UNESCO-IHE • Kwame Nkrumah University of Science and Technology, Ghana	Double degree
	• UNESCO-IHE • Universidad de Valle, Cali, Colombia	Double degree
2. Sanitary Engineering	UNESCO-IHE	UNESCO-IHE degree
	• UNESCO-IHE • Kwame Nkrumah University of Science and Technology, Ghana	Double degree
	• UNESCO-IHE • Universidad de Valle, Cali, Colombia	Double degree
3. Urban Water Engineering and Management	• 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
	• 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	• UNESCO-IHE • BOKU - University of Natural Resources and Life Sciences, Vienna, Austria • Egerton University, Egerton, Kenya	Joint degree
5. Environmental Technology for Sustainable Development	• UNESCO-IHE • Asian Institute of Technology,Thailand	Joint degree
6. Environmental Technology and Engineering (Erasmus Mundus programme)	• 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	• 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
	• UNESCO-IHE • Hohai University, China P.R.	UNESCO-IHE degree
2. Hydraulic Engineering - River Basin Development	UNESCO-IHE	UNESCO-IHE degree
	• UNESCO-IHE • Sriwijaija University, Palembang, Indonesia	Double degree
3. Coastal Engineering and Port Development	UNESCO-IHE	UNESCO-IHE degree
	• UNESCO-IHE • Hohai University, China P.R.	UNESCO-IHE degree
	• UNESCO-IHE • Sriwijaija University, Palembang, Indonesia	Double degree
4. Land and Water development	UNESCO-IHE	UNESCO-IHE degree
	• UNESCO-IHE • Sriwijaija University, Palembang, Indonesia	Double degree
	• UNESCO-IHE • Asian Institute of Technology Thailand	Double degree
	• UNESCO-IHE • University of Nebraska -Lincoln, USA	Double degree
5. Hydroinformatics- Modelling and information systems for water management	UNESCO-IHE	UNESCO-IHE degree
	• UNESCO-IHE • Hohai University, China P.R.;	UNESCO-IHE degree
	• UNESCO-IHE • Universidad del Valle, Colombia	UNESCO-IHE degree
6. Flood Risk Management (Erasmus Mundus programme).	• 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).	• 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 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 membber 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. posses 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 ofrrigation, 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 students 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, than 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) = sum [credits x mark] / 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 GI	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 GI	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		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 / KI	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 develo	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)							

The programme components, credits, and the nature of the examinations in the specialisation **Environmental Technology and Engineering with Prague and Ghent** are:

1 General Courses		**71**	**ECTS**
U-IHE	I002048	Introduction in Environmental Science I [en]	5
	I002049	Introduction to Environmental Science II [en]	5
	I002050	Introduction to Environmental Science III [en]	5
	I002051	Integrated Project Environmental Science [en]	5
Prague	I001978	Environmental Microbiology [en]	4
	I001977	Environmental Engineering [en]	4
	I001856	Wastewater Treatment [en]	5
	I001857	Sludge Management [en]	2
	I001976	Atmosphere Protection Technology [en]	3
	I001859	Waste Management and Treatment [en]	4
	I001860	Elective Project [en]	5
	I001980	Laboratory Training in Environmental Technology [en]	3
Ghent	I001861	Scientific Skills [en]	6
	I001512	Clean Technology [en]	3
	I001862	Environmental Fate and Management of Heavy Metals and Metalloi	5
	I001873	Microbial Re-use Technology [en]	3
	I001863	Summer School Environmental Technology and Engineering [en]	4

2 Elective Courses		**19**	**ECTS**
U-IHE	I001865	Basic Dutch for Foreigners [en]	2.0
Prague	I001864	Basics of Czech [en]	2.0
Ghent	I000675	Advanced Waste Gas Treatment [en]	3.0
	I001368	Applied Isotopes [en]	5.0
	I001549	Applied Statistics [en]	5.0
	I001974	Ecological Risk Assessment [en]	7.0
	I001522	Environmental Constructions [en]	5.0
	I001349	Environmental Ecology [en]	7.0
	I001439	Environmental Noise [en]	3.0
	I000256	Geostatistics [en]	5.0
	I000260	Life Cycle Assessment [en]	3.0
	I001554	Membrane Processes in Environmental Technology [en]	3.0
	I001755	Modeling and Control of Waste Water Treatment Plants [en]	3.0
	I001563	Quality of Groundwater Resources [en]	5.0
	I001872	Soil Degradation [en]	3.0
	I000846	Soil Water Management [en]	3.0
	I000447	Urban and Indoor Air Pollution [en]	5.0
	I001979	Internship [en]	6.0
	I001571	Environmental Legislation [en]	3.0
	I001973	Basics of Control Engineering and Process Engineering [en]	4.0
U-IHE	I001867	Cleaner Production and the Water Cycle [en]	5.0
	I001868	Constructed Wetlands for Wastewater Treatment [en]	5.0
	I001869	Ecological Sanitation [en]	5.0
	I001981	Modelling Sanitation Systems [en]	5.0
3 Master Dissertation			**30.0**

The programme components, credits, and the nature of the examinations in the specialisation **Limnology and Water Management with Boku and Egerton** are:

Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab report (%)	Home work (%)	Integrated in modules (%)
LWM1	Basics in Limnology	9							
LWM2	Ecology of Aquatic Organisms	6							
LWM3	Basics in Applied Limnology	6							
LWM4	Aquatic Ecosystem Management	4							
LWM5	Scientific Working	3							
ES05bL	Lake Ecology	5.6	60		10	20	10		
ES06L	Stream & River Ecology	5.6	60			20	20		
ES07L	Tropical wetlands for Water Quality	5.6	60		10	20			10
ES08L	Fisheries & Aquaculture	5.6	60			20			20
ES09L	Data Analysis and Modeling for Aquatic Ecosystems	5.6	40		40	20			
ES10TWL	Aquatic Ecosystems: Processes and Applications	5.6			90	10			
ES11LM	Wetlands for livelihoods and conservation	5	40		40	20			
ES12	Summer courses	1			100				
ES13TMW	Group-work	5.6			100				
ES14	MSc research methodology and proposal development	9			100				
ES 15	LWM15: Research plan, logistics, site assessment, application & s	13.4							
	MSc-Thesis								
	LWM16: M.Sc. Research and Thesis writing	30							
	TOTAL	120							

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 drai	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 drai	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 Sriwijajija University** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
Sriwijaija	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/05s	Tertiary unit design and hydraulics	5	40		60				
	WSE/LWDFS/06/s	Socio-economic and environmental aspects of irrigation and drai	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	
Sriwijaija		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 Sriwijajija University*** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
Sriwijaija	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	
Sriwijaija		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 Sriwijajija University*** are:

Location	Code	Module Name	ECTS	Written exam (%)	Oral exam (%)	Assignments (%)	Oral presentation (%)	Lab Report (%)	Home work (%)	Integrated in modules (%)
Sriwijaija	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	
Sriwijaija		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 resili	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 drai	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 Irrigati	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				
	ES11X	IWRM as a Tool for Adaptation to Climate Change	5	70			30			
TU-Dresden		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 adn Water Treatment (optinal)	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	Environtmental 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 unrealisitc.	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 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 finding 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 lease some use of key literature. There will likely to 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 intepretation.

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.

UNESCO-IHE - Academic Calendar 2015/2017

YEAR 1	42	43	44	45	46	47	48	49	50	51	52	53	01	02	03	04
Year	2015											2016				
Month	October		November				December					January				
Mon	12	19	26	02	09	16	23	30	07	14	21	28	04	11	18	25
Tue	13	20	27	03	10	17	24	01	08	15	22	29	05	12	19	26
Wed	14	21	28	04	11	18	25	02	09	16	23	30	06	13	20	27
Thu	15	22	29	05	12	19	26	03	10	17	24	31	07	14	21	28
Fri	16	23	30	06	13	20	27	04	11	18	25	01	08	15	22	29
Sat	17	24	31	07	14	21	28	05	12	19	26	02	09	16	23	30
Sun	18	25	01	08	15	22	29	06	13	20	27	03	10	17	24	31
		(2x5 ECTS)							(2x5 ECTS)							
		Module 1			Module 2				Module 3				Module 4			

YEAR 1	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Year	2016															fieldtrip			2016	
Month	February				March				April				May					June		
Mon	01	08	15	22	29	07	14	21	28	04	11	18	25	02	09	16	23	30	06	13
Tue	02	09	16	23	01	08	15	22	29	05	12	19	26	03	10	17	24	31	07	14
Wed	03	10	17	24	02	09	16	23	30	06	13	20	27	04	11	18	25	01	08	15
Thu	04	11	18	25	03	10	17	24	31	07	14	21	28	05	12	19	26	02	09	16
Fri	05	12	19	26	04	11	18	25	01	08	15	22	29	06	13	20	27	03	10	17
Sat	06	13	20	27	05	12	19	26	02	09	16	23	30	07	14	21	28	04	11	18
Sun	07	14	21	28	06	13	20	27	03	10	17	24	01	08	15	22	29	05	12	19
	(2x5 ECTS)								(2x5 ECTS)							(1x5 ECTS)			(2x5 ECTS)	
	Module 5		Module 6						Module 7			Module 8				Module 9			Module 10	

YEAR 1	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Year							Groupwork				2016						
Month		July					August				September					October	
Mon	20	27	04	11	18	25	01	08	15	22	29	05	12	19	26	03	10
Tue	21	28	05	12	19	26	02	09	16	23	30	06	13	20	27	04	11
Wed	22	29	06	13	20	27	03	10	17	24	31	07	14	21	28	05	12
Thu	23	30	07	14	21	28	04	11	18	25	01	08	15	22	29	06	13
Fri	24	01	08	15	22	29	05	12	19	26	02	09	16	23	30	07	14
Sat	25	02	09	16	23	30	06	13	20	27	03	10	17	24	01	08	15
Sun	26	03	10	17	24	31	07	14	21	28	04	11	18	25	02	09	16
						1	(1x5 ECTS)					(4+5 ECTS)					
		Module 11				M12	Module 13					Module 14					

YEAR 2	42	43	44	45	46	47	48	49	50	51	52
Year	2016										2017
Month	October		November				December				January
Mon	17	24	31	07	14	21	28	05	12	19	26
Tue	18	25	01	08	15	22	29	06	13	20	27
Wed	19	26	02	09	16	23	30	07	14	21	28
Thu	20	27	03	10	17	24	01	08	15	22	29
Fri	21	28	04	11	18	25	02	09	16	23	30
Sat	22	29	05	12	19	26	03	10	17	24	31
Sun	23	30	06	13	20	27	04	11	18	25	01

YEAR 2	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Month					February				March				April				
Mon	02	09	16	23	30	06	13	20	27	06	13	20	27	03	10	17	24
Tue	03	10	17	24	31	07	14	21	28	07	14	21	28	04	11	18	25
Wed	04	11	18	25	01	08	15	22	01	08	15	22	29	05	12	19	26
Thu	05	12	19	26	02	09	16	23	02	09	16	23	30	06	13	20	27
Fri	06	13	20	27	03	10	17	24	03	10	17	24	31	07	14	21	28
Sat	07	14	21	28	04	11	18	25	04	11	18	25	01	08	15	22	29
Sun	08	15	22	29	05	12	19	26	05	12	19	26	02	09	16	23	30

(36 ECTS)

Module 15

Legend

- = Lecture period
- = Examination days
- = MSC thesis writing
- = Holiday/free time
- = Opening acad. year
- = Diploma awarding
- = Summer course

Chistmas:	Dec 25/26 2015
Good Friday:	March 25 2016
Easter:	March 27/28 2016
Kingsday:	April 27 2016
Liberationday:	May 5 2016
Ascencion:	May 5 2016
Pentecost:	May 15/16 2016
Chistmas:	Dec 25/26 2016
Good Friday:	April 14 2017
Easter:	April 16/17 2017
Kingsday:	27 April 2017

UNESCO-IHE
Institute for Water Education

MASTER PROGRAMME UWS 2015-2017

Overview of module descriptions and workloads

Studyguide - part 2

UNESCO-IHE
Institute for Water Education

URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Salinas Rodriguez, S.G. (Sergio)

Module Name	Module Code	Credit Points
Hydrology, Water supply and water demand management and GIS	**UWS/01**	**5**

Target Group	Prerequisites
Programme target group	Programme prerequisites

Assessment

%	Format	(Comment)
45	Written Exam (closed book)	Hydrology and Hydraulics
30	Written exam (closed book)	Water Supply and Water Demand Management
25	Assignment	GIS

Learning Objectives

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

- Identify and discuss the basic elements of hydrology, and apply hydrological principles in water and wastewater engineering.
- Apply the fundamental concepts of fluid properties, hydrostatics, fluid flow in closed conduits and open channels, and basic hydraulic structures. In addition students will be able to apply fundamental principles applied in the analysis, design, modeling and operation of hydraulic systems.
- Forecast water demand in a city, based on population forecasts, per capita use and Water Demand Management measures.
- Explain the basic concepts of GIS (raster, vector, projections, geospatial analysis); Use a GIS for thematic mapping, basic data processing and editing, basic geoprocessing and analysis, DEM processing and catchment delineation; Find open source GIS software; Find open access GIS data

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Topics and Learning Activities

TOPIC: Hydrology and Hydraulics

DESCRIPTION: Hydrological cycle, precipitation, evaporation, run-off, river systems, unsaturated zone and groundwater systems; rock and water, porosity, permeability, aquifers and aquitards, groundwater balances, groundwater availability, use and method of groundwater extractions; theory of groundwater flow, flow towards wells, superposition and boundary effects, potential and stream functions, development of observations and productions wells; groundwater pollution. The topics in hydraulics are fluid properties, hydrostatics, fluid flow in closed conduits and open channels, and basic hydraulic structures .

Learning Activities:
Lectures, workshops.

TOPIC: Water Supply and Water Demand Management

DESCRIPTION: Different types of water demand, factors affecting water demand, demand forecasting, urban water demand management approaches, measures and case studies.

Learning Activities:
Lectures, workshops.

TOPIC: Geographic Information Systems (GIS)

DESCRIPTION: A practical introduction to the use of geographic information systems, remote sensing technologies and GIS-based modelling for the analysis and solution of different water and environmental problems. State of the art open source software will be used for the GIS computer exercises.

Learning Activities:
Lectures and computer workshops.

Lecturing Material

- Lecture notes Hydrology
- IHE lecture notes on Applied Hydraulics in Sanitary Engineering. N. Trifunovic, L.A. van Duijl.
- Lecture notes Water Supply and Water Demand Management
- Lecture notes GIS

Scientific software

Quantum GIS

UNESCO-IHE
Institute for Water Education

URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Salinas Rodriguez, S.G. (Sergio)

Module Name	Module Code	Credit Points
Hydrology, Water supply and water demand management and GIS	UWS/01	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)
	Hydrology and Hydraulics	12		8				20	44	*Salinas Rodriguez*
	Hydrology and Hydraulics (2)							0	0	*Stigter, Wenniger*
	Water Supply and Water Demand Management	8						8	24	*dr. S.K. Sharma*
	Geographic Information Systems	8	8					8	32	*dr. J. van der Kwast*
	Total	28	8	8	0	0	0	36	100	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

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

Module Name	Module Code	Credit Points
Chemistry and public health	UWS/02	5

Target Group	Prerequisites
Programme target group	Programme prerequisites

Assessment

%	Format	(Comment)
65	Written Exam (closed book)	Chemistry
35	Assignment	Public health

Learning Objectives

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

- Describe bonds between elements and identify chemical reactions.
- Calculate stoichiometric relationships in reactions and balance them.
- Describe reactions in water treatment (flocculation, adsorption, disinfection, softening, etc.).
- Describe waterborne infectious diseases and the pathogens.
- List legislative requirements for safe water, and explain Water Safety Plan and QMRA concepts for waterborne infections.
- Reproduce pathogen reductions by treatment processes.

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Topics and Learning Activities

TOPIC: Chemistry

DESCRIPTION: Atoms, ions, molecules; Periodic table of elements; Chemical bonds; Physical properties of matter; Basic principles of chemical reactions; Reaction rate; Equilibrium; Acid-base reactions; Precipitation vs. solubility; Redox reactions; Adsorption phenomenon and mechanisms; Ion exchange; Reactions in water treatment (flocculation, disinfection, iron removal, removal of aggressivity, softening); Introduction to organic chemistry.

Learning Activities:

Lectures, workshop, laboratory work.

TOPIC: Public health

DESCRIPTION: Waterborne infectious diseases; Global situation and regulations concerning water quality (WHO, UN, etc.); Current and innovative water treatment processes - focus on pathogen reduction; Water Safety Plans and risk assessment; Detection methodologies for microbial indicators and pathogens (e.g. ISO).

Learning Activities:

Lectures, assignment.

Lecturing Material

- Chemistry: self-study material, lecture notes, laboratory notes.
- Public health: lecture notes.

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

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

Module Name: Chemistry and public health								Module Code: UWS/02			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)	
	Chemistry	12		10	4			26	54	*Dr. Y.M. Slokar*	
	Public health	8	6	2				10	32	*Prof. dr. A.M. de Roda-Husman*	
	Total	20	6	12	4	0	0	36	86		

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Steen, N.P. van der

Module Name	Module Code	Credit Points
EPT, Microbiology and Integrated Urban Water	UWS/03	5

Target Group	Prerequisites
Programme target group	Programme prerequisites

Assessment

%	Format	(Comment)
35	Written Exam (closed book)	Environmental Process Technology
35	Written exam (closed book)	Microbiology
30	Assignment	Integrated Urban Water Management

Learning Objectives

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

- Apply mass balance analysis to natural and engineered water systems, especially for the analysis of microbial growth and substrate conversion in batch, CFST and plug flow reactors.
- Apply microbiological principles in water and wastewater engineering.
- Develop strategies for Integrated Urban Water Management, and to evaluate consequences for the wider social, economic and environmental context. The specific learning objectives for IUWM are: The knowledge/insight level: - To describe the urban water system (cycle), its components and interrelations, and its interactions with the (aquatic) environment. - To describe the causes of urbanisation and the effect on the urban water system. - To model water flows, material flows and energy consumption of an urban water system using a water balance software tool. The application level: - To apply theoretical concepts from systems engineering to the urban water system - To apply strategic and masterplanning of the urban water system, and describe links with general urban planning. The integration level: - To develop a strategy for IUWM, making use of water demand management and pollution prevention. - To clearly and coherently present your ideas in a well-organised formal academic report.

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Topics and Learning Activities

TOPIC: Environmental Process Technology (EPT)

DESCRIPTION: Mass balance analysis, reactor models, mixing in reactors, kinetics, mathematical description of chemical and biological reactions in reactors.

Learning Activities:
Lectures, workshops.

TOPIC: Microbiology

DESCRIPTION: In (water) microbiology will be discussed: morphology, physiology, growth kinetics, classification and ecology of bacteria, fungi, protozoa, algae, cyanobacteria and viruses; pathogenic organisms and public health; principles of microbial transformations of matter in natural and biological treatment systems; bacteriological tests in drinking water supply and waste water treatment.

Learning Activities:
Lectures, laboratories.

TOPIC: Integrated Urban Water Management (IUWM)

DESCRIPTION: The module is centered around a writing assignment, which is about assessing, evaluating and developing a strategy for IUWM in a real city. The lectures and workshops are aimed at supporting the students in preparing the technical report by training them in a number of tools that can be used to evaluate/develop IUWM strategies.

Learning Activities:
Lectures, workshops, assignment.

Lecturing Material

- UNESCO-IHE lecture note Environmental Process Technology - 2015 update - author: M. Bijlsma
- Various lecture notes provided by the lecturers.

Scientific software

AquaCycle

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Steen, N.P. van der

Module Name	Module Code	Credit Points
EPT, Microbiology and Integrated Urban Water	UWS/03	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	EPT	18		4				22	58	*dr. N.P. van der Steen*
2	Microbiology	12		16				28	52	*dr. J. vd Vossenberg, dr. H. vBruggen*
3	Intro IUWM and Technical report assignment	1	20					1	23	*dr. N.P. van der Steen*
4	IUWM Technical Writing	4						4	12	*W.J. Sturrock, Adv Dip Ed*
5	IUWM Systems analysis and the Urban Water System	4		6				10	18	*dr. N.P. van der Steen*
6	IUWM Material flows, Water and Energy	2		3				5	9	*dr. N.P. van der Steen*
7	IUWM Strategic planning for the Urban Water System	4						4	12	*dr. N.P. van der Steen*
8	IUWM Masterplanning for the Urban Water System	4						4	12	*prof. dr. D. Brdjanovic*
9	IUWM Stakeholder participation in Urban Water	2						2	6	*J.S. Kemerink, MSc*
	Total	51	20	29	0	0	0	80	202	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: WSE
Module Coordinator: Kennedy, M.D. (Maria)

Module Name	Module Code	Credit Points
Surface water treatment I	UWS/WSE/04	5

Target Group	Prerequisites
Mid-career professionals dealing with technical aspects of water and wastewater treatment plants, working for municipalities, water supply agencies or consulting firms.	BSc degree in Engineering or similar technical background meeting the MSc Programme entry requirements.

Assessment

%	Format	(Comment)
20	Assignment	
20	Lab report	
60	Written Exam (closed book)	

Learning Objectives

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

- Describe the theoretical principles of the unit processes: coagulation, filtration, sedimentation and dissolved air flotation in conventional surface water treatment
- Link theoretical principles with practical aspects
- Determine design parameters from experimental studies
- Design a sedimentation tank

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Topics and Learning Activities

TOPIC: Coagulation

DESCRIPTION: Theory of coagulation and flocculation processes: colloidal stability and mechanisms of destabilization, rapid and slow mixing, coagulation in practice and natural coagulants.

TOPIC: Sedimentation

DESCRIPTION: Hydrodynamic principles of sedimentation and flotation, Stokes Law, principles of discrete settling, flocculent settling and hindered settling. Horizontal and vertical continuous flow basins, settling tanks, shape of inlets and outlets. Design of a rectangular horizontal sedimentation tank.

TOPIC: Dissolved air flotation

DESCRIPTION: Key design parameters, Henry s law, nucleus theory, Stokes law, rate of rise theory, hydraulic loading rate, solids loading

TOPIC: Filtration

DESCRIPTION: General introduction to various types of filtration systems, Mechanical filtration, Slow sand filtration, Rapid sand filtration (pilot experiments, removal mechanisms, hydraulics, filter elements, rate control, backwashing, multi-layer filtration, applications, design considerations, filter arrangements, modelling, optimisation). Design aspects of the different filtration types.

TOPIC: Laboratory session

DESCRIPTION: Coagulation, sedimentation and filtration

TOPIC: Fieldtrip

Lecturing Material

- K. Ghebremichael, J. C. Schippers, J.P. Buiteman, Coagulation/Flocculation (LN0056/07/01)
- S.K. Sharma, Sedimentation (LN 0007/15/1)
- M.W. Blokland, N. Trifunovic and S.K Sharma, Sedimentation: Workshop problems (LN0009/07/1)
- S. K. Sharma , J.C. Schippers Filtration (Handout);
- J.P. Buiteman and K. J. Ives Filtration Workshop Problems (LN 0023/07/1)
- L. Huisman, Rapid filtration, (LN 0022/86/1); Reference
- L. Huisman, Mechanical filtration, (EE144/85/1); Reference
- J.P. Buiteman and K.J. Ives, Filtration, workshop problems (LN 0023/04/1)
- J.P. Buiteman, K. Ghebremichael, Laboratory Process Technology (LN 0004/07/1).

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: WSE
Module Coordinator: Kennedy, M.D. (Maria)

Module Name	Module Code	Credit Points
Surface water treatment I	UWS/WSE/04	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)
	Coagulation	6		2	4			12	28	*Prof. M.D. Kennedy; J.P. Buiteman*
	Sedimentation	10	4	6	3			19	46	*S.K. Sharma*
	Filtration	12		6	4			22	50	*S.K. Sharma, J.P. Buiteman*
	Dissolved air flotation	2		2				4	8	*A. Vlaski*
	Design asects of surface water treatment					8		8	8	*Prof. M.D. Kenendy, S.K. Sharma*
	Total	30	4	16	11	8	0	65	140	

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Institute for Water Education

URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Hammond, M.J. (Michael)

Module Name	Module Code	Credit Points
Urban drainage and sewerage	UWS/SE/UWEM/04	5

Target Group	Prerequisites
The same as the specializations (SE, UWEM) target groups.	The same as the specializations (SE, UWEM) per-requisites and having followed all the preceding modules.

Assessment

%	Format	(Comment)
60	Written Exam (closed book)	The written exam covers the following topics; (1)Introduction to urban drainage and sewerage, (2) Urban hydrological processes, (3)Sewerage layout and design and design exercise and pumping stations, (4)Hydraulics for urban drainage and sewerage (5) Sewer processes
15	Assignment	Computer workshops and Individual assignment
25	Assignment	Design Exercises

Learning Objectives

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

- Describe the purpose, need and importance of urban drainage and the challenges of modern urban drainage. Appraise different types of sewer systems and assess design, construction, operation and maintenance aspects, conditions of applicability and relative advantage and disadvantage of different types of sewer systems. Describe various aspects of Sustainable Drainage Systems / Best Management Practices and the design implications
- Describe the hydrological processes relevant to urban storm drainage and evaluate the impacts of urbanization on hydrological processes. Describe basic concepts in catchment modelling and compare different model types. Describe basic concepts of fluid flow and discuss the principles, fundamentals and applicability of methods to analyse conduit and free surface flows.
- Critically assess and analyse quantity and quality characteristics of stormwater and wastewaters originating from urban environments as a basis for the design, operation and maintenances of urban drainage system facilities.
- Describe data requirements and processing methods used in urban drainage management, by integrating different spatial and temporal data types, design standards and regulations and health safety for proper design, simulation and operation of urban drainage systems.
- Describe the chemical and biological processes that take place within sewer systems, and evaluate their implications for the design and operate of urban drainage systems.
- Explain the elements of an urban drainage system model, construct a simple model for analysis of hydraulics of a drainage system and interpret simple model results and use them for decision making in design, renewal and upgrading of urban drainage systems.
- Explain the standard practice in designing urban drainage systems. Prepare drainage system designs by integrating information on hydrological, hydraulic, economic and practical engineering concerns, and evaluating different design options.

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Topics and Learning Activities

TOPIC: Introduction to urban drainage and sewerage and types of drainage and sewer system

DESCRIPTION: purpose, types and historical development, system components and layout. Concepts such as Sustainable Drainage Systems / Best Management Practices

Learning Activities:
Lectures

TOPIC: Urban hydrological and hydraulic processes

DESCRIPTION: Hydrological processes relevant to urban storm drainage; rainfall and surface runoff, rainfall-runoff transformation, rainfall frequency analysis, extreme values and design storms; Hydraulics including the basic principles, pipe flow, part-full flow, open channel flow, pumped systems;

Learning Activities:
Lectures and exercises

TOPIC: Sewerage layout and design and design exercise and pumping stations

DESCRIPTION: Sewer system layout, approaches to urban drainage system
design, design criteria, sewer design calculations

Learning Activities:
Lectures, design exercise and assignment

TOPIC: Sewer processes

DESCRIPTION: Fundamentals of sewer processes; anaerobic processes; gas transfer; odour and corrosion problems; sewer ventilation; mitigation methods; case studies

Learning Activities:
Lectures and exercises

TOPIC: Data acquisition for urban drainage and sewerage studies

DESCRIPTION: Types of data and methods of acquisition for urban drainage systems design and management

Learning Activities:
Lectures

TOPIC: Dry and wet weather flows quantitative characterization

DESCRIPTION: Characterizing wet and dry weather flow for urban drainage systems design and management

Learning Activities:
Lectures and exercises

TOPIC: Model-based design and simulation

DESCRIPTION: Modelling principles, modelling tools, application
of models

Learning Activities:
Lecture, exercise and assignment

Lecturing Material

- UNESCO-IHE lecture materials and other relevant lecturing materials

Scientific software

MIKE URBAN

UNESCO-IHE
Institute for Water Education

URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Hammond, M.J. (Michael)

Module Name	Module Code	Credit Points
Urban drainage and sewerage	UWS/SE/UWEM/04	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	1						1	3	*Hammond*
2	Introduction to urban drainage and sewerage and Types of drainage and sewer s	2						2	6	*Hammond*
3	Urban hydrological processes	6						6	18	*Pathirana*
4	Hydraulics of urban drainage and sewerage	6						6	18	*Hammond*
5	Dry and wet weather flows quantitative characterization and exercise	4						4	12	*Brdjanovic*
6	Sewerage layout and design	4						4	12	*Hammond*
7	Conventional sewer design exercise						6	6	18	*Hammond/ van der Zwan / Kleijn*
8	Pumping stations and CSOs	2						2	6	*Hammond*
9	Sewer proceses	8		4				12	28	*Vollertsen / Nielsen*
10	Data acquisition for urban drainage and sewerage studies	2						2	6	*Vojinovic*
11	Model-based design and simulation	2		4				6	10	*Vojinovic / Hammond*
12	Field trip					3		3	3	*Hammond*
	Total	37	0	8	0	3	6	54	140	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Lopez Vazquez, C.M.

Module Name	Module Code	Credit Points
Conventional wastewater treatment	**UWS/SE/05**	**5**

Target Group	Prerequisites
MSc participants enroled in the Municipal Water Infrastructure program from the Sanitary Engineering Specialization (uws-SE). Wastewater professionals with background and/or proven qualifications in sanitary engineering, environmental sciences, microbiology, civil engineers, chemical engineering, biochemical engineering, environmental engineering and/or environmental biotechnology.	Preceding modules of the uws-SE program and/or, in the case of short-course participants, required background on sanitary and wastewater engineering (see target group) in full compliance with UNESCO-IHE admission regulations.

Assessment

%	Format	(Comment)
80	Written Exam (closed book)	
20	Assignment	

Learning Objectives

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

- critically determine and analyse quality and quantity characteristics of wastewater originating from urban environments as a basis for the design, control and operation of sewage treatment facilities.
- discuss the physical, chemical, and biological processes applied for sewage purification and the complex interactions among them occurring in wastewater treatment systems.
- apply the knowledge on biological treatment processes and engineering on the process design and critical assessment of wastewater treatment systems and configurations for the removal of organic matter (as COD) and nutrients (nitrogen and phosphorus) as a function of environmental, operating and wastewater conditions and characteristics.
- discuss the principles, fundamentals and applicability of recently developed wastewater treatment processes such as innovative nitrogen removal processes and membrane bioreactors.

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Topics and Learning Activities

TOPIC: Wastewater characterization and sampling

DESCRIPTION: Description and analysis of the different factors that affect the quantity and quality of wastewater generated in urban environments. Discussion of relevant components and activities commonly used to assess and determine the wastewater quality and strength. Review of typical wastewater compositions as a function of their origin and procedence.

Learning Activities:
Lecture, field trip.

TOPIC: Primary treatment

DESCRIPTION: Fundamentals and (design) principles of primary treatment systems commonly applied in wastewater treatment processes and configurations.

Learning Activities:
Lecture, field trip.

TOPIC: Biological processes for the removal of organic matter, nitrogen and phosphorus

DESCRIPTION: Fundamentals, mechanisms and design principles of the microbial processes involved in the biological removal of carbon, nitrogen and phosphorus in wastewater treatment systems. Influence of environmental, operating and wastewater conditions and characteristics on the biological processes. Guidance for the selection of relevant parameters for the design (following a stochiometrically-based steady-state model), operation and control of treatment systems.

Learning Activities:
Lecture, exercise lab, field trip.

TOPIC: Final settling

DESCRIPTION: Design, operating and practical aspects that affect the solid-liquid separation processes that occur in secondary settling tanks in (activated sludge) wastewater treatment systems.

Learning Activities:
Lecture, exercise lab, field trip.

TOPIC: Innovative nitrogen removal processes

DESCRIPTION: Overview of the principles, fundamentales, characteristics, and operating and control aspects of the SHARON, ANAMMOX, combined SHARON-ANNAMOX and BABE processes. Guidance for the selection of the most appropriate and feasible side-stream process according to local and operating needs and conditions. Review of recent case-studies.

Learning Activities:
Lecture, field trip.

TOPIC: Membrane bioreactors

DESCRIPTION: Principles, characteristics and fundamentals of membrane bioreactors (MBR) applied in municipal wastewater treatment facilities. Review and discussion of the latest (full-scale) case-studies and recent developments.

Learning Activities:
Lecture.

Lecturing Material

- M. Henze, MCM van Loosdrecht, G. Ekama and D. Brdjanovic: Biological Wastewater Treatment: Principles, Modelling and design. IWA Publishing (2008).
- (Selected) video lectures from the Online Course on Biological Wastewater Treatment: Principles, Modelling and design (OLC-BWWT). UNESCO-IHE, Institute for Water Education. Delft, The Netherlands.
  http://www.unesco-ihe.org/Education/Short-courses/Online-courses

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Lopez Vazquez, C.M.

Module Name Conventional wastewater treatment								Module Code UWS/SE/05		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	Wastewater chracterization and sampling	4						4	12	*Prof. Brdjanovic*
2	Primary treatment	4						4	12	*Prof. Brdjanovic*
3	Organic matter removal	4		1	1		2	8	21	*Dr.Lopez Vazquez/Prof.Ekama/Dr.Welles*
4	Nitrification	4		1	1	1	2	9	22	*Dr.Lopez Vazquez/Prof.Ekama/Dr.Welles*
5	Denitrification	4		1	1		2	8	21	*Dr.Lopez Vazquez/Prof.Ekama/Dr.Welles*
6	Enhanced biolological phosphorus removal	4		1	1	1	2	9	22	*Dr.Lopez Vazquez/Prof.Ekama/Dr.Welles*
7	Final settling	4		1				5	13	*Dr. Lopez Vazquez*
8	Innovative nitrogen removal	4						4	12	*Prof. van Loosdrecht / Dr. Lopez Vazquez*
9	Membrane bioreactors	4		1				5	13	*Dr. Garcia Hernandez*
	Total	36	0	6	4	2	8	56	148	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Pathirana, P.D.A.

Module Name	Module Code	Credit Points
Asset management	**UWS/UWEM/05**	**5**

Target Group	Prerequisites
Engineers, Managers and other water professionals at the mid-carrier level. Especially relevant for those involved in the urban water context (e.g. Utilities, Urban Water management)	A first degree in Engineering, Science or a related field. However, enthusiastic participants who possess degrees of different backgrounds would be admitted on case-by-case basis.

Assessment

%	Format	(Comment)
60	Oral Exam	
40	Assignment	All assignments. Including workshops and homework.

Learning Objectives

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

- explain the historical processes that made asset management approach important for urban infrastructure engineers and managers anddescribe the drivers (e.g. climate variability/change, urbanization, increasing poverty, etc...) that make asset management crucial for sustainable provision of water related infrastructure services;
- define asset management in your own words and List and describe the essential steps of an asset management plan and provide example problems from ones own experience (professional or personal) which asset management approach would be/would have been able to solve;
- describe the techniques used in asset inventories (e.g. condition rating) and describe the importance of data for asset management process.
- Define databases and describe what a relational database is. Design a simple relational database (on paper!). List the important features of a relational database and appraise the use of data driven models in Asset Management. Describe sample approaches (e.g. ANN, Decision Trees);
- explain a decision prioritisation plan based on the analysis of significance and condition of asset components and apply hydraulic modelling to establish significance of asset components of water distribution/drainage systems;
- describe asset condition modelling approaches. Recommend suitable modelling approaches for practical problems and appraise the recent developments in the field of Asset Management of water infrastructure.

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Topics and Learning Activities

TOPIC: Introduction + Overview of the course

TOPIC: Introduction and historical perspectives

TOPIC: Risk based renewal decision making

TOPIC: Asset condition assessment and modelling

TOPIC: Significance assessment of assets.

TOPIC: Data in asset management

TOPIC: Optimization in asset management

Lecturing Material

- ...

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Pathirana, P.D.A.

Module Name Asset management								Module Code UWS/UWEM/05		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 + Overview of the course	1						1	3	*Pathirana*
2	Asset Inventory	2						2	6	*Gersonius*
3	Data/Databases	1						1	3	*Seyoum*
4	Relational databases in Asset Management	2		2				4	8	*Pathirana*
4	Making sense of data - data mining in AM	2		4				6	10	*Seyoum/Pathirana*
5	Risk-based decision making in AM	2						2	6	*Pathirana*
7	Risk-based decision making - workshop	1		8				9	11	*Pathirana*
8	Condition Modelling	8						8	24	*Kliener*
9	Condition Modelling excercise			10				10	10	*Kliener*
10	Field trip					8		8	8	*Pathirana*
11	Advancements in Asset Management	6		2				8	20	*van Heck/van der Drift/Pathirana*
12	Economics of AM	2						2	6	*van Dijk*
13	Failure registration in AM	2						2	6	*KWR water*
14	Special considerations in applying AM in developing countries	2		2				4	8	*Pathirana*
15	Historical context of modern Asset Management	1						1	3	*Pathirana*
	Sustainable Water Services and AM	6						6	18	*Ashley*
	Total	38	0	28	0	8	0	74	150	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water supply engineering
Module Coordinator: Ferrero, G.

Module Name	Module Code	Credit Points
Surface water treatment II	UWS/WSE/05	5

Target Group	Prerequisites
Students of the UWS master programme. Professionals in water treatment, consulting agencies, ministries and equipment suppliers.	Participants should meet the general UNESCO-IHE admission criteria, and possess a BSc degree in chemical, environmental, or civil engineering.

Assessment

%	Format	(Comment)
70	Written Exam (closed book)	
20	Lab report	
10	Assignment	

Learning Objectives

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

- Explain the principles of disinfection, drinking water quality, natural treatment systems, adsorption and activated carbon filtration processes
- Integrate theoretical principles of disinfection with practical aspects of evaluation of disinfection systems
- Prepare conceptual design of appropriate processes depending on the nature of impurities to be removed and the intended use of the treated water

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Topics and Learning Activities

TOPIC: Drinking water quality

DESCRIPTION: Drinking water quality guidelines

Learning Activities:
lecture

TOPIC: Water collection and storage

DESCRIPTION: Algae in surface water treatment and effect of storage on water quality

Learning Activities:
lecture, exercise

TOPIC: Disinfection

DESCRIPTION: Basic principles of disinfection; chemical disinfection; disinfection by products; ozone disinfection; UV disinfection.

Learning Activities:
lecture, exercise, labwork

TOPIC: Adsorption

DESCRIPTION: Theoretical background of adsorptive processes.

Learning Activities:
lecture

TOPIC: Activated carbon

DESCRIPTION: Granular and powdered activated carbon, modelling and design.

Learning Activities:
lecture, exercise, labwork

TOPIC: Natural systems

DESCRIPTION: Theory of bank filtration and aquifer recharge

Learning Activities:
lecture

Lecturing Material

- Ferrero, G., Schippers, J.C., Kruithof, J.C., Martijn, B.J. Disinfection of Drinking Water & Water Quality (LN0461/14/2)
- Buiteman, J.P. Surface Water Treatment Laboratory manual - part 2 - (LN0469/13/1)
- Handouts on Water collection and storage, Adsorption and activated carbon, Natural systems

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water supply engineering
Module Coordinator: Ferrero, G.

Module Name: Surface water treatment II								Module Code: UWS/WSE/05			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)	
	Drinking water quality	4						4	12	*G. Ferrero, PhD*	
	Surface water collection and storage	4		2				6	14	*Prof. M.D. Kennedy*	
	Disinfection	12		4	8		4	28	68	*G. Ferrero, PhD/B. Martijn, MSc*	
	Adsorption	4		2				6	14	*S. Sharma, PhD*	
	Activated carbon	4		2	2			8	18	*S. Sharma, PhD*	
	Natural systems	4						4	12	*S. Sharma, PhD*	
	Field trip					4		4	4	*G. Ferrero, PhD*	
	Total	32	0	10	10	4	4	60	142		

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: SE
Module Coordinator: Ronteltap, M.

Module Name	Module Code	Credit Points
Resource oriented wastewater treatment and sanitation	**UWS/SE/06**	**5**

Target Group	Prerequisites
Participants of the uws/SE programme and short course participants.	Preceding Sanitary Engineering Modules.

Assessment

%	Format	(Comment)
80	Written Exam (closed book)	
20	Assignment	

Learning Objectives

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

- describe the physical, chemical and microbiological processes occurring in anaerobic reactors and a number of natural systems
- critically reflect on the current sanitation systems encountered in many urban areas and to indicate ways to improve this situation in a sustainable manner;
- evaluate the possibilities for closing cycles of energy, water and nutrients
- evaluate the feasibility of the application of the technologies studied in this module in urban settings in the developing world
- carry out preliminary process design of treatment and reuse systems to assess the needs for capital, land, equipment and operation and maintenance

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Topics and Learning Activities

TOPIC: Anaerobic Wastewater Treatment

DESCRIPTION: Fundamentals about anaerobic degradation and its application in wastewater treatment.

Learning Activities:
Lectures; process design exercise; laboratory assignment; field trip

TOPIC: Urine Treatment

DESCRIPTION: Different technologies for the treatment of urine and possible recovery routes for nutrients and energy.

Learning Activities:
Lectures and laboratory exercise.

TOPIC: Effluent reuse in agriculture

TOPIC: Waste Stabilisation Ponds; Constructed Wetlands; Soil aquifer treatment

DESCRIPTION: Technology of Waste Stabilisation Ponds and their application.
Technology of Constructed Wetlands and their application.
Technology of SAT.

Learning Activities:
Lectures; process design exercise

TOPIC: Algae photobioreactors

TOPIC: Energy recovery (in view of New Sanitation)

DESCRIPTION: New sanitation is about the recovery of water, nutrients and energy, i.e. seeing waste as a resource. This class will discuss new sanitation with an emphasis on energy recovery.

Learning Activities:
Lecture

Lecturing Material

- Lecture notes.
- van Loosdrecht, Ekama and Brdjanovic. Biological wastewater treatment.

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: SE
Module Coordinator: Ronteltap, M.

Module Name	Module Code	Credit Points
Resource oriented wastewater treatment and sanitation	UWS/SE/06	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	Anaerobic WWT Introduction	8						8	24	*Van Lier*
2	Anaerobic Microbiology	2						2	6	*Van de Vossenberg*
3	UASBs	6						6	18	*Van Lier*
4	Case studies anaerobic WWT			4				4	4	*Chernicharo*
5	Waste Stabilisation Ponds				6			6	12	*Van der Steen*
6	Urine treatment	6			3			9	24	*Udert / Ronteltap*
7	Field Trip					8		8	8	*Ronteltap*
8	Effluent reuse	2						2	6	*Van Lier*
9	Algae photobioreactors	6			2			8	22	*Van der Steen*
10	Soil Aquifer Treatment	2						2	6	*Sharma*
11	Constructed Wetlands	4						4	12	*Van Bruggen*
	Total	**36**	**0**	**4**	**11**	**8**	**0**	**59**	**142**	

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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

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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

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WATER MANAGEMENT

MASTERS PROGRAMME

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

Module Name: Managing water organisations								Module Code: WSM06			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)	
	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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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Petrusevski, B.

Module Name	Module Code	Credit Points
Groundwater resources and treatment	UWS/WSE/06	5

Target Group	Prerequisites
The module specifically targets professionals in water treatment companies, consulting agencies, ministries and equipment suppliers.	Participants should meet the general UNESCO-IHE admission criteria, and possess a BSc degree in Chemical, Environmental, Civil or Sanitary Engineering.

Assessment

%	Format	(Comment)
70	Written Exam (closed book)	
15	Assignment	
15	Lab Report	

Learning Objectives

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

- Assess if given (ground)water is aggressive against materials used in water a supply system and propose appropriate neutralisation technique.
- Assess overall quality of a given groundwater.
- Establish appropriate treatment approach for groundwater containing commonly occurring impurities and pollutants including iron, manganese, ammonia, fluoride, and hydrogen sulphate.
- Gain knowleadge on arsenic and fluoride related problems and select appropriate treatment methods for their removal.

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Topics and Learning Activities

TOPIC: Water Quality & Treatment

DESCRIPTION: Removal of taste and odour, aggressive characteristics of water, neutralisation of aggressive nature of water, aeration

Learning Activities:
Lectures, exercise

TOPIC: Groundwater quality

DESCRIPTION: Relevant parameters for groundwater quality, assessment of quality of selected groundwater

Learning Activities:
Lectures, exercise

TOPIC: Groundwater treatment

DESCRIPTION: Conventional and advanced concepts in the removal of iron, manganese, ammonia, arsenic, fluoride and hydrogen sulphate

Learning Activities:
Lectures,(comupter) exercises, assignements

TOPIC: Laboratory Course on Iron and Arsenic analysis and removal:

DESCRIPTION: Kinetics of ferrous iron oxidation, removal of iron and arsenic, analysis of iron and arsenic

Learning Activities:
Laboratory course, assignement

TOPIC: Fieldtrip

DESCRIPTION: Visit of a selected groundwater treatment plant in The Netherlands, Establishing a conceptual design for groundwater treatment plant based on quality of available groundwater and clients requirements

Learning Activities:
Group exercise, field visit of a groundwater treatment plant

TOPIC: Advance Groundwater Treatment in The Netherlands and Belgium

DESCRIPTION: An overview of advance groundweater treatment applied in The Netherlands including Ion Exchange for removal of organics and (direct) nano filtration

Learning Activities:
Lectures, design exercise, field visit

Lecturing Material

- J. C. Schippers, Petrusevski, S. Sharma Water Quality & Treatment; Groundwater Treatment (LNO263-12-1)
- P. Hiemstra, Design Exercise Advanced Groundwater Treatment
- W. v/d Meer, Advance Groundwater Treatment in The Netherlands
- H.J. Poepel and P.J.H. Post, Aeration and Gas Transfer- Part 1 (EE123/99/1)
- H.J. Poepel and P.J.H. Post Aeration and Gas Transfer- Part 2, Appendix- Practical Aspects of Aerators (EE123/94/1);
- P.J.H. Post, Aeration, workshop problems (EE377/98/1)

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Petrusevski, B.

Module Name Groundwater resources and treatment								Module Code UWS/WSE/06		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)
	Introduction	1		1				2	4	*B. Petrusevski*
	Water Quality and Treatment	4		4				8	16	*B. Petrusevski, Y.M. Slokar*
	Ground Water Quality	2		2				4	8	*B. Petrusevski*
	Conventional Ground Water Treatment	8		2	4			14	34	*B. Petrusevski, S.Sharma, Y.M. Slokar*
	Advanced GWT in The Netherlands	1		3				4	6	*W. v/d Meer*
	Field trip					6		6	6	*B. Rietman, B. Petrusevski*
	Aerartion	4		2				6	14	*Y.M. Slokar*
	Patogens transport in soil	1		1				2	4	*J.W. Foppen*
	Arsenic removal	3		3	4			10	20	*B. Petrusevski, Y.M. Slokar, F. Kruis*
	Fluoride removal	2						2	6	*B. Petrusevski*
	Computer exercise: Groundwater treatment			4			2	6	10	*P. Hiemstra*
	Hydrogen sulfide removal	1		1				2	4	*S. Sharma*
	Groundwater Treatment in Belgium	1		3				4	6	*K. Huysman*
	Introduction to Igrac and Akvo			2				2	2	*L.van Noort, N. Kukuric*
	Total	28	0	28	8	6	2	72	140	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Lopez Vazquez, C.M.

Module Name	Module Code	Credit Points
Wastewater treatment plants design and engineering	**UWS/SE/07**	**5**

Target Group	Prerequisites
MSc participants enrolled in the Urban Water and Sanitation program from the Sanitary Engineering Specialization (UWS-SE). Wastewater professionals with background and/or proven qualifications in sanitary engineering.	Preceding modules of the UWS-SE program and/or, in the case of short-course participants, required background on sanitary and wastewater engineering (see target group) in full compliance with UNESCO-IHE admission regulations.

Assessment

%	Format	(Comment)
50	Written Exam (closed book)	
25	Oral exam	Based on the development of a design project.
25	Assignment	

Learning Objectives

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

- Select the most suitable and cost-effective wastewater treatment process technology (among the most widely applied anaerobic, aerobic, land-based and on-site systems) to treat certain wastewater stream given its composition and characteristics and taking into account the required effluent standards.
- Carry out a preliminary design of a wastewater treatment system (based on the most widely applied anaerobic, aerobic, land-based and on-site systems) including the engineering process lay-out, hydraulic profile and process flow-diagram (PFD).
- Identify and estimate the construction, operational and maintenance costs of a wastewater treatment plant and the investments required to secure its satisfactory operation throughout the expected life-span of the system.
- Describe the main elements and components involved in the project planning for the design, engineering, construction, start-up and operation of a wastewater treatment plant.

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Topics and Learning Activities

TOPIC: Technology Selection.

DESCRIPTION: Review of the most commonly applied wastewater treatment process technologies (among anaerobic, aerobic, land-based and on-site systems). Criteria selection guidelines for the determination of a suitable wastewater treatment process technology to treat a wastewater stream to the required degree to meet the required effluent standards taking into account local conditions and resources availability. Technology selection software tools.

Learning Activities:
Lecture, exercise, design exercise, case-studies.

TOPIC: Costing

DESCRIPTION: Fundamentals and principles of costing. Identification and estimation of direct and indirect costs involved in the design, construction, operation and maintenance of wastewater treatment systems. (Project) budgeting.

Learning Activities:
Lecture, exercise.

TOPIC: Engineering Economics.

DESCRIPTION: Fundamentals and principles of economics (such as cash-flow, interest factors, return of investment and benefit-cost analyses, among others). Evaluation, comparison and selection of cost-effective wastewater treatment system alternatives.

Learning Activities:
Lecture, exercise.

TOPIC: Engineering process layouts and process flow diagrams.

DESCRIPTION: Design and calculation of engineering process layouts and process flow diagrams for the design and operation of wastewater treatment plants (for conventional anaerobic, aerobic, land-based and on-site systems). A detailed design exercise will be carried out on a selected wastewater treatment processes lay-out.

Learning Activities:
Lecture, exercise, case-studies.

TOPIC: Hydraulic design.

DESCRIPTION: Calculation and design of hydraulic profiles (based on the behaviour and performance of hydraulic structures and elements) for the design and operation of wastewater treatment plants.

Learning Activities:
Lecture, design exercise, case-studies.

TOPIC: Design and Engineering of CAS and UASB wastewater treatment systems

DESCRIPTION: Preliminary design, including influent characteristics, sizing and dimensioning of a conventional activated sludge and conventional anaerobic wastewater treatment plant. Design and selection of equipment for monitoring, operation and control. Review of case-studies including planning, project management, and project administration of the construction and operation.

Learning Activities:
Lecture, exercise, case-studies, design exercise.

TOPIC: Design and Engineering of land-based and on-site wastewater treatment systems.

DESCRIPTION: Preliminary design, including influent characteristics, sizing and dimensioning of a land-based wastewater treatment plant (e.g. pond systems,constructed wetlands) and on-site sanitation systems. Design and selection of equipment for monitoring and operation. Review of case-studies including planning, project management, and project administration of the construction and operation.

Learning Activities:
Lecture, exercise, case-studies, design exercise.

Lecturing Material

- MOP 8: Design of Municipal Wastewater Treatment Plants. 5th Edition. ASCE Manuals and Reports on Engineering Practice No. 76.
- Franceys R, Pickford J, Reed R (1992) A Guide to the Development of on-Site Sanitation, World Health Organization. ISBN 92 4 154443 0. U.K.

Scientific software

Process selection software tools, hydraulic design software tools, AutoCad.

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Institute for Water Education

URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Lopez Vazquez, C.M.

Module Name	Module Code	Credit Points
Wastewater treatment plants design and engineering	UWS/SE/07	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	Technology Selection.	4		2				6	14	*Dr. C.M. Hooijmans*
2	Engineering Economics	4		2				6	14	*Ir. Hans Haase/Grontmij*
3	Costing	4		2				6	14	*Ir. Hans Haase/Grontmij*
4	Engineering process layouts and process flow diagrams	4		2			2	8	20	*Prof. Damir Brdjanovic*
5	Hydraulic design.	4		2			2	8	20	*Dr. Carlos Lopez-Vazquez*
6	Design and Engineering of Conventional Activated Sludge (CAS) Systems	4		2			2	8	20	*Ir. Annette Buunen van Bergen/Grontmij*
7	Design and Engineering of Conventional UASB systems.	4		2			2	8	20	*Prof. Jules van Lier*
8	Design and Engineering of land-based wastewater treatment systems	4		2			2	8	20	*Prof. M. von Sperling*
	Total	32	0	16	0	0	10	58	142	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Supply Engineering, Urban Water Engineering and Management
Module Coordinator: Trifunovic, N.

Module Name	Module Code	Credit Points
Water transport and distribution	UWS/WSE/UWEM/07	5

Target Group	Prerequisites
Mid-career professionals dealing with technical aspects of drinking water transport & distribution, working for water supply companies, municipal assemblies or consulting bureaus.	BSc degree in Civil Engineering or similar technical background; general PC-computer knowledge; good English command.

Assessment

%	Format	(Comment)
60	Written Exam (open book)	The exam inludes the part on Chapters 2 to 4 of the introductory subject and the other one on the leakage mangement and control
40	Assignment	Design exercise assignment Water Distribution, using EPANET network modelling software. Individual report should be submitted.

Learning Objectives

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

- distinguish between different network configurations and supplying schemes; recognise various consumption categories and their growth patterns, including water leakage; define the relation between the main hydraulic parameters, namely the demands, pressures, velocities and hydraulic gradients;
- demonstrate understanding of the steady-state hydraulics by being able to select appropriate pipe diameters, indicate optimum location of reservoirs and identify pumps capable to supply the demand;
- apply the above theoretical knowledge by learning to perform computer-aided hydraulic calculations and predict the consequences of demand growth on the hydraulic performance of particular WTD system;
- analyse the implications of various operational modes of pumping stations and compare the investment and operational costs for various network layouts and supplying schemes;
- propose preliminary hydraulic design that will integrate economic aspects, choose adequate components, and judge technical solutions dealing with the network maintenance, rehabilitation, and expansion.

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Topics and Learning Activities

TOPIC: Introduction to Water Transport and Distribution

DESCRIPTION: Main objectives and components of WTD systems; water demand categories, patterns, calculation and forecasting; steady-state hydraulics of pressurised flows, single pipe calculation, branched and looped networks, pressure driven demand; hydraulics of storage and pumps; hydraulic design: choice of supply scheme, network layouts, design of pumping stations, power requirements and energy consumption; engineering design: choice of pipe materials, valves and other equipment; network construction: pipe laying, testing and disinfection; operation & maintenance: regular & irregular supply, network cleaning and rehabilitation.

Learning Activities:

The core of the blended learning approach is the MS PowerPoint slideshow prepared with audio presentation, discussed during lectures accompanied by MS Excel spreadsheet hydraulic lessons; these are also available for self study i.e. solving of workshop problems. During the design exercise, network operation is analysed by using EPANET software (US Environmental Protection Agency, Ver.2). Finally, a seminar is organised to present typical operation and maintenance practices in The Netherlands.

TOPIC: Water Loss Management and Control

DESCRIPTION: Definition of non-revenue water and IWA terminology used in the sector, components of water losses, methods of reducing and controlling real- and apparent network losses; quantification of leakage in distribution systems, leak location and repair techniques, pressure management.

Learning Activities:

The lecture materials consist of Power Point presentations slides. Additionally, some sample questions (including calculations) and multiple choice questions have been provided to practice and to test the understanding of the subject. After going through the lectures, the participants are advised to answer the sample questions and then they can do the multiple choice questions. Furthermore, lists of additional reading materials have been provided, which will help the participants to further enrich knowledge in this field.

Lecturing Material

- N.Trifunovic - Introduction to Urban Water Distribution, Taylor & Francis, 2006, reprint 2008
- S.Sharma - Water Losses in Distribution Systems, lecture notes UNESCO-IHE 2010 (LN/0346/10/1)
- Electronic materials: slide presentations (MS PowerPoint), design assignment, design network model (EPANET Ver.2), spreadsheet hydraulic lessons (MS Excel)

Scientific software

EPANET (US Environmental Protection Agency, Ver.2)

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Institute for Water Education

URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Water Supply Engineering, Urban Water Engineering and Management
Module Coordinator: Trifunovic, N.

Module Name: Water transport and distribution								Module Code: UWS/WSE/UWEM/07			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 to Water Transport and Distribution	23		9			12	44	114	*N.Trifunovic, A.Pathirana, J.Vreeburg*	
2	Water Loss Management and Control	8		2				10	26	*S.Sharma*	
	Total	31	0	11	0	0	12	54	140		

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Hooijmans, C.M. (Tineke)

Module Name	Module Code	Credit Points
Modelling of wastewater treatment processes and plants	UWS/SE/08	5

Target Group	Prerequisites
The module primarily targets professionals working in water and sewerage companies, consulting firms, industry, municipalities, universities and ministries.	General admission criteria IHE and a B.Sc. degree in preferably Civil Eng., Env. Eng., Microbiology, Chemistry or Chemical

Assessment

%	Format	(Comment)
25	Assignment	Assessment of application skills: Modelling of an activated sludge WWTP using BioWin
15	Assignment	Assessment of application skills: Modelling of another type of reactor using BioWin
60	Written Exam (closed book)	Assessment of theoretical knowledge and application skills

Learning Objectives

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

- memorize the basics of wastewater treatment modelling (kinetics, stoichiometry, mass balances, hydraulics and matrix notations). Can develop a matrix for a biological model. Can use the computer software AQUASIM as a tool for modelling wastewater treatment processes. Can put a matrix in AQUASIM
- explain the nitrification and bio-P-process and the matrix of the biological models. Can put the matrix in AQUASIM and explain the outcome of the model run and the implications for wastewater treatment
- evaluate data and processes and apply it in a BioWin exercise, relates the use of BioWin as a tool for modeling activated sludge processes. Apply the theory with respect to modeling using a case study. Can put the model into BioWin and can discuss and explain the outcome of the model
- explain the modeling of other reactor types. Memorize how the model works in BioWin
- explain the modeling of natural systems and the difference with activated sludge modeling.

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Topics and Learning Activities

TOPIC: Wastewater treatment modelling

DESCRIPTION: Basic wastewater treatment modelling kinetics, stoichiometry, mass balances, hydraulics and matrix notations. Introduction of computer program AQUASIM as tool for modelling wastewater treatment processes.

Learning Activities:
Presentations, tutorial and AQUASIM computer exercises.

TOPIC: Modelling activated sludge processes: ASM approach

DESCRIPTION: An overview of existing IWA models (e.g. ASM1, ASM2d), ASM3, TUD(P) models. Procedures for characterisation of wastewater and sludge. Protocol for development of calibrated activated sludge models. Case studies on modelling wastewater treatment processes using AQUASIM and BioWin.

Learning Activities:
Presentations, case studies.

TOPIC: Modelling of an activated sludge plant using BioWin

DESCRIPTION: Optimization of an existing wwtp, supported by presentations on the approach and procedures.

Learning Activities:
Presentations, computer exercise.

TOPIC: Modelling other sytems such as MBR reactors using BioWin

DESCRIPTION: Modelling of other reactors following the ASM approach

Learning Activities:
Presentations, computer exercise.

TOPIC: Modelling pond systems

DESCRIPTION: Modelling of pond systems by modification and extension of ASM and hydraulic modelling.

Learning Activities:
Presentations.

Lecturing Material

- Wastewater treatment modelling: an introduction (Presentation);
  Modelling Activated Sludge Processes (Book Chapter);
  A General Model for Single-sludge Wastewater Treatment Systems (Paper).
- AQUASIM Modelling (Presentation);
  AQUASIM (Tutorial including Exercises);
  Determination of kinetic parameters of nitrification (Presentation);
  Modelling Nitrification, Heterotrophic Growth and Predation in Activated Sludge (Paper).
- Modeling the carbon source, temperature and pH-effects on the Biological Phosphorus Removal Process (Presentation);
  Biological P-removal modelling (Exercise);
  Temperature Effects on Glycogen Accumulating Organisms (Paper).
- Modelling activated sludge wastewater treatment plants: applications (Presentation); Modelling Activated Sludge Wastewater Treatment Plants: Applications (Paper).
- Modelling activated sludge processes (Presentation);
  Activated Sludge Modelling and Simulation (Paper);
  Practical Protocol for Dynamic Modelling of Activated Sludge Systems (Paper).
- Data and process evaluation (Presentation);
  Experience with Guidelines for Wastewater Characterization in the Netherlands (Paper);
  BioWin modelling (Exercise).
- Modelling waste stabilization ponds (Presentation);
  3D Model for a Secondary Facultative Pond (Paper).
- Modelling other bioreactors (Presentation);BioWin modelling. (Exercise)
- Practical guide for activated sludge modelling, UNESCO-IHE lecture notes series, S.Meijer/D.Brdjanovic

Scientific software

AQUASIM, BioWin

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Hooijmans, C.M. (Tineke)

Module Name	Module Code	Credit Points
Modelling of wastewater treatment processes and plants	UWS/SE/08	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	Modelling introduction	2						2	6	*Hooijmans*
2	Set-up matrix			2				2	2	*Hooijmans*
3	Aquatic systems modelling (AQUASIM), BioWin introduction	7		15				22	36	*Hooijmans*
4	Modelling activated sludge processes	4						4	12	*van Loosdrecht*
5	Data and process evaluation	4						4	12	*Meijer*
6	Activated sludge system modelling (BioWin)		10	18				18	28	*Meijer*
7	Other reactor system modelling (BioWin)	2	8	10				12	24	*Garcia (reserve: Spanjers)*
9	Modelling application examples	4						4	12	*Brdjanovic*
9	Fieldtrip					4		4	4	
	Total	23	18	45	0	4	0	72	136	

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WATER SCIENCE AND ENGINEERING

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Hydroinformatics: modelling and information systems for water management
Module Coordinator: Hammond, M.J. (Michael)

Module Name	Module Code	Credit Points
Urban flood management and disaster risk mitigation	WSE/HI/08B/e	5

Target Group	Prerequisites
Participants in WSE programmme; Participants in short course "Urban Flood Management and Disaster Risk Mitigation"	Basic knowledge of hydrology and hydraulics

Assessment

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

Learning Objectives

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

- A change to proactive management of water-related disasters in urban areas requires an identification of the risk, the development of strategies to reduce that risk, and the creation of policies and programmes to put these strategies into effect.
  This course introduces current theory and practice of flood risk estimation and modelling of floods in urban areas. It provides hands-on practice with industrial standard software. The main objective of this course is to provide the most up-to-date information on the topic of urban flood modelling and disaster management and to enable participants to be more effective in applying modelling tools and techniques for urban flood management.
  Different modelling approaches are considered and they range from data driven to physically based, from conceptual to detailed 1D-2D modelling. These approaches are then embedded in the wider context of flood risk assessment and disaster management. This wider context considers everything from how the urban planning process should take place in areas with potential flood risks, to urban hydrology, climate change, flood hazards, environmental impacts, public health issues and the conceptual design of flood protection schemes.

  The first learning objective is to develop enhanced understanding of the effects of climate variability on the hydrology that affects urban areas
- Understand the structure, service provided and failures of the service for urban stormwater /drainage networks; Urban Drainage Asset Management and Optimisation, and learn how to model these systems and how to apply a typical modelling product (MOUSE, MIKE11, MIKE21 and SWMM)
- Develop understanding of how to use the models to assess the performance of existing systems and how to design the new ones within the context of different flood risks (pluvial, fluvial, coastal and flash floods)
- Learn how to build safe and reliable urban drainage models and how to evaluate system performance against different standards (engineering, environmental, public health, etc.), and develop understanding of novel techniques for modelling the complex geometry and interaction between surface water (including floodplains), sub-surface flows and urban drainage infrastructure (1D and coupled 1D/2D)
- Learn how to produce different flood risk maps in a GIS environment and how to calculate different types of flood damages, and
- Develop understanding of structural and non-structural flood resilience measures such as, conventional and innovative structures, early warning systems, etc., and understand how to develop effective flood disaster management plans

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Topics and Learning Activities

TOPIC: Application domains of Hydroinformatics: floods, urban systems and environment, R. K. Price (IHE), Z. Vojinovic (IHE) and A. Mynett (IHE)

DESCRIPTION: Introduction to floods and flooding. Introduction to urban floods and urban water systems. Introduction to environmental systems.

Learning Activities:
Lectures

TOPIC: Climate change and its impact on hydrology, P.D.A. Pathirana(IHE)

DESCRIPTION: Introduction to the effects of climate variability on the hydrology that affects urban areas, urban hydrology as a very fast rainfall-runoff process, selection of appropriate time steps in urban runoff modelling, global, regional and local climate models, development of climate change scenarios.

Learning Activities:
Lectures

TOPIC: Ethics of risk, N. Doorn

DESCRIPTION: Introduction to the basic theory of ethics and its application to the flood risk management.

Learning Activities:
Lectures

TOPIC: Mathematical foundation of 2D urban flood modelling, I. Popescu (IHE), S. Djordjevic (UoE)

DESCRIPTION: Introduction to the basic principles of 2D modelling, solutions of the 2D shallow-water equations, schemes for dealing with high velocity flows at shallow depths, numerical issues concerning interaction between 1D and 2D flow domains, below ground and above ground flows, subcritical and supercritical flows over urban floodplains, treatment of buildings in 2D models, etc.

Learning Activities:
Lectures / Exercise

TOPIC: Urban Flood Modelling and Evaluation of Flood Risks, Z. Vojinovic (IHE), O. Mark (DHI), S. Djordjevic (UoE)

DESCRIPTION: Stormwater collection systems; services provided, beneficiaries, structure and concepts of draiange networks, rainfall input, rainfall-runoff modelling, free-surface and pressurised pipe flows, LIDAR filtering of urban features, rainfall and flow measurements, instrumentation, SCADA, telemetry, weather radar, numerical weather forecasts, build-up, wash-off, surface runoff water quality modeling in pipe networks, familiarisation with MOUSE, MIKE11, MIKE21 and SWMM software, setting up 1D and 1D-2D models, calibrating and verifying models using flow survey data, calculation of flood damages (tangible, intangible, direct, indirect damages), production of flood hazard maps, , sensitivity-based flood risk attribution.

Learning Activities:
Lectures / Exercise

TOPIC: Structural and Non-structural Urban Flood Management Measures, Z. Vojinovic (IHE), O. Mark (DHI), B. Gersonius (IHE)

DESCRIPTION: Sustainable structural and nonstructural urban flood management measures such as: amplification of pipe networks, open channels, detention/retention basins, on-site-detention, on-site-infiltration, on-site-retention, SUDS, stormwater sensitive urban design, asset management and multi-objective optimization of rehabilitation measures (use of computational intelligence), design and employment of early warning systems.

Learning Activities:
Lectures / Exercise

TOPIC: Managing Urban Flood Disasters, Z. Vojinovic (IHE), D. Sakulski (UNU)

DESCRIPTION: Framework for urban flood disaster management (pre-disaster, during disaster, post disaster phase), disaster morphology, evaluation of disaster scenarios, development and testing of plans, emergency preparedness and response activities, use of GIS and communication and information systems.

Learning Activities:
Lectures / Exercise

Lecturing Material

- Vojinovic, Z. and M.B. Abbott, 2011, Flood Risk and Social Justice: From Quantitative to Qualitative Flood Risk Assessment and Mitigation, 2011, IWA Publishing

Scientific software

None

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Institute for Water Education

WATER SCIENCE AND ENGINEERING

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Hydroinformatics: modelling and information systems for water management
Module Coordinator: Hammond, M.J. (Michael)

Module Name	Module Code	Credit Points
Urban flood management and disaster risk mitigation	WSE/HI/08B/e	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)
	Application domains of Hydroinformatics: floods, urban systems and environme	4		2				6	14	*R.K. Price, A.E. Mynett, Z. Vojinovic*
	Climate change and its impact on hydrology	4		2				6	14	*P.D.A. Pathirana*
	Ethics of risk	2						2	6	*N. Doorn*
	Introduction to 1D2D, 2D modelling	7		7				14	28	*I. Popescu, S. Djordjevic*
	Urban flood modelling and evaluation of flood risks	9			3			12	33	*Z. Vojinovic, O. Mark*
	Structural and non-structural measures	4			2			6	16	*Z. Vojinovic, O. Mark, B. Gersonius*
	Managing urban flood disasters	6			4			10	26	*D. Sakulski*
	Total	**36**	**0**	**11**	**9**	**0**	**0**	**56**	**137**	

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MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: WSE
Module Coordinator: Salinas Rodriguez, S.G.

Module Name	Module Code	Credit Points
Advanced water treatment and reuse	**UWS/WSE/08**	**5**

Target Group	Prerequisites
Students of the Urban Water and Sanitation master programme with specialization in Water Supply engineering. Professionals in water treatment, consulting agencies, ministries and equipment suppliers.	Participants should meet the general UNESCO-IHE admission criteria, and possess a BSc degree in chemical, environmental, or civil engineering.

Assessment

%	Format	(Comment)
70	Written Exam (closed book)	
20	Assignment	Computer aided RO design
10	Lab Report	

Learning Objectives

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

- DESALINATION TECHNOLOGIES
  - identify technologies for desalination;
  - explain and compare membrane-based and thermal-based desalination;
  - tell current capacity of desalination in the world;
- LOW PRESSURE MEMBRANES (UF and MF)
  - explain the basic principles of low pressure membranes;
  - identify advantages and differences in various commercial systems;
  - define and explain fouling and cleaning in low pressure membranes;
  - justify the use of low pressure membranes in membrane disinfection;
  - compare low pressure membranes with other technologies;
- REVERSE OSMOSIS
  - explain the basic principles of reverse osmosis;
  - identify and assess commercial elements and systems;
  - define and classify fouling and propose mitigation activities to control fouling in RO systems;
  - evaluate need for pre-treatment and for post-treatment in RO systems;
  - design manually and by commercial software seawater and brackish water reverse osmosis systems;
- SOFTENING AND ION EXCHANGE - explain the basic principles of chemical softening and ion exchange.
- ADVANCED OXIDATION PROCESSES
  - explain and identify advantages of various AOPs;
  - design AOPs for removal of contaminants;
- WATER REUSE
  - assess potential applications of water reuse systems;
  - define water reuse and describe various case studies

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Topics and Learning Activities

TOPIC: Microfiltration and Ultrafiltration

DESCRIPTION: basic principles of membrane filtration, micro and ultrafiltration elements and systems, fouling and cleaning, membrane disinfection, exercises

TOPIC: Reverse Osmosis

DESCRIPTION: fundamentals of desalination, reverse osmosis elements and systems, particulate and inorganic fouling, organic fouling and bioufouling, scaling, pre- and post-treatment; process design of RO systems

TOPIC: Desalination

DESCRIPTION: Current status of desalination in the world, thermal systems versus membrane systems

TOPIC: Ion Exchange and Softening

DESCRIPTION: Basic principles of ion exchange and softening

TOPIC: Advanced oxidation processes

DESCRIPTION: fundamentals of AOPs including ozone, H2O2, UV and combinations; applications

TOPIC: Water reuse

DESCRIPTION: Fundamentals of water reuse, applications and case studies for potable reuse, industrial reuse and aquifer recharge

Lecturing Material

- Kennedy, M.D., Salinas Rodriguez, S.G. & Schippers J.C. (2013) Low pressure membrane technology, LN0424/13/1
- Kennedy, M.D., Salinas Rodriguez, S.G. & Schippers J.C. (2011), Desalination and membrane related technology, LN0076/13/1
- Kruithof, J.C., Martijn, B (2013), Advanced oxidation processes.
- Crittenden, J. C., Trussell, R. R., Hand, D. W., Howe, K. J. & Tchobanoglous, G. (2005). Water Treatment: Principles and Design / MWH, New Jersey, Montgomery Watson Harza
- Selected papers from scientific and professional journals.

Scientific software

IMS Design (Hydranautics): Software for the design of RO systems.

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MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: WSE
Module Coordinator: Salinas Rodriguez, S.G.

Module Name: Advanced water treatment and reuse								Module Code: UWS/WSE/08			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 to Desalination and Mem. Tech.	2						2	6	*Prof. M. Kennedy, PhD*
2	Microfiltration and Ultrafiltration	12		2	2			16	42	*Prof. M. Kennedy, PhD / S. Salinas, PhD*
3	Reverse Osmosis	12		2			4	18	50	*Prof. M. Kennedy, PhD*
4	Softening	2			1			3	8	*J.P. Buiteman, MSc / S. Salinas, PhD*
5	Advanced oxidation processes	4						4	12	*J. Kruithof, PhD / B. Martijn, MSc*
6	Introduction to Water Reuse	2		2				4	8	*S. Sharma, PhD / S. Salinas, PhD*
7	Interactive fieldtrip Mem. Tech.					6		6	6	*S. Salinas, PhD / M. Kennedy, PhD*
8	Ion Exchange	2			1			3	8	*J.P. Buiteman, MSc / S. Salinas, PhD*
	Total	**36**	**0**	**6**	**4**	**6**	**4**	**56**	**140**	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Slokar, Y.M. (Yness March)

Module Name	Module Code	Credit Points
International fieldtrip and fieldwork	UWS/09	5

Target Group	Prerequisites
Students of the SE, WSE and UWEM specialisation within the UWS programme.	Previous Modules of UWS Programme

Assessment

%	Format	(Comment)
100	Assignment	

Learning Objectives

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

- International Field Trip: To expose the participants to different international practises in the design, operation and management of water supply, wastewater, solid waste and urban civil infrastructure networks.
- Fieldwork: To familiarize the participants with performing research on location, how to process real data, and how to apply the newly acquired knowledge to a practical situation.

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Topics and Learning Activities

TOPIC: International Field Trip

DESCRIPTION: The International Field Trip takes place for up to 2 weeks (continuously) in a European country other than The Netherlands. During this time, the participants visit various water and wastewater treatment plants, research institutes and water companies dealing with overall urban water structure.

Learning Activities:

Field visits, lectures, participant observation, debates, company and product demonstrations.

TOPIC: Fieldwork

DESCRIPTION: The Fieldwork lasts for up to 5 days. During this time the participants, with a group of staff members and laboratory staff, travel to a location typically within The Netherlands to carry our different types of measurements in the field.

Learning Activities:

Field work, participant observation, basic qualitative | quantitative research.

Lecturing Material

- Handouts for each of the activities (Field Trip and Fieldwork) will be handed out prior to beginning of the activities, providing information relevant for the sites to be visited.

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Slokar, Y.M. (Yness March)

Module Name	Module Code	Credit Points
International fieldtrip and fieldwork	UWS/09	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 Field Trip				**6**	**96**		**102**	**108**	*Y.M. Slokar, PhD | M. Mulenga, PhD*
	Field Work				**6**	**30**		**36**	**42**	*Miscelaneous*
	Total	**0**	**0**	**0**	**12**	**126**	**0**	**138**	**150**	

(c) UNESCO-IHE 2015/2017-UWS/09: International fieldtrip and fieldwork

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Institute for Water Education

URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: uws-SE, uws-UWEM
Module Coordinator: Garcia Hernandez, H.A.

Module Name	Module Code	Credit Points
Industrial Effluent Treatment and Residuals Management	UWS/SE/UWEM/10	5

Target Group	Prerequisites
Mid-career professionals dealing with the technical, environmental, and management aspects pertaining to industrial pollution control, wastewater treatment, residuals/waste minimization, and disposal and reuse.	MSc programme entry requirements

Assessment

%	Format	(Comment)
15	Homework	Homework
25	Assignment	Final project related to a particular industry
60	Written Exam (open book)	Cumulative Final Exam

Learning Objectives

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

- Define cleaner production and explain the advantages and disadvantages of applying cleaner production activities.

  Implement cleaner production activities on a selected industrial sector.

  Describe industrial water management strategies for pollution prevention including the planning and performance of water audits, the implementation of waste minimization plans, and the adequate selection of wastewater treatment technologies

  Implement industrial water management strategies for pollution prevention on a selected industrial sector

  Define industrial effluent toxicity and identify problems associated with industrial effluent toxicity

  Illustrate how to measure industrial effluent toxicity and explain alternatives to deal with toxic effluent streams
- Define the most commonly applied wastewater treatment technologies and explain their most suitable industrial waste treatment applications as well as their advantages and disadvantages

  Select the most appropriate treatment technology and design a wastewater treatment train (sequence of treatmen processes) to treat an industrial effluent stream for a selected industry

- Define sludge handle and sludge treatment and explain the needs for sludge handle and treatment activities in the context of industrial wastewater treatment

  Describe sludge handling and treatment processes such as sludge conditioning, thickening, stabilization, and dewatering

  Design sludge thickeners and anaerobic sludge digesters

Describe sludge drying and sludge incineration processes

- Recognize wastewater treatment technologies applied to indsutrial waste treatment and analyze industrial waste schemes from case studies presented from a diverse range of industries

Integrate cleaner production, industrial water management, wastewater treatment processes, and sludge handling and disposal in the design on an industrial waste treatment process for a slected industry

Topics and Learning Activities

TOPIC: Cleaner Production

DESCRIPTION: Trend-setting introduction of industrial pollution; Theoretical concept of Eco-efficiency; What is cleaner production; Financial benefits of cleaner production; A future prospective

Learning Activities:
Lectures including case studies and a group work

TOPIC: Industrial Water Management

DESCRIPTION: Impact of industry on water resources; Industrial water quality; Water audit; Waste minimization; Treatment options; Appropiate technology; and Implementation

Learning Activities:
Lectures including case studies and a group work

TOPIC: Toxicity in Industrial Wastewater

DESCRIPTION: Measures of toxicity; Kinetic models for toxic substrates; and Dealing with toxicity

Learning Activities:
Lectures including case studies

TOPIC: Physical Chemical Processes

DESCRIPTION: Contaminants/Classes and Process selection; Physical-Chemical Transformation Processes; Physical-Chemical Separation Processes; and Coagulation/Flocculation

Learning Activities:
Lectures

TOPIC: Anaerobic Industrial Wastewater Treatment

DESCRIPTION: Anaerobic High-rate Treatment of Industrial Wastewater; UASB reactors; EGSB reactors; EGSB/IC reactors; Examples

Learning Activities:
Lectures

TOPIC: Sludge Management and Treatment

DESCRIPTION: Sludge conditioning; Sludge thickening; Sludge stabilization; Sludge dewatering; Design Problems; Aerobic digestion; and Anaerobic digestion

Learning Activities:
Lectures and excercises

TOPIC: Case studies

DESCRIPTION: Several case studies are presented:
Steel Industry; Tannery; Aquaculture; Industrial practices: Potato processing, sugar, tannery and yeast; Sugar, steel and water reclamation; Resource recovery; Water management/water reuse (membrane bioreactors); Shell and water; Leachate treatment; Metal surface protection by advanced wastewater treatment; Brewery industry; Sludge drying; and Sludge incineration.

Learning Activities:
Lectures

Lecturing Material

- Lecture notes posted on the e-campus webiste
- Suggested lecturing material:
  (1) Industrial Wastewater Management, Treatment, and Disposal (WEF)
  (2) Physical/Chemical Treatment Processes for Water and Wastewater (D. Lawler)
  (3) Handbook of Industrial and Hazardous Wastes Treatment (L. Wang et al)

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: uws-SE, uws-UWEM
Module Coordinator: Garcia Hernandez, H.A.

Module Name	Module Code	Credit Points
Industrial Effluent Treatment and Residuals Management	UWS/SE/UWEM/10	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	*Dr. H. Garcia*
2	Cleaner Production	3						3	9	*Dr. M.S. Moussa*
3	Industrial Water Management	6						6	18	*Dr. M.S. Moussa*
4	Toxicity	2						2	6	*Dr. M.S. Moussa*
5	Case Studies (Pollution Prevention)			3				3	3	*Dr. M.S. Moussa*
6	Pre and Primary Treatment	4						4	12	*Dr. H. Garcia*
7	Secondary Treatment	2						2	6	*Prof. J. van Lier*
8	Physical Chemical Treatment	3						3	9	*Dr. H. Garcia*
9	Case Study: Aquaculture			2				2	2	*Prof. D. Brdjanovic*
10	Case study: Oil Industry			1				1	1	*TBD*
11	Case Study: Industrial Waste and Resource Recovery			2				2	2	*Ir. A. Mulder*
12	Case Study: Potato, Sugar, Tannery, and Water Reuse							0	0	*Ir. A. Mulder*
13	Case Study:Water Reuse (Dow Chemical)			1				1	1	*K. Majamaa*
14	Case Study: Sugar, Steel, and Water Resue			2				2	2	*Appelman*
15	Case Study: Wastewater Reuse (Evides)			1				1	1	*JW Mulder*
16	Case Study: Field Trip (Heineken)			4				4	4	*Dr. H. Garcia*
17	Case Study: Process Water and Reuse			2				2	2	*A. Vlaski*
18	Case Study: Leachate Treatment			1				1	1	*D. Jaksic*
19	Case Study: Metal Surface Treatment			2				2	2	*D. Jaksic*
20	Case Study: Brewery Industry			1				1	1	*D. Jacksic*
21	Sludge Management	6		3				9	21	*A. Salome*
22	Sludge Treatment	9		3				12	30	*G. Ekama*
23	Sludge Incineration			3				3	3	*Brdjanovic & Salzmann*
24	Sludge Drying			1				1	1	*A. Kuppe*
	Final Project		8					0	8	*Dr. H Garcia*
	Total	**36**	**8**	**32**	**0**	**0**	**0**	**68**	**148**	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Hammond, M.J. (Michael)

Module Name	Module Code	Credit Points
Urban water systems	UWS/UWEM/10	5

Target Group	Prerequisites
Programme target group	Urban Drainage I (recommended, but not essential)

Assessment

%	Format	(Comment)
40	Written Exam (closed book)	
60	Assignment	Computer workshops, Homework, Class work, participation

Learning Objectives

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

- describe the processes that are necessary for analysis and planning of urban water systems.
- explain the processes that are necessary for modelling, analysis and planning of water distribution systems.
- give a detailed decription of the processes that are necessary for modelling, analysis and planning of sewerage and drainage systems.
- model Urban drainage Networks using advanced simulation software for urban drainage systems. The model effects and processes include surcharge, sewer overflow, water quality issues; analyse model output and desire if some part of the system shall be changed; recommend possible solutions to improve the function of a drainage system to prevent flooding and pollution of receiving waters
- Explain in detail the processes that are necessary for the modelling, analysis and planning of wastewater treatment plants.
- understand and evaluate the impacts of urban water systems on the receiving environment.

Topics and Learning Activities

TOPIC: Water distribution systems

Learning Activities:
Lecture, Exercise, Workshop

TOPIC: Urban Drainage

Learning Activities:
Lecture, Exercise, Workshop

TOPIC: Water Quality for Urban Drainage

Learning Activities:
Lecture, Exercise, Workshop

TOPIC: Wastewater treatment

Learning Activities:
Lecture, Exercise, Workshop

Lecturing Material

- Lecture notes (provided by each lecturer)
  Workshop material (including the case study date)
  Additional material provided on the module web site.

Scientific software

DHI MIKE URBAN, EPANET

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Hammond, M.J. (Michael)

Module Name	Module Code	Credit Points
Urban water systems	UWS/UWEM/10	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)
	Urban Water Systems Theory and Workshops (Water Distribution, Drainage, Wa	20	10	20				40	90	*Vojinovic,Trifunovic,Savic,Mark,Nopens*
	Hydrology for Urban Drainage	4						4	12	*Pathirana*
	Water Quality for Urban Drainage	2	4					2	10	*Vojinovic, Mark*
	Impacts on Receiving Environment	1	3					1	6	*van Griensven,Mynett,McClain,*
	Total	27	17	20	0	0	0	47	118	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: WSE
Module Coordinator: Sharma, S.K. (Saroj)

Module Name	Module Code	Credit Points
Water treatment processes and plants	UWS/WSE/10	5

Target Group	Prerequisites
Mid-career professionals dealing with technical aspects of water abstraction and drinking water treatment, working for municipal assemblies, water supply companies or consulting agencies.	BSc degree in Civil Engineering or similar technical background; good command of English language; basic knowledge of water treatment methods.

Assessment

%	Format	(Comment)
40	Assignment	Design Exercise
60	Oral Exam	Oral Exam and Presentations

Learning Objectives

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

- apply (gained) knowledge and experience regarding water quality and treatment methods in design, operation & maintenance and rehabilitation of conventional water treatment processes and plants;
- analyse water quality data and to select the most attractive raw water resource;
- design and engineer a water treatment plant (conventional and advanced) for both groundwater and surface water treatment);
- execute plant performance studies and to evaluate results, as well as to propose improvements in order to rehabilitate a malfunctioning plant;
- show professional knowledge and know-how for operating (process & quality control, troubleshooting) and maintaining water treatment plants;
- acquire and improve their skills on problem solving, decision making, oral presentations, writing reports, working in small task forces.

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Topics and Learning Activities

TOPIC: Water Treatment Processes and Plants

DESCRIPTION: Raw water and drinking water quality aspects. Conventional treatment processes for groundwater and surface water. Introduction to process, plant and plant-site design.

Learning Activities:
Lecture, Workshop

TOPIC: Process Modelling

DESCRIPTION: Identification of model structure and parameters; integrated hydraulic, water quality models; use of the Stimela model for the design of drinking water plants.

Learning Activities:
Lecture, Workshop

TOPIC: Operation & Maintenance and Residual Management

DESCRIPTION: Importance of adequate O&M, O&M of individual units, equipment and plants, Basics of process and quality control, water quality control during all steps of water supply system, Management of residuals: treatment, disposal and reuse

Learning Activities:
Lecture, Workshop

TOPIC: Design of Water Treatment Plant - Case study

DESCRIPTION: Examples/Case studies of the detailed design of conventional water treatment plants

Learning Activities:
Workshop, Field trip

TOPIC: Design Exercise

DESCRIPTION: Identification of water resources, comparison and evaluation of various treatment methods and processes for ground and surface water, calculation of water demand, process design, calculation of achieved drinking water quality, calculation of cost, engineering details.

Learning Activities:
Design Exercise - Group work

Lecturing Material

- J.P. Buiteman, Water Treatment Processes and Plants (LN 0087/07/2).
- J.P. Buiteman, O&M of Conventional Water Treatment Plants (LN 0094/03/1).
- J.P. Buiteman, Process and Quality Control (LN 0097/06/1).
- J.P. Buiteman, Rehabilitation of Conventional WTPs (LN 00099/06/1).
- L. Rietveld (2015) Process Modelling with Stimela

Scientific software

MATLAB

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: WSE
Module Coordinator: Sharma, S.K. (Saroj)

Module Name	Module Code	Credit Points
Water treatment processes and plants	UWS/WSE/10	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 Processes and Plants	5		4				9	19	*S. Sharma; J.P Buiteman*
	Process Modelling	2		4				6	10	*Prof. L. Rietveld*
	Operation and Maintenance and Residual Management	4		4				8	16	*Guest Lecturer*
	Water Treatment Plant Design			4		7		11	11	*B. Petrusevski; S. Sharma*
	Design Exercise WTP						28	28	84	*S. Sharma; J.P. Buiteman; P. Hiemstra*
								0	0	
	Total	11	0	16	0	7	28	62	140	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Ronteltap, M.

Module Name	Module Code	Credit Points
Faecal sludge management	UWS/SE/11	5

Target Group	Prerequisites
This course is a specialist course fitting within Sanitary Engineering. It is designed for sanitary, civil / wastewater and environmental engineers who are facing challenges with faecal sludge. As on-site sanitation is by far the most applied sanitation technology, faecal sludge management is of paramount importance globally.	Preceding modules in Sanitary Engineering; an interest in and working knowledge of the business of faecal sludge management help to bring this module to a good end.

Assessment

%	Format	(Comment)
85	Written Exam (closed book)	
15	Assignment	

Learning Objectives

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

- Describe the way how excreta and faecal sludge are characterised.
- Know which technologies can be applied for which type of faecal sludge (settling tanks, planted and unplanted drying beds, etc)
- Name the key stakeholders in FSM.
- Describe the relationship between sanitation and health.
- Name the challenges in emergency sanitation and know how emergency sanitation can be addressed.
- Be familiar with the latest developments in sustainable (on-site) sanitation solutions that can be applied in high density low income areas.

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Topics and Learning Activities

TOPIC: (Overview) Faecal sludge management

DESCRIPTION: Faecal sludge management (FSM) is incredibly important in sanitation. While the focus has been on the provision of toilets mainly in the light of the MDGs, the adequate collection and treatment of the remaining faecal sludge was not always a priority, to say the least. As so many factors play a role in faecal sludge management / climate, hardware, a vast number of stakeholders, willingness to pay, space to store and treat, groundwater pollution, different toilet types / a proper and well-functioning faecal sludge management system is hard to achieve. In this module we will address a holistic approach on FSM. There will be a focus on technology; however, technology cannot be seen separately from planning and management aspects; therefore, non-technical aspects will also be addressed in this module.

Learning Activities:

The participants will be offered substantial fundamentals as well be informed with the latest insights in faecal sludge management, emergency sanitation and slum sanitation. The classes are taught by our own staff as well as international experts in the field of FSM.Topics in the module:- Public Health and Sanitation- Excreta Characterisation- Faecal Sludge Sanitation Systems- Non-technical aspects of FSM- Specific circumstances

Lecturing Material

- Faecal Sludge Management Book (IWA; Editors Linda Strande, Mariska Ronteltap, Damir Brdjanovic)
- Handouts.

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Ronteltap, M.

Module Name: Faecal sludge management	Module Code: UWS/SE/11	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)
	Public Health	6						6	18	*Jeroen Ensink*
	Institutional Aspects	4		4				8	16	*Lukas Ulrich / Christoph Luethi*
	Collection and Transport	6						6	18	*Jan Spit*
	Emergency Sanitation	4						4	12	*Tineke Hooijmans / Jan Heeger*
	Co treatment	2						2	6	*Carlos Lopez*
	Sludge characterisation	2						2	6	*Mariska Ronteltap*
	Treatment Mechanisms	6	6					6	24	*Mariska Ronteltap*
	Operation and Maintenance	4						4	12	*Martin Mulenga*
	Financial Aspects	6						6	18	*Valentin Post*
	Slum sanitation	2						2	6	*Mariska Ronteltap*
	Total	42	6	4	0	0	0	46	136	

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Academic Year:
Specialization:
Module Coordinator:

Module Name	Module Code	Credit Points
MSc prep. course and MSc research proposal	**UWS/UWEM/11**	**0**

Target Group	Prerequisites

Assessment

%	Format	(Comment)

Learning Objectives

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

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Topics and Learning Activities

Lecturing Material

- ...

Scientific software

None

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Academic Year:
Specialization:
Module Coordinator:

Module Name MSc prep. course and MSc research proposal								Module Code UWS/UWEM/11			Credit Points 0
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)	
	Total	0	0	0	0	0	0	0	0		
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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Elective module
Module Coordinator: Trifunovic, N.

Module Name	Module Code	Credit Points
Advanced water transport and distribution	**UWS/WSE/11a**	**5**

Target Group	Prerequisites
Engineers and scientists with keen interest in modern methods, technologies and tools used in design, operation and maintenance of water transport & distribution networks.	BSc degree in Civil Engineering or similar; a few years of relevant experience; knowledge of steady-state hydraulics of pressurised flows; basic use of network models; good English command. Students without any WTD experience should first complete the module Water Transport and Distribution.

Assessment

%	Format	(Comment)
60	Written Exam (closed book)	Multiple choice test covering theoretical aspects of (1) advanced water distribution modelling, (2) water quality and corrosion in distribution networks and (3)water hammer (20% each)
28	Assignment	Report on four short assignments regarding advanced water distribution modelling done in WaterGEMS software: (1) Network design using GA optimiser, (2) Network criticality analysis, (3) Water quality analysis, and (4) Water hammer analysis.
12	Assignment	GIS assignment on the exercise using ArcGIS.

Learning Objectives

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

- distinguish between various sources of water quality problems in distribution networks;understand the basic corrosion mechanisms and suggest the list of preventive and reactive measures;
- understand the theory of advanced hydraulic and water quality modelling; apply state-of-the-art network software for assessment of irregular operational scenarios and develop a reliability-based and cost effective design using computer model.
- recognise the GIS and remote sensing technologies, and familiarise with the GIS-based techniques for sustainable planning and management of WTD systems;
- understand the theory of transient flows, and plan the measures to prevent/control water hammer;
- select modern tools for monitoring of operation, and planning of maintenance of WTD systems.

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Topics and Learning Activities

TOPIC: Water Quality in Distribution Networks

DESCRIPTION: Corrosion of pipe materials, indices of measure, corrossion assessment, prevention and control, optial water composition, principles of water quality modelling of distribution networks, modelling of chlorine residuals.

Learning Activities:

Series of lectures is followed by exercise in which the case of distribution network developed during the design exercise in the module Water Transport and Distribution is tested on water quality parameters, namely the water age, source tracing and chlorine residuals, by using WaterGEMS software.

TOPIC: Advanced Water Distribution Modelling

DESCRIPTION: Principles of genetic algorithm; pressure-driven demand calculations; network calibration; failure analysis and calculation of demand losses; economic aspects of capital investments and network operation.

Learning Activities:

Series of lectures is followed by exercise in which the case of distribution network developed during the design exercise in the module Water Transport and Distribution is optimised and tested on irregular supply and demand scenarios by using WaterGEMS software.

TOPIC: GIS in Water Distribution

DESCRIPTION: The aim of this course is to provide both a solid theoretical understanding and a comprehensive practical introduction of how to use geographic information systems and remote sensing technologies for the analysis and solution of water distribution related problems. The course focuses on the analysis of digital spatial data, preparation for numerical modelling, presentation of modelling results and support to the decision making process. The topics covered in the course include the following: introduction to geographic information systems and remote sensing technologies, active and passive remote sensing,data structures, map projections and coordinate systems, processing of digital geographic information, creation of digital elevation models, visualisation,
mapping of water related features features, delineation of pressure zone areas, digitisation, soil and land use mapping,map algebra, export of GIS layers into a modelling package, incorporation of modelling results in GIS.

Learning Activities:

The main learning activities are grouped around exercises and production of individual assignment. The output files produced in the exercise shall be used for hydtraulic analyses conducted by network modelling software.

TOPIC: Introduction to Water Hammer

DESCRIPTION: Basic equations and applications; computer modelling: model building, simulations of simple cases (full pump trip, emergency shut down; protection devices: practical methods of surge suppression, direct action, diversionary tactics, choice of protection strategy.

Learning Activities:

Series of lectures combined with software demonstrations is followed by exercise in which the case of transportation network from the design exercise Pumping Stations, developed in the module Water Transport and Distribution is teseted on water hammer using WaterGEMS software.

TOPIC: Advanced O&M Practices in Water Distribution

DESCRIPTION: Monitoring of network condition and operation; data collection and management; organisation of maintenance, emergency water supply, asset management plans, water company organisation.

Learning Activities:

Series of lectures is followed by a field trip to one of water supply companies in the Netherlands.

Lecturing Material

- N.Trifunovic - Introduction to Urban Water Distribution, Taylor & Francis, 2006, reprint 2008 (e-book)
- S.Sharma - Corrosion of Pipe Materials, lecture notes UNESCO-IHE 2009 (LN/0310/09/1)
- Electronic materials: slide presentations (MS PowerPoint), design assignments, spreadsheet hydraulic lessons (MS Excel).

Scientific software

WaterGEMS network modelling software (Bentley, Ver.8i), ArcGIS, EPANET (US Environmental Protection Agency, Ver.2)

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Elective module
Module Coordinator: Trifunovic, N.

Module Name	Module Code	Credit Points
Advanced water transport and distribution	UWS/WSE/11a	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 in Distribution Networks	6					4	10	30	*S.Sharma, S.Velickov, N.Trifunovic*
2	Advanced Water Distribution Modelling	6		12			6	24	48	*D.Savic, S.Velickov, N.Trifunovic*
3	GIS in Water Distribution			4			4	8	16	*Z.Vojinovic, A.Sanchez-Torres*
4	Introduction to Water Hammer	6		4			4	14	34	*E. Arpadzic, S.Velickov, N.Trifunovic*
5	Advanced O			4		8		12	12	*K.van der Drift, E.Arpadzic*
	Total	18	0	24	0	8	18	68	140	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Elective Module (Open for all specializations)
Module Coordinator: Sharma, S.K. (Saroj)

Module Name	Module Code	Credit Points
Decentralised water supply and sanitation	UWS/WSE/11b	5

Target Group	Prerequisites
Mid-career professionals, planning and management aspects of decentralised, small-scale or low-cost water supply or sanitation systems, working for municipalities, universities, research institutes, government ministries, water supply agencies, NGOs, consultancies.	MSc. programme entry requirements

Assessment

%	Format	(Comment)
60	Written Exam (closed book)	
30	Assignment	
10	Presentation	

Learning Objectives

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

- know different technologies/methods for small-scale water abstraction and water treatment that can be used at household or small community level
- understand the basics of sustainable sanitation technologies including nutrient reuse in agriculture (ecological sanitation), soild waste management and fecal sludge management and their implementation in small towns, peri-urban and urban poor areas of developing countries
- prepare concept design for small-scale water supply treatment and ecosan technology
- facilitate planning, financing, implementation and operation and maintenance of decentralised water supply and sanitation infrastructures based on stakeholder participation and community management

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Topics and Learning Activities

TOPIC: Introduction

DESCRIPTION: Introduction to the module; Water Supply and Sanitation situations in small towns, peri-urban areas and urban poor areas. Rationale for decentralised water supply system

Learning Activities:
Lecture and discussions

TOPIC: Decentralised Water Supply and Treatment Systems

DESCRIPTION: Water Supply Systems (water sources,source selection,service levels, suitability of types of water supply systems under different conditions); Rainwater Harvesting (introduction, collection systems, advantages and limitations, design considerations). Small-scale Water Treatment Methods (design water treatment systems for small community or household. Roughing filtration, slow sand filters, small-scale disinfection)

Learning Activities:
Lectures, Workshop for calculations, Design Exercise on Multi-stage Filtration

TOPIC: Decentralised Sanitation Systems

DESCRIPTION: Ecological sanitation (introduction to ecosan approach; characteristics of urine, faeces and greywater; overview of technologies for ecosan; treatment aspects for urine, faeces and greywater; conventional on-site sanitation; storage and transport logistics; introduction to anaerobic treatment, composting and constructed wetlands; safe reuse of ecosan products in agriculture with WHO guidelines; financial institutional, social and policy aspects of ecosan). Faecal Sludge Management (treatment goals and standards, treatment options, faecal sludge management (planning, financial, economic, agronomic, institutional and legal aspects), transmission of excreta-related infections and risk management). Solid waste management in developing countries (technical and practical aspects of collection, transport, segregation, disposal and reuse)

Learning Activities:
Lectures, Workshop/Discussion, Assignment, Field Trip

TOPIC: Management Aspects of Watsan

DESCRIPTION: Participatory planning and evaluation of DWSS systems, demand responsive approach; Institutional arrangements (community based management; small-scale independent providers), Financial and Operational aspects (financing, cost recovery, operation and maintenance of DWSS systems)

Learning Activities:
Lectures and discussion

TOPIC: Presentation of the participants

DESCRIPTION: All participants make a presentation of 10 minutes in the field of decentralised water supply and sanitation in order to share experiences or problems they are facing now and learn from each others experience.

Learning Activities:
Individual presentations and discussion

Lecturing Material

- Sharma, S. (2015) Decentralised Water Supply and Sanitation: Selected Topics UNESCO-IHE Lecture Notes LN0368/15/1
- Sharma, S. (2015) Rainwater Harvesting. UNESCO-IHE Lecture Notes LN 0357/15/1
- Rontelap, M. (2015) Ecological Sanitation. UNESCO-IHE Lecture Notes
- Strande, L., Ronteltap, M. and Brdjanovic, D. (2014) Fecal Sludge Management: Systems Approach for Implementation and Operation, IWA Publishing
- Siebel, M (2015) Solid Waste Management in Urban Poor Areas (Handouts)
- Mulenga, M. (2015) Participatory Planning (Handouts)
- Schwartz, K. (2015) Institutional Arranagements (Handouts)

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Elective Module (Open for all specializations)
Module Coordinator: Sharma, S.K. (Saroj)

Module Name: Decentralised water supply and sanitation								Module Code: UWS/WSE/11b			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**							**0**	**0**	*S. Sharma*	
1.1	Module introduction			1				1	1		
1.2	Introduction to decentralised water supply and sanitation	2						2	6		
2	**Decentralised Water Supply and Treatment Systems**							**0**	**0**	*S. Sharma*	
2.1	Water supply systems	3						3	9		
2.2	Rain water harvesting	2		2				4	8		
2.3	Small-scale water treatment	6	6					6	24		
3	**Decentralised Sanitation Systems**							**0**	**0**		
3.1	Ecological sanitation	6		2		4		12	24	*M. Ronteltap*	
3.2	Soild waste management in small towns and urban poor areas	4						4	12	*M. Siebel*	
3.3	Sanitation planning and strategic tools	2		2				4	8	*Guest Lecturer (EAWAG)*	
3.4	Fecal sludge management	2		4				6	10	*M. Ronteltap*	
4	**Management Aspects of DWSS**							**0**	**0**		
4.1	Participatory planning and evaluation	2		2				4	8	*M. Mulenga*	
4.2	Institutional arrangements	2		2				4	8	*K. Schwartz*	
4.3	Financing and cost recovery aspects	2		2				4	8	*Guest Lecturer*	
4.4	Operation and maintenance aspects	2		2				4	8	*S. Sharma*	
5	**Presentation of the Participants**			**6**				**6**	**6**	*S. Sharma*	
	Total	**35**	**6**	**25**	**0**	**4**	**0**	**64**	**140**		

(c) UNESCO-IHE 2015/2017-UWS/WSE/11b: Decentralised water supply and sanitation

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Ploeger, E.L. (Erwin)

Module Name	Module Code	Credit Points
Summer course	UWS/12	1

Target Group	Prerequisites
All participants of the programme	

Assessment

%	Format	(Comment)
40	Assignment	Pass / fail based on attendance to research methodolgy and summer course
60	Written exam (closed book)	Statistics

Learning Objectives

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

- Discuss the latest insights, context and concepts of a contemporary issue of choice
- Able to justify his or her research in the context of UNESCO-IHE research lines, personal professional interests and preferably in local, national and regional contemporary issues.
- Apply basic statistics into research.

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Topics and Learning Activities

TOPIC: Research methodology

DESCRIPTION: Selected attention to one or several aspects of epistemology, literature review, scientific research methods, statistics, writing for publication, etc.

Learning Activities:
Presentations by and debate between staff, guest lecturers and participants on issues of research methods, epistemology, contemporary issues, etc

TOPIC: Summer courses

DESCRIPTION: Participant will need to select 1 course out of the available Summer Courses on offer during this period (each Masters programme will offer one or more Summer Course open to all participants, as long as prerequisites are met). Topics will be presented as seminars by UNESCO-IHE staff and guest lecturers on specific contemporary themes and issues. Some examples of previous Summer Courses are: -Water and Climate -Environmental Flows -Conflict Resolution - Flood resilient planning and building

Learning Activities:
Lectures, workshops, assignments

TOPIC: Statistics

DESCRIPTION: Statistical methods for the interpretation of scientific data are explained and applied to practical problems.

Learning Activities:
Lectures, exercise

Lecturing Material

- To be announced

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Ploeger, E.L. (Erwin)

Module Name: Summer course	Module Code: UWS/12	Credit Points: 1

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)
	Research methodology		24					0	24	*various*
	Summer course			20				20	20	*various*
	Statistics	12		10				22	46	
	Total	12	24	30	0	0	0	42	90	

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

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

Module Name	Module Code	Credit Points
Groupwork Sint Maarten	UWS/13	5

Target Group	Prerequisites
Students from UWS Programme	UWS Specialisations

Assessment

%	Format	(Comment)
20	Assignment	Phase 1: Assessment of the report (specialized assignment) by the "client"; group evaluation.
10	..	Phase 1: Peer scoring; individual evaluation.
20	Presentation	Phase 1: Individual presentations of the work included in the report to the "client"; individual evaluation.
20	Assignment	Phase 2: Assessment of the report (master plan) by the panel; group evaluation.
10	..	Phase 2: Peer scoring; individual evaluation.
20	Presentation	Phase 2: Group presentations of the work included in the report to the panel; group evaluation.

Learning Objectives

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

- Apply and integrate the knowledge obtained during the specialisation to solve water and sanitation related issues.
- Analyze complex water and sanitation issues in a limited time frame and with limited background information available.
- Defend his/her input in an (interdisciplinary) team of specialists.
- Assess his/her own strengths and weaknesses with respect to working in a group.
- Recommend engineering solutions to water and sanitation related problems.
- Defend the groups' findings in front of a team of experts in the field.

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Topics and Learning Activities

TOPIC: Didactics

DESCRIPTION: Participants work in teams. The group work is based on a real case, the caribbean island of Sint Maarten. In the first pahse, groups identify issues and develop engineering solutions for individual problems and, in the second phase, integrate single solution in a master plan. The master plan is to be presented to a panel of experts. Groups are supported by mentors and can consult academic staff members as resource persons.

Lecturing Material

- All material is available on the Moodle platform for Module 13, containing video footage, data, interviews with Sint Maarten civil servants and inhabitants, as well as the Terms of Reference for the different phases of the group work.

Scientific software

Biowin, EPANET, AUTOCAD

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

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

Module Name: Groupwork Sint Maarten								Module Code: UWS/13			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)	
	Introduction	2						2	6	*Ferrero*	
	Masterclass Master Planning	4						4	12	*Belt/Bodegom*	
	Masterclass Consultancy	2						2	6	*Buijs*	
	Consultancy work			45				45	45	*Group work mentors*	
	Master plan			55				55	55	*Group work mentors*	
	Final presentations			8				8	8	*Panel members*	
	Masterclass How to work in groups	4						4	12	*Luising*	
	Total	12	0	108	0	0	0	120	144		

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Slokar, Y.M. (Yness March)

Module Name	Module Code	Credit Points
MSc preparatory course and thesis research proposal	UWS/14	9

Target Group	Prerequisites
All students of the Urban Water and Sanitation programme	The successful completion of at least 8 of the first 11 modules

Assessment

%	Format	(Comment)
100	Oral Exam	The MSc research proposal needs to be approved by the mentor and the professor before the student can actually start the research work. This proposal needs to be presented and defended by the student.

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 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.

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Topics and Learning Activities

TOPIC: Selection of research topic

DESCRIPTION: The initial research topic of study will be selected in a consultative process with a mentor, the MSc coordinator and a professor. 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. 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:
Discussion with academic staff members

TOPIC: Proposal drafting

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. 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:
Writing of the proposal

TOPIC: Proposal presentation

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

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Lecturing Material

- MSc thesis protocol
- How to write an MSc thesis – Wendy Sturrock

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Slokar, Y.M. (Yness March)

Module Name	Module Code	Credit Points
MSc preparatory course and thesis research proposal	UWS/14	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 research proposal		196					0	196	
	Total	0	196	0	0	0	0	0	196	

(c) UNESCO-IHE 2015/2017-UWS/14: MSc preparatory course and thesis research proposal

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Salinas Rodriguez, S.G. (Sergio)

Module Name	Module Code	Credit Points
MSc thesis research work	UWS/15	36

Target Group	Prerequisites
UWS participants	Completion of the first 14 modules of the master programme of which at least 11 modules were approved.

Assessment

%	Format	(Comment)
100	Oral Exam	The MSc work is assessed based on the criteria described in the programme handbook (e.g., the written report, the final presentation, the defense, etc.)

Learning Objectives

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

- Explore the background of the research problem by critically reviewing scientific literature; Evaluate relevant theories and applying these theories to a relevant scientific problem; Assure adequate delineation and definition of the research topic; Formulate research questions and hypotheses.
- Conduct research, independently or in a multidisciplinary team by selecting and applying appropriate research methodologies and techniques, collecting and analysing data.
- Formulate well-founded conclusions and recommendations based on a comprehensive discussion of the results.
- 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.
- 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.

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Topics and Learning Activities

Lecturing Material

- ...

Scientific software

None

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URBAN WATER AND SANITATION

MASTERS PROGRAMME

Academic Year: 2015-2017
Specialization: Core Programme
Module Coordinator: Salinas Rodriguez, S.G. (Sergio)

Module Name	Module Code	Credit Points
MSc thesis research work	UWS/15	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)
	MSc thesis research	10	08					0	1008	*Supervisor / Mentor(s)*
	Total	10	08	0	0	0	0	0	1008	

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