Delft, December 2011

Master Programme
Municipal Water and Infrastructure

Handbook 2011-2013

UNESCO-IHE
Institute for Water Education

Disclaimer:

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 Certain modules or parts of modules may be changed, withdrawn and/or replaced by other modules.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

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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
- Municipal Water and Infrastructure
- 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 Municipal Water and Infrastructure;
- 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 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* (separately included in 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 programmes are conducted over a period of 18 months during two academic years. The general planning structure is shown in the *Academic Calendar* printed in the preamble of this handbook.

In the first year, the calendar is divided into 14 periods of three weeks, in which the components of the curriculum are presented as modules. After each second module, a separate week is reserved during which the examinations for the two modules take place. The first six months of the second year are reserved for completion of the MSc thesis research work.

Within each programme, the following generic components are distinguished:

- ten taught modules of 5 credit points each;
- fieldtrips and groupwork, total 10 credit points;
- a special/research topics module of 4 credit points;
- the thesis proposal preparation of 6 credit points;
- the thesis research and examination, 36 credit points.

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;
- the required and recommended literature, and other materials.

2.5 Learning Objectives

Each programme specialisation has a set of learning objectives that state the knowledge, insight and skills achieved by students who successfully complete the programme. A distinction is made between discipline-specific learning objectives, which are required by the field of study, and general academic skills, which are expected from university education graduates. The programme objectives for each specialisation are provided in the programme-specific part of the handbook.

Similarly, each component 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 usually aim to achieve a further detailed subset of the overall learning objectives.

2.6 Working 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 groupwork 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 for a specific component of the programme, and ultimately those of the programme itself. The examination for a component 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 groupwork report.

Assessment of examination material is carried out by appropriate examiners, which are usually the involved lecturers. Students who successfully complete a component of the programme will be granted the credit points for that component. 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. The (minimum) study load determination criteria for the various education activities are shown in the following table.

Activity	**Study load / contact time**
Lecture, with assignment	≥ 3 hours / hour
Assignment	1 hour / hour
Workshop	1-2 hours / hour
Fieldtrip	≥ 8 hours / day
Fieldwork	≥ 8 hours / day
Laboratory session	≥ 1-2 hours / hour

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

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

Education and Examination Regulations 2011– 2012

For the Master Programmes in:

- Municipal Water and Infrastructure
- Environmental Science
- Water Management
- Water Science and Engineering

Approved by the Academic Board of UNESCO-IHE, 29 September 2011

3.1 General Information

Article 1 Scope of the regulations

1.1 The present regulations apply to the education and examinations within the above mentioned master programmes 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 In case of joint specialisations (see art. 3.2) the present regulations also apply for the part of the programmes offered by UNESCO-IHE.

1.3 In case a joint specialisation leads to a double degree, the rules and regulations of the partner institute will be applicable for those parts of the programme organised and implemented by the partner. Credit transfer agreements and all details of the programme offered by the partner institute are described in the cooperation agreement between UNESCO-IHE and the partner institute.

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*);

Module : a self-contained programme unit with specified learning

objectives, as stipulated in article 7.3 of the Act;

Rector : the rector of the Institute;

ECTS : the European Credit Transfer and Accumulation System;

Examination : an interim study performance assessment for a component of the programme (in the Act: *tentamen*);

Constitutent examination : an examination consisting of a number of different

parts (e.g. assignments, written or oral exams, presentations)

Examination board : the committee as stipulated in article 7.12 of the Act;

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 examination : the formal evaluation of the student performance

before graduation (in the Act: *examen*);

Student : a person who is registered in a study programme and sits

examinations.

Article 3 Programme and specialisations

3.1 The programmes are characterised as post-initial master programmes in scientific education, as stipulated in article 7.3b of the Act.

3.2 The following specialisations are distinguished within the programmes:

Municipal Water and Infrastructure programme:

1. Water Supply Engineering;

2. Sanitary Engineering;

3. Joint specialisation in Water Supply Engineering with Kwame Nkrumah University of Science & Technology, Ghana;

4. Joint specialisation in Sanitary Engineering with Kwame Nkrumah University of Science & Technology, Ghana;

5. Joint specialisation in Water Supply Engineering with Universidad del Valle, Colombia;

6. Joint specialisation in Sanitary Engineering with Universidad del Valle, Colombia; and

7. Joint specialisation in Urban Water and Management with Asian Institute of Technology, Thailand.

Environmental Science programme:

1. Environmental Science and Technology;

2. Environmental Planning and Management;

3. Water Quality Management;

4. Joint specialisation in Limnology and Wetland Ecosystems with Institute of Limnology, Austria and Egerton University, Kenya;

5. Joint specialisation in Environmental Technology for Sustainable Development with Asian Institute of Technology, Thailand; and

6. Environmental Technology and Engineering (Erasmus Mundus programme).

Water Management programme:

1. Water Resources Management;

2. Water Services Management;

3. Water Quality Management; and

4. Water Conflict Management.

Water Science and Engineering programme:

1. Hydrology and Water Resources;

2. Joint specialisation in Hydrology and Water Resources with Hohai University, China P.R.;

3. River Basin Development;

4. Coastal Engineering and Port Development;

5. Joint specialisation in Coastal Engineering and Port Development, with Hohai University, China P.R.;

6. Land and Water development;

7. Joint specialisation on Land and Water development with Sriwijaija University, Palembang, Indonesia;

8. Joint specialisation on Agricultural Water Management for Enhanced Land and Water Productivity with Asian Institute of Technology Thailand;

9. Agricultural Water Management for Arid and Semi-Arid Climates with Haramaya University, Ethiopia;

10. Hydroinformatics;

11. Joint specialisation in Hydroinformatics with Hohai University, China P.R.;

12. Joint specialisation in Hydroinformatics with Universidad del Valle, Colombia;

13. Joint specialisation in Hydroinformatics with Ain Shams University, Egypt;

14. Ecohydrology (Erasmus Mundus programme); and

15. Flood Risk Management (Erasmus Mundus programme).

Article 4 Aim of the programme

4.1 The aim of the programmes is to convey to the students the knowledge, insight and skills that are required 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 programme graduates are listed in Appendix A.

Article 5 Full-time/part-time

5.1 The programmes are executed on a full-time basis.

Article 6 Study load of the programme

6.1 The minimum study load of the programmes is 106 ECTS credit points, with reference to article 7.4a, paragraph 8 of the Act.

Article 7 Programme examination

7.1 Students in the programmes are eligible to sit the programme examination leading to the degree of Master of Science in the programme they are registered for.

7.2 The programme examination is passed if all designated examinations in the programme curriculum have been successfully completed, as stipulated in article 7.10, paragraph 1 of the Act.

3.2 Academic Admission Requirements

Article 8 Admission to the programmes

8.1 Academic admission to the programmes may be granted to applicants who provide evidence of having:

a. a university level Bachelor's degree in an appropriate field for the specialisation, as listed in Appendix B, and which has been awarded by a university of recognised standing.

b. some working experience in an environment related to the specialisation. At least three years experience is normally preferred.

c. a good command of the English language, if this is not the first language. This is measured by a minimum IELTS score of 6.0, a minimum paper-based TOEFL score of 550,

or a minimum computer-based TOEFL score of 213. For other tests, the results will be interpreted to show alignment with the Council of Europe's Common European Framework (CEF) levels C1 or C2.

8.2 Academic admission to the programmes will be granted on the basis of a decision taken to that effect by the Academic Registrar, upon advice of the appropriate programme coordinator.

3.3 Content of the Programme

Article 9 Composition of the specialisations and joint specialisations

9.1 The composition of each programme specialisation is defined in Appendix C.

Article 10 Practicals and participation

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

3.4 Examinations

Article 11 Sequence of the examinations

11.1 Students can sit the thesis examination only if all other examinations of the programme specialisation curriculum have been successfully completed.

11.2 Notwithstanding the stipulations in article 11 paragraph 1, successful completion of the examinations is not required for sitting subsequent examinations.

Article 12 Periods and frequency of examinations

12.1 Students can sit each oral or written examination only two times per academic year, except where indicated in subsequent paragraphs.

12.2 The date and time allocations for the first sitting are announced in the programme schedules. Examinations take place during the examination periods indicated in the academic calendar.

12.3 Groupwork, fieldwork and fieldtrips are offered and assessed once per academic year.

12.4 Students are not allowed to re-sit (constituent parts of) module examinations for which a successful result has been obtained.

12.5 Written re-examinations normally take place during the next examination period indicated in the academic calendar. The students involved are notified sufficiently in advance in writing about the date and time allocation for re-examinations. All students will take the re-sit at the same time.

12.6 Students will not be allowed to sit for further re-examinations and -assignments if they failed more than three re-examinations for the first 13 modules of the programme.

12.7 The maximum recorded module mark after a successful re-sit is limited to 6.0.

Article 13 The nature of the examinations

13.1 The constituent parts of a module are assessed via a combination of written and or oral examinations, assignments and presentations as indicated in the module descriptions.

13.2 In case of a combination of an oral and written examination the maximum total duration of both examinations shall not exceed 3 hours.

13.3 A written examination has to take place in a period of max. 3 hours during a morning or afternoon session. A break of 15 minutes is allowed.

13.4 The nature of the examinations for each module in each programme is indicated in Appendix C, and is described separately in the in each module sheet.

13.5 The nature of a re-examination may deviate from that of the first examination for the same module.

13.6 Re-examination proceeds by re-examining one or more failed constituent parts, as would be necessary to achieve a successful examination result.

13.7 The credits for successful completion of fieldwork and fieldtrips are granted on the basis of active participation, unless stated otherwise in the module sheet.

13.8 Students who suffer from a physical or sensory impairment are offered the opportunity to take part in an examination such that, as much as possible, account is taken of their disability. If required, an expert will be consulted for advice.

Article 14 Oral examinations

14.1 Oral examinations involve only one student at a time. During oral examinations, a second examiner is present as independent observer.

14.2 The examination of the thesis research is open to public attendance and discussion. All other oral examinations are non-public, unless stated otherwise in the module sheet.

Article 15 Exemptions and transfer of credit points

15.1 Exemptions to sit examinations are generally not granted. In specific cases, the examination board may evaluate a request and conclude a decision on transfer of credit points, after receiving a favourable recommendation from the programme committee.

15.2 For joint specialisations 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 a medical note stating the inability to participate; or

b. serious 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 chair of the examination board, 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 chair of the examination board, decides that the absence is not justified the result 1.0 will be recorded.

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 An examiner who observes or suspects fraud during the assessment of examination work is required to submit a substantiating report to the examination board.

17.3 If the examination board, after investigation of the incident, concludes that there has been a case of fraud, the offender will be given the mark 1.0 for the examination work.

3.5 Results of Examinations

Article 18 Assessment and notice of examination results

18.1 Examination 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 successful result.

The following grading scale is used:

- 9.1-10 outstanding
- 8.6-9.0 very excellent
- 8.1-8.5 excellent
- 7.5-8.0 very good
- 7.0-7.4 good
- 6.0-6.9 sufficient
- 5.9- and below insufficient - fail

18.2 The mark for a constituted examination is determined by the weighted average of the results of the constituent parts. The weights for the constituent parts must be stated in the module sheet.

18.3 The examiner shall assess a written examination or practical paper within a period of 14 days after the date of the examination.

18.4 All written examination work of the students will be blind corrected by the examiners involved.

18.5 The examiner shall determine the result of an oral examination shortly after the examination has been conducted.

18.6 The examination committee for the thesis examination shall determine the result after the defence. The mark shall be communicated to the student before the diploma awarding.

18.7 Examiners inform the module coordinators about the results of all examinations (written and oral) via standard examination result forms. Subsequently the module coordinators inform the Education Bureau via standard forms about the final module mark.

18.8 Examination 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.

18.9 For each examination, the student receives a written statement from the Education Bureau of the examination result obtained for the module and, if successful, the associated credit points granted for that module.

Article 19 Period of validity

19.1 The result of an examination, when 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 examination results into account for the programme examination is four years.

Article 20 Right to inspection of assessments

20.1 Students may, upon their own request, peruse their assessed written examination work within ten working days after they were notified of the examination result.

20.2 Where a practical forms part of an examination, the work for that part may be returned to the students after the full assessment of the examination is completed.

20.3 Written examination work is kept in archive for a minimum of 6 years.

3.6 Thesis Examinations

Article 21 Periods and frequency of thesis examinations

21.1 The thesis will be assessed by a thesis examination committee, consisting normally of 3 members (or in special circumstances of maximum 4 members); (at UNESCO-IHE) a professor as chairman, the mentor and one or two external examiners.

In case a PhD fellow, who is mentoring MSc students in his/her own research, is proposed as member of the committee, a fourth additional staff member is compulsory.
External examiners are normally from outside the institute or in incidental cases from a chair group not involved in the supervision of the research work.

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

21.3 All students have to submit the examination version of the thesis report on the same date, i.e. the second Thursday of the month of the thesis examination.

21.4 Admission to the thesis examination is granted when the supervisor, upon recommendation of the mentor, has approved the draft thesis; in other words, the draft thesis needs to be approved as ‘ready for the MSc defence’.

21.5 In exceptional cases, when the outcome of the thesis examination, including the defence, was negative, the examination can be repeated once. The supervisor and mentor will detail the reasons for the failure in writing and clarify what is required to pass the exam. The re-sit shall be taken within three months of the first attempt.

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

21.7 The mark for the thesis examination is based on the following components: written MSc thesis report, presentation and discussion. The latter includes the ability of the student to answer questions from the examination committee and the audience.

21.8 The maximum duration of the MSc research phase is 6 months for a full time study. Extension of this period may be granted on request by the student and is subject to approval by the rector.

Article 22 Study progress and study advice

22.1 All study results that are required for evaluating the performance of the students, and the evaluation results are recorded on behalf of the Academic Board.

22.2 Upon request, students will be provided with a written summary of the study results obtained in the programme to date.

3.7 Examination Board

Article 23 Examination board procedures

23.1 The examination board is a sub-board of the Academic Board and normally meets before the monthly meeting of the Academic Board. The calendar of meetings is established and circulated at the beginning of the academic year. Additional meetings will be set or meetings can be rescheduled whenever circumstances dictate.

23.2 For each meeting, the administrative secretary will provide all required material to properly conduct the examination board's deliberations.

23.3 Decisions of the examination board are concluded by majority vote.

23.4 The mandate of the examination board is defined by its Terms of Reference.

Article 24 Assessment of the programme examination

24.1 The student has fulfilled the requirements for the programme examination if (s)he has successfully completed all examinations of the programme.

24.2 The student has successfully completed the programme examination when the examination board takes a decision to that effect.

Article 25 Degree awarding

25.1 Students who have successfully completed the programme examination will be awarded the Master of Science degree at the next scheduled degree awarding ceremony.

25.2 The degree will be awarded with distinction if the candidate obtained a mark of 8.5 or higher for the thesis examination, and an arithmetic average mark of 8.0 or higher for all other examinations in the programme that are assessed on a numerical scale, conform article 2.1.

Article 26 Diploma and supplement

26.1 As evidence of successful completion of the programme examination, the examination board issues a diploma during the degree awarding ceremony. The diploma is signed by the Chairman of the examination board, the Rector of the Institute and the Academic Registrar.

26.2 In addition to the diploma, the graduate receives a diploma supplement stating the results achieved and credit points for each component of the programme.

Article 27 Programme certificate

27.1 Students who fail to meet the programme examination 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.

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

3.8 Appeals

Article 28 Grounds for appeal

28.1 Students have the right to appeal against an examination assessment or an evaluation of the examination board 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 examination or assessment had occurred;

c. the examination or evaluation was not conducted in accordance with the regulations; or

d. some other material irregularity had occurred.

Article 29 Procedure for appeal

29.1 A student shall first attempt to resolve the problem through the programme coordinator, with the examiner, or the chairman of the examination committee or examination board.

29.2 If the student proceeds, the appeal shall be written in a letter stating the grounds for appeal and enclosing documentation as appropriate. The letter shall be addressed to the Rector.

29.3 After consultations, the Rector shall accept or reject the appeal (after consultation with the examination board) and communicate the decision to the appellant via the Academic Registrar as soon as possible but usually within a period of ten working days.

Article 30 Evaluation of the programme

30.1 All taught components of the programme are routinely evaluated via a standardised questionnaire, which is completed by the students during a class session.

30.2 The evaluation class session for a programme component is held after students have submitted all examination material, and before the examination results are being notified to the students.

30.3 Upon explicit request by the students or a student representative, an oral evaluation discussion may be organised at any time. The purpose of such a discussion is entirely to obtain specific information or suggestions for improvement of a programme component.

3.9 Final Articles

Article 31 Amendments

31.1 Amendments to these regulations are made by separate decision of the Academic Board.

31.2 No amendments shall be made in relation to the current academic year, unless there is reasonable expectation that the amendment will not work to the disadvantage of the students.

Article 32 Unforeseen situations

32.1 Situations which are not foreseen by the present regulations, will be decided on by the Academic Board, where necessary after consultation with the examination board and/or programme committees.

Article 33 Publication

33.1 The Academic Board is responsible for the timely publication of the Education and Examination Regulations, and any amendments thereof.

Article 34 Period of application

34.1 These regulations take effect for the academic year 2011– 2012. Approved by the Academic Board of UNESCO-IHE on 29 September 2011

3.10 Appendix A Qualifications of Graduates ES

- [1] Knowledge and understanding:
- Knowledge of current theory and contemporary developments in Environmental Science.
- Knowledge of physical, chemical and biological processes of the environment.
- Understanding of what is meant by “sustainability” and “wise use” of natural resources.
- The ability to describe the rationale for an integrated and interdisciplinary approach for managing the environment.
- Understanding the broader scientific, engineering and socio-economic context and the role of other disciplines required for Environmental Science.

Environmental Science and Technology

- To list concepts, instruments and technologies for pollution prevention, treatment and remedial action.

Environmental Planning and Management

- Knowledge of economic, institutional and legal principles, approaches and instruments relating to the environment.
- To list and explain legislative, institutional and management principles and arrangements.

Water Quality Management

- The ability to recognize the pollution impacts on water quality and identify remedial actions.
- To list and explain legislative, institutional and management principles and arrangements.

Limnology and Wetland Ecosystems

- The ability to recognize the pollution impacts on water quality and identify remedial actions.

[2] Applying knowledge and understanding:

- The ability to contribute to theoretical, methodological or applied developments in environmental science.
- The ability to prepare and implement a sound plan for environmental research.
- The ability to collect, analyse and organise relevant information and to draw sound conclusions on environmental issues.

Environmental Science and Technology

- To select and apply instruments and technologies for pollution prevention, treatment and remedial action.

Environmental Planning and Management

- To contribute to managing environmental systems and organisations and to the development of the institutional arrangements of the latter.

- To design and apply models for institutional development in water policy.
- To design and facilitate stakeholder involvement in decision-making processes.
- To formulate environmental policy strategies.

Water Quality Management

- To apply experimental, statistical and modelling tools for interpreting and designing water quality management programmes.

Limnology and Wetland Ecosystems

- To apply experimental and modelling tools for managing freshwater ecosystems.
- To apply knowledge of processes and functions of freshwater ecosystems in their management and protection.

[3] Making judgements:

- The ability to decide between different environmental ideas and approaches independently, based on available information, and to assess the potential for their application, integration and further development.
- The ability to select and apply a variety of techniques, tools and procedures in order to evaluate the environmental consequences of different development and intervention scenarios.
- The ability to reflect critically on the impacts of different activities on the environment.

Environmental Science and Technology

- To develop technological solutions for environmental problems based scientific knowledge.

Environmental Planning and Management

- To enumerate ecological and socio-economic functions and values of an environmental system and related, competing stakeholder interests.
- To design environmental policies that incorporate technical, administrative and financial aspects.

Water Quality Management

- To develop on the basis of scientific knowledge, technical and managerial solutions for water quality problems.

Limnology and Wetland Ecosystems

- To develop on the basis of scientific knowledge, technical and managerial solutions for problems in freshwater ecosystems.

[4] Communication:

- The ability to report and communicate environmental results clearly, and to explain and defend the reasoning, knowledge and assumptions to a variety of audiences.
- The ability to function effectively in a multi-disciplinary team.

Environmental Planning and Management, Water Quality Management

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

[5] Learning skills:

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

3.11 Appendix A Qualifications of Graduates MWI

[1] Knowledge and understanding:

- Knowledge of relevant theory and the contemporary developments in the field of study;
- Understanding of the required basic physical, applied mathematical and computing principles and the capability to integrate these within the appropriate discipline;
- Appreciation of the broader scientific, engineering and socio-economic framework, and recognition of the relevant disciplines and sub-disciplines that are related to the own discipline.

[2] Applying knowledge and understanding:

- The ability to apply disciplinary knowledge, academic capabilities and engineering skills independently and within a multidisciplinary context:
- The ability to select and apply suitable techniques and methods for analysis, assessment, planning, design, operation, rehabilitation and maintenance;
- The ability to independently formulate the appropriate questions, to identify and formulate appropriate approaches, and to pose original models, tests and/or engineering solutions;
- The ability to collect, analyse and structure required data and information and to recognise relations in them.
- The ability to prepare a research plan, including the description of the approach, the realisation of the research and the evaluation of the results.
- The attitude and the ability to contribute to theoretical, methodological or application development within the respective discipline.

[3] Making judgements:

- The ability to critically assess own investigation results, implementation feasibility and risks, and the ability to reflect on the ethical and socio-economic aspects connected with application;
- The ability to identify original ideas and approaches from the literature or other sources and assess the potential for application, integration or further development.

[4] Communication:

- The competence to clearly report and orally communicate results, the underpinning reasoning, knowledge and assumptions.

[5] Learning skills:

- The ability to extend and enhance the own knowledge, insight and skills in an autonomous manner.
- The ability to conduct independent academic research in a subsequent post-graduate (i.e., PhD) programme.

3.12 Appendix A Qualifications of Graduates WM

[1] Knowledge and understanding:

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

[2] Applying knowledge and understanding:

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

[3] Making judgements:

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

[4] Communication:

- The ability to report and communicate results clearly, and to explain and defend the reasoning, knowledge and assumptions to a variety of audiences.
- The ability to function effectively in a multi-disciplinary team.
- The capability to assess interests among different stakeholders and to facilitate decision-making processes.

[5] Learning skills:

- The ability to extend and enhance one’s own knowledge, insight and skills in an autonomous manner.

3.13 Appendix A Qualifications of Graduates WSE

[1] Knowledge and understanding:

- Knowledge of current disciplinary theory and the contemporary developments in the field of study within the context of water science and engineering;
- Understanding of the required basic physical, applied mathematical and computing principles and the capability to integrate these within the appropriate discipline;
- Appreciation of the broader scientific, engineering and socio-economic framework, and recognition of the relevant disciplines and sub-disciplines that are related to the own discipline.

[2] Applying knowledge and understanding:

- The ability to apply disciplinary knowledge, academic capabilities and engineering skills independently and within the multidisciplinary context of water science and engineering;
- The ability to select and apply suitable techniques and methods for analysis, assessment, planning, and where appropriate, design, construction, operation and maintenance;
- The ability to independently formulate the appropriate questions, to identify and formulate appropriate and approaches, to pose original models, tests and/or engineering solutions;
- The ability to collect, analyse and structure required information and to recognise relations in that information;
- The ability to prepare a research plan, including descriptions of the approach, the realisation of the research and the evaluation of the results, and the time planning for the research;
- The attitude and the ability to contribute to theoretical, methodological or application development within the respective discipline.

[3] Making judgements:

- The ability to critically assess own investigation results, implementation feasibility and risks, and the ability to reflect on the ethical and social aspects connected with application;
- The ability to identify original ideas and approaches from the literature or other sources and assess the potential for application, integration or further development.

[4] Communication:

- The adequacy to clearly report and orally communicate results, the underpinning reasoning, knowledge and assumptions, and where appropriate, to ensure the practical implementation of scientific or engineering solutions.

[5] Learning skills:

- The ability academic attitude to extend and enhance the own knowledge, insight and skills in an autonomous manner.

3.14 Appendix B Eligible Bachelor's Degrees for Academic admission

The specialisation in Water Supply Engineering accepts applicants with a BSc degree in civil, chemical, environmental, hydraulic or mechanical engineering.

The specialisation in Sanitary Engineering accepts applicants with a BSc degree in civil, environmental or chemical engineering, or in microbiology.

The specialisation in Integrated Urban Engineering accepts applicants with a BSc degree in civil engineering.

The specialisation in Hydrology and Water Resources accepts applicants with a Bachelor of Science degree in civil or agricultural engineering, earth sciences, environmental sciences, or physics.

The specialisation in Hydroinformatics accepts applicants with a Bachelor of Science degree in civil, agricultural or systems engineering, earth sciences, environmental sciences or physics.

The specialisations in Hydraulic Engineering and River Basin Development, and Hydraulic Engineering - Coastal Engineering and Port Development accept applicants with a Bachelor of Science degree in civil engineering or related field with a hydraulic engineering background.

The specialisation in Hydraulic Engineering - Land and Water Development accepts applicants with a Bachelor of Science degree in civil or agricultural engineering, or a related field.

The Water Management programme accepts applicants with a good Bachelor's degree in the fields of engineering, natural sciences, economics and the social sciences.

For the Water Resources Management specialisation, affinity with quantitative methods is essential. Similarly, for the Water Quality Management specialisation, affinity with chemistry and biology is desired. For the Water Services Management specialisation a professional background in the water utility sector is desired. And for the Water Conflict Management specialisation interest in local, national and international water management is desired.

The specialisation in Environmental Science and Technology accepts applicants with a BSc degree in civil, chemical, agricultural or environmental engineering, natural sciences, chemistry, environmental science, agriculture, or in geology.

The specialisation in Environmental Planning and Management accepts applicants with a BSc degree in civil, chemical, agricultural or environmental engineering, natural sciences, chemistry, environmental science, agriculture, geology, geography, or in environmental economics.

The specialisation in Water Quality Management accepts applicants with a BSc degree in civil, chemical, agricultural or environmental engineering, natural sciences, chemistry, environmental science, agriculture, or in geology.

The specialisation in Limnology and Wetland Ecosystems accepts applicants with a BSc degree in civil, chemical, agricultural or environmental engineering, natural sciences, chemistry, environmental Science, agriculture, or in geology.

3.15 Appendix D 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.

Students are advised to arrive at an examination in time and to be outside the examination room 10 minutes before the examination is scheduled to start.

Misreading the date, time or room allocation will not be accepted as an excuse for absence from an examination or for arriving too late.

Written Examinations

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.

Student card: Students are required to bring their UNESCO-IHE student card and are allowed to enter the examination room after a signal from the invigilators. Students will not be allowed into the room if they present themselves later than 15 minutes after the start of the examination.

Attendance list: After entering the examination room, students have to sign the 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: Each student has an allocated table with a set of answer and scratch papers with their student number printed on the cover sheet. Additional paper can be obtained from the invigilators upon request.

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).

Calculators: Only self contained calculators with a single-line display or dual-line display and an electronic language dictionary 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 and language translation 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.

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.

Thesis Proposal and Research Examinations

The thesis proposal is to be submitted for assessment to the responsible professor and the mentor, who will evaluate the proposal and assign a 'satisfactory' judgement if the evaluation is passed. Additionally, a presentation by the student may be part of the evaluation.

The examination of the thesis research consists of a maximum 30 minutes presentation of the thesis work by the candidate, followed by a maximum 30 minutes examination discussion with the examination committee and, possibly, the audience.

3.16 Appendix E Result form MSC research proposal

Date:_____

The supervisor and the mentor of Mr./Ms. _____

of programme _____ with specialization _____

consider the result of the MSc Research Proposal as being:

SATISFACTORY/UNSATISFACTORY*

Title MSc Research Proposal:

_____

_____

_____

Further remarks:

_____

_____

Name and signature supervisor: Name and signature mentor:

* delete what is not applicable

3.17 Appendix F Criteria for the MSc thesis evaluation

Approved by the Academic Board (05.03.2009).
To be used by the MSc Examination committees and the participants as a guide.
(Does not replace the standard evaluation form.)

Participant's name	
Topic	
Mentor	
Supervisor	
Date	

Criteria	**possible comments**
1. THESIS	
Abstract • Are motivation and objectives presented correctly? • Are own contribution, results and conclusions presented? • Is it clearly written?	
Introduction • Does it really introduce the work? • Does it logically lead to research questions and objectives? • Are objectives and goals (specific objectives) clearly formulated?	
Background/literature review • Are enough sources covered? • Is literature relevant and up-to-date?	
Materials & methods • Are methods explained clearly enough to understand their relevance and use? • Is quality assurance/quality control adequately addressed in experimental work?	
Discussion • Is discussion systematic and comprehensive? • Does it lead to conclusions?	
Conclusions • Are objectives achieved? • Are conclusions formulated concisely? • Are recommendations for future work given?	

Criteria	possible comments
1. THESIS *(continue)*	
Tables and figures • Do captions clearly explain contents of the Figures? • Are formatting and quality adequate?	
References, proper citation • Is material from other publications properly attributed and/or cited? • Are references and citations properly formatted?	
Editorial aspects • Is structure clear and logical? • Is spelling and grammar adequate? • Are text, headings, graphs and tables understandable? • Is layout appropriate?	
2. WORK PROCESS	
Creativity • Was participant generating new ideas, critical to the results published elsewhere? • Was participant creative, what is his/her own scientific contribution?	
Critical capacity • Are the limitations of the study understood and explained? • Does the participant show a capacity for self-criticism? • Are their clear suggestions for further research priorities?	
Other aspects • Was the participant really committed to work? • Was the participant working independently? • Were comments of the supervisors and reviewers taken into account?	
3. PRESENTATION	
• Is presentation properly structured? • Is timing good? • Is the balance of material on slides appropriate (not too much / too little)? • Are all major aspects of work presented? • Are all questions answered well?	

4 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.

5 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. h e 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 T he 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

6 Introduction MWI programme

The Municipal Water and Infrastructure Programme educates professionals that:

- can place their profession in the wider social, economic and environmental contexts of urbanisation and
  municipal water and infrastructure services provision;
- possess the engineering and related knowledge and skills required to act as a competent professional in
  their area of chosen specialisation;
- can contribute to the development of innovative approaches to the provision of sustainable and equitable
  municipal water and infrastructure services in developing and transition countries.

The programme offers the following specialisations:

- WSE Water Supply Engineering
- SE Sanitary Engineering
- UWEM Urban Water Engineering 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 double degree programme together with AIT Bangkok.

6.1 Learning objectives MWI programme

- Place their profession in the wider social, economic and environmental contexts of urbanisation and municipal water and infrastructure services provision;
- Act as a competent professional in their area of chosen specialisation;
- Contribute to the development of innovative approaches to the provision of sustainable and equitable municipal water, sanitation, environmental and infrastructure services in developing and transition countries.

6.2 Specialisations

Urban Water Engineering and Management
You will learn to deliver both water and wastewater services within the context of the urban water cycle, covering both technical and management aspects.

Sanitary Engineering
You will learn to design solid waste and wastewater collection and treatment systems and develop rational approaches towards sustainable waste management via cleaner production, appropriate treatment and re-use.

Water Supply Engineering
You will learn to deal with technical aspects of drinking water treatment and distribution in an integrated way, paying attention to the choice of technologies and tools, ranging from low-cost to advanced options.

6.3 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 programme graduates will be able to:

Knowledge and Theory:

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

Methods, Techniques and Tools:

- Prepare conceptual engineering and process design of sanitation components
- Apply modern tools for technology selection and carry out modelling of sanitation components

Analysis, Synthesis and Integration:

- Define and critically analyse, assess and evaluate various urban drainage and sewerage schemes, and wastewater, sludge and solid waste treatment process technologies
- 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:

- Identify, develop and conduct independent research including formulation of hypotheses selection and application of research methodologies, and the formulation of conclusions and recommendations
- Carry on desk studies, field work, and laboratory based research
- 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

- Clearly communicate concerning both oral and written skills
- Continuously acquire knowledge and assimilate and implement innovative learning methods and skills in an independent manner
- Operate both autonomously and in a multidisciplinary and multinational environment

6.4 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, graduates will:

Knowledge and Theory:

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

Methods, Techniques and Tools:

- Be able to design and to rehabilitate raw water abstraction, transport, treatment and distributionprocesses and systems
- Understand the importance and methods for operation and maintenance of water supply systems
- Understand options for centralised & urban versus decentralized & rural systems

Analysis, Synthesis and Integration:

- Be able to define & evaluate project alternatives based on chosen selection criteria
- Be able to use statistical and modelling tools for simulating, prediction of performance and operation of water supply system components
- Understand water supply engineering within a watershed context

Research:

- Be able to conduct independent research, including formulation of hypotheses, selection and application of research methodologies, and the formulation of conclusions and recommendations

General Academic Skills:

- Posses the learning skills to acquire continual knowledge in an independent manner
- Be able to communicate effectively in oral and written presentations to technical and non-technical audiences

6.5 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.

More specifically, the learning objectives of the program will include the following:

Subject knowledge and skills:

- Understanding of the urban water cycle and its water system components, their characteristics and functioning within greater urban infrastructure systems
- Understanding of 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
- Ability to 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
- Understanding of water infrastructure/asset planning, financing and management, and utility management
- Familiarity 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:

- Ability to identify, articulate, analyse and solve problems of the urban water cycle and systems, integrating theory and applications
- Collect, summarise, analyse and interpret technical data/materials in a structured form to gain knowledge on urban water system design and operation and maintenance
- Ability to critically recognize and assess the need for continued-education and research on planning, design, maintenance and management of urban water systems
- Have a working knowledge of 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:

- Improved skills for independent learning
- Enhanced reporting and presentation skills
- Improved IT skills
- Ability to work independently or as part of a team
- Ability to manage time effectively

6.6 Module coordinators

- 1 Research Methodology and GIS H.J. Lubberding ,
- 2 Hydrology, Water Chemistry and Modelling H.J. Lubberding ,
- 3 Microbiology, EnvironmentalPT , Demography and Public Health H.J. Lubberding ,
- 4 Integrated Urban Water Management N.P. van der Steen
- 5 Conventional Surface Water Treatment S.Salinas
- 5 Urban Drainage and Sewerage P.D.A. Pathirana
- 6 Biological Wastewater Treatment C.M. Lopez Vazquez
- 6 Groundwater Treatment and Resources B. Petrusevski ,
- 6 Water Sector and Utility Management M. Rusca
- 7 Advanced Water Treatment S.Salinas
- 7 Integrated Asset Management Systems P.D.A. Pathirana
- 7 Resource Oriented Sanitation M. Ronteltap
- 8 Modelling of Wastewater Treatment Processes and Plants C.M. Hooijmans
- 8 Water Transport and Distribution I N. Trifunovic ,
- 9 International Fieldtrip and Fieldwork H.A. Garcia
- 10 Industrial Effluents Treatment and Residuals Management H.A. Garcia
- 10 Water Treatment Processes and Plants S.Salinas (New lecturer)
- 11 Decentralized Water Supply and Sanitation S.K. Sharma
- 11 Modelling Urban Drainage and Sewerage S. Seyoum , PhD, MSc
- 11 Water Transport and Distribution II N. Trifunovic , MSc
- 12 Group work MWI M. Ronteltap ,
- 13 Research Methodology and Summer Courses for MWI E.A. de Jong / C.M. Hooijmans
- 14 MSc Research Proposal Development for MWI E.A. de Jong /C.M. Hooijmans

7 Facilities

7.1 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

7.2 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 well being. 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.

7.3 Student Association Board

The Student Association Board (SAB) is composed of representatives who are elected by the students in annual elections that take place some four 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. The board also publishes its own magazine *The Informer*, in which the rich variety of contributions are entirely derived from, and produced by, the student community.

7.4 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 educational programmes. All participants will get a free UNESCO-IHE web-based e-mail box. 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.

7.5 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. Last-minute changes in schedules are indicated on the announcement board near the entrance. Two monitor screens opposite the reception desk are regularly updated with news or information on events taking place at UNESCO-IHE.

Private telephone calls can be made from card-operated phone booths located next to the reception desk. A photocopy service near the entrance is available to students at all times. There is also a facility to recharge chip-cards, which students receive from the bank to pay for small purchases without using cash. Furthermore, the building contains a meditation room, which is located on the third floor.

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

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. The library, computer facilities and laboratory are described in detail below.

7.6 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, M.Sc 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.

From July 2011 until December 2011, the Library spaces are being renovated. Most of the printed collections and the reference desk have been relocated to A2 a/b on the first floor and on account of missing the reading room, the opening hours have been changed to Monday-Friday 09-15-17.30

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

7.7 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 micropollutants, 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.

7.8 Study Materials

Study materials such as textbooks, lecture notes and hand-outs are provided by the Institute. Students receive the lecture notes in their personal locker before the start of the involved lecture series. Additional material can be provided by the lecturers in the form of hand-outs. Reference works are available from the Institute library or the library of the Delft University of Technology (see above).

A number of supporting materials, such as for example PowerPoint presentations or exercise materials used by the lecturers, can be accessed or downloaded from the electronic repository. Students can login to the electronic repository from any location via the Internet web page located at http://km.ihe.nl.

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

7.9 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 (CEFR) for Languages is a basis for recognising language qualifications. A1-A2 = Basic; B1-B2 = Intermediate; C1-C2 = Advanced) , are obliged to attend a support course: attendance is required. Students whose test score is B2 are strongly recommended to attend a course. If students who score B2 choose to take a support course, regular attendance is required. Those with score levels C1 and C2 are exempt from academic writing courses.

Scheduling and attendance

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

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

- Tuesdays 3.45pm-5.30pm
- Thursdays 8.45am-10.30am

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

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

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

Summary descriptions of writing courses

First Steps in Academic Writing: *lower intermediate*

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

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

New Headway Academic Skills: *intermediate*

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

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

Academic Writing: *upper intermediate*

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

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

Advanced Academic Writing: *advanced*

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

- Specifically aimed at improving key academic writing skills, this is a very practical and thorough course.
- Three main areas are covered: The Writing Process – from making an outline to proof-reading; Elements of Writing – writing skills such as making comparisons, describing results and paraphrasing; Accuracy in Writing – to improve common problems, eg articles, passives, prepositions.

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

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

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

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MASTERS PROGRAMME MWI 2011-2013 - PART 2

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MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: H.J. Lubberding, PhD, MSc

Module Sheet

Module Name Research Methodology and GIS	Module Code MWI/01	Credits 5

Target Group	Prerequisites
Programme target group	Programme prerequisites

Learning Objectives

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

- make a critical analysis of the global and national agendas and policies for â€˜Water and Environmentâ€™ in the context of sustainable development;
- apply the principles of the scientific method to the design and development of a research project and to develop and present the background,
- problem statement, research objectives and methodology for a research project;
- understand basic engineering economic principles;
- apply basic GIS tools.

Topics and Learning Activities

Week 1

Week 1 will provide an introduction to the global agendas and policies for water and environment. Participants will be introduced to key documents in these fields (World Water Vision, Vision21, Earth Summit on Sustainable Development, WWF-3). The concept of IWRM will be explained and illustrated by examples.

Learning Activities:

Week 1 will consist of lectures, exercises, workshops, video-conferencing sessions, and role play sessions.

Methodology

Methodology pays attention to "what is science", to ethics in science and the design of a research project.

Learning Activities:

Methodology is given in the form of introductory lectures by /debate between experts in themes. Subsequently, there is an assignment per group of three: read a number of relevant papers in one theme, prepare brief review papers concluded with a number of recommendations for action. Finally, there is a presentation and debate among participants and experts.

Engineering economy

Engineering economy will introduce basic economic concepts of price equilibrium, financial and economic costs, tariff calculation, B/C ratio and break-even utilization and cost benefit analysis.

Learning Activities:

Lectures

GIS

Application of GIS in urban environments, digital mapping urban water systems, spatial coordination systems, terrain analysis, water distribution and urban networks, land use mapping, flood plain mapping, urban infrastructure analysis and mapping, data acquisition and remote sensing

Learning Activities:

Lectures,workshops

Lecturing Material

- Handouts
- Lecture notes Methodology
- Lecture notes Engineering economics
- Lecture notes GIS

Assessment
- **50%: Written Exam (closed book)**
- **25%: Assignment**
- **25%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/01: Research Methodology and GIS											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Week 1	20	20							40	
	Engineering economics	24							24	50	Bijlsma
	GIS	14							14	22	Vojinovic
	Methodology	10	4	8					20	22	Irvine, Schwartz
	Excursion						4	4	4	4	
	Exam								2	2	
	Total	**68**	**24**	**8**			**4**		**64**	**140**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: H.J. Lubberding, PhD, MSc

Module Sheet

Module Name Hydrology, Water Chemistry and Modelling	Module Code MWI/02	Credits 5

Target Group	Prerequisites
Programme target group	Programme prerequisites

Learning Objectives

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

- understand the basic elements of (water) chemistry and hydrology;
- apply chemical and hydrological principles in water and wastewater engineering;
- understand the concept of development and implementation of a reliable model in water and wastewater engineering.

Topics and Learning Activities

Hydrology

The content of hydrology will be: hydrological circle, 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 extraction; theory of groundwater flow, flow towards wells, superposition and boundary effects, potential and stream functions, development of observation and production wells; groundwater pollution.

Learning Activities:

Lectures, workshops (participants present solution of problems).

Chemistry

After a brief refreshment of the basic chemical knowledge, water chemistry will deal with structure and properties of matter, chemical reactions in general, chemical calculations, reactions in aqueous solutions and at surfaces, principles of analytical chemistry and chemistry of organic compounds in water.

Learning Activities:

Lectures and laboratory work.

Modelling

Theory of modelling. Modelling practice

Learning Activities:

Lectures, workshops, computer models.

Lecturing Material

- Lecture notes Hydrology
- Lecture + laboratory notes Chemistry
- Lecture notes Modelling

Assessment

- **70%: Written Exam (closed book)**
- **30%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/02: Hydrology, Water Chemistry and Modelling											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Hydrology	10	8						18	38	Wenninger, Nonner
	Chemistry	12			16				28	48	Slokar
	Modelling	6	2						8	28	Seyoum, Trifunovic, Brdjanovic, Ann van Griensven
	Excursion						8	8	8	8	
	Exam									3	
	Total	**28**	**10**		**16**		**8**		**62**	**125**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME
Academic Year: **2011-2013**
Specialization: **Core Programme**
Module Coordinator: **H.J. Lubberding, PhD, MSc**

Module Sheet

Module Name	Module Code	Credits
Microbiology, Environmental Process Technology, Demography and Public Hea	**MWI/03**	**5**

Target Group	Prerequisites
Programme target group	Programme prerequisites

Learning Objectives

Upon completion of the module participants will be able to..
- understand the basic elements of (water) microbiology and process technology;
- apply microbiological and process technological principles in water and wastewater engineering;
- analyse dynamic interactions between human development and changes in water and wastewater engineering.

Topics and Learning Activities

Microbiology

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, laboratory

Environmental process technology

In environmental process technology: mass balance analysis, reactor models, mixing in reactors, kinetics, mathematical description of chemical and biological reactions in reactors.

Learning Activities:

Lectures, workshops

Demography

In demography the components of demographic change (fertility, mortality, migration, population models) will be discussed in relation with sustainable development.

Learning Activities:

Lectures and group discussions, culminating in an assignment (analysis and presentation of gathered information).

Human health

In human health the relation between environmental pollution and human diseases is discussed.

Learning Activities:

Lectures and group discussions, culminating in an assignment (analysis and presentation of gathered information).

Lecturing Material
- Microbiology lecture notes and laboratory notes
- EPT lecture notes
- Demography lecture notes
- Public health lecture noters

Assessment

- **60%: Written Exam (closed book)**
- **20%: Assignment**
- **20%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/03: Microbiology, Environmental Process Technology, Demography and Public Hea

Nr	Course/Topic	lecture	exercise	workshop	labwork	fieldwork	fieldtrip	selfstudy	contact hours	studyload hours	Lecturer(s)
	Microbiology	12			12				24	48	Lubberding
	EPT	18							18	46	Bijlsma
	Demography	8	4						12	20	Visser
	Public health	8	8						16	24	Hamel
	Exam									3	
	Total	**46**	**12**		**12**				**70**	**141**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: N.P. van der Steen, PhD, MSc

Module Sheet

Module Name Integrated Urban Water Management	Module Code MWI/04	Credits 5

Target Group	Prerequisites
Programme target group	-

Learning Objectives

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

- General objective 1: Develop strategies for Integrated Urban Water Management, and to evaluate consequences for the wider social, economic and environmental context.
- The knowledge/insight level:

  â€¢To describe the urban water system (cycle), its components and interrelations, and its interactions with the (aquatic) environment.
  â€¢To describe the causes of urbanisation and the effect on the urban water system.
  â€¢To model water flows, material flows and energy consumption of an urban water system using a water balance software tool.
  â€¢To forecast water demand in a city, based on population forecasts, per capita use and Water Demand Management measures
- The application level:

  â€¢To apply theoretical concepts from systems engineering to the urban water system
  â€¢To apply strategic and masterplanning of the urban water system, and describe links with general urban planning.
- The integration level:

  â€¢To develop a strategy for IUWM, making use of water demand management and pollution prevention
- General objective 2: Process scientific data in a statistical sound way by applying basic statistics

Topics and Learning Activities

Water supply and WDM

Forecasting methods to project urban water demand and measures to manage urban water demand will be presented

Learning Activities:

Lectures

Systems engineering

The application of systems engineering to urban water system will be illustrated. A systematic method to develop systems diagrams will be elaborated in a workshop

Learning Activities:

Lectures, workshop

Material, Water and Energy flows

Flows of materials, water and energy through the urban water system will be introduced. City Water Balance software will be used to investigate water flows and how they can be manipulated by infrastructure choices.

Learning Activities:

Lectures, workshop.

Strategic and master planning for the urban water system

The different steps of a the planning processes will be presented and discussed.

Learning Activities:

Lectures

Stakeholder participation in urban (water) planning

The possible roles stakeholders may play in an urban planning process and described and critically discussed.

Learning Activities:

Lectures

The city and the catchment

Water resource allocation between urban, industrial and agricultural use is presented in the form of a roleplay supported by spreadsheet model. Integration of economica and financial aspects are taken into account as well.

Learning Activities:

Role-play

Statistics

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

Learning Activities:

Lectures, workshops.

Lecturing Material

• Various handouts.

Assessment

- **70%: Written Exam (closed book)**
- **30%: Written Exam (closed book)**

UNESCO-IHE - MSc Module 2011/2013-MWI/04: Integrated Urban Water Management											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**Water supply and WDM**	8								24	Dr. S.K. Sharma
2	**Systems engineering and the Urban Water System**	4								12	Dr. N.P. van der Steen
3	**Systems diagram development**	2		2						6	Dr. B. Enserink
4	**Material, Water and Energy flows**	2								6	Dr. N.P. van der Steen
5	**City Water Balance**	2		4						6	Dr. N.P. van der Steen
6	**Strategic planning for the Urban Water System**	4								12	Dr. N.P. van der Steen
7	**Masterplanning for the Urban Water System**	4								12	Prof. dr. D. Brdjanovic
8	**Stakeholder participation in urban (water) planning**	4								12	to be identified
9	**The city and the catchment**			6						6	J.C. Heun, MSc
10	**Case study I**			2						2	Prof. L. Rietveld
11	**Case study II**			2						2	to be identified
12	**Statistics**	12		10						46	Dr.Singer
	Total	**42**		**26**				**24**		**146**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME
Academic Year: **2011-2013**
Specialization: **WSE**
Module Coordinator: **S. Salinas, PhD, MSc**

Module Sheet

Module Name Conventional Surface Water Treatment	Module Code MWI/WSE/05	Credits 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.	Bachelors degree in engineering or similar technical background meeting the MSc Programme entry requirements

Learning Objectives

Upon completion of the module participants will be able to..
- describe the theoretical principles of the conventional water treatment
- link the practical aspects with theoretical principles
- determine design parameters from experimental studies

Topics and Learning Activities

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

Sedimentation
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.

Filtration
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.

Disinfection
Conventional disinfection, chlorination principles and practice and an overview of disinfection by products.

Lecturing Material
- K. Ghebremichael, J Schippers, JP Buiteman, Coagulation/Flocculation (LN0056/07/01)
- S.K. Sharma, Sedimentation (LN 0007/07/1),
- M.W. Blokland, N. Trifunovic and S.K Sharma, Sedimentation: Workshop problems (LN0009/07/1)
- N. Graham, Filtration (LN0330/07/1);
- 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).
- J.P. Buiteman, K. Ghebremichael and J. Schippers, Disinfection

Assessment

- **20%: Assignment**
- **20%: Lab Report**
- **60%: Written Exam (closed book)**

UNESCO-IHE - MSc Module 2011/2013-MWI/WSE/05: Conventional Surface Water Treatment											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Coagulation	6		2	4				12	18	S. Salinas, PhD
	Sedimentation	8	4	4	4				20	40	S.K. Sharma, PhD
	Filtration	14		6	4				24	56	Prof. N.J.D. Graham, PhD
	Disinfection	4		2	4				10	18	J.P. Buiteman, MSc
	Fieldtrip	8							8	8	S. Salinas, PhD
	Total	**40**	**4**	**14**	**16**				**74**	**140**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: P.D.A. Pathirana, PhD, MSc

Module Sheet

Module Name Urban Drainage and Sewerage	Module Code MWI/SE/UWEM/05	Credits 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.

Learning Objectives

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

- describe the inputs, outputs and functioning of urban drainage/sewerage systems;
- appraise urban drainage and wastewater management problems in global cities;
- describe the standard practice in designing urban drainage systems and develop simple drainage system designs;
- explain the elements of an urban drainage/sewerage hydraulics/water-quality model;
- describe the elementary hydraulic/hydrological processes involved in the urban drainage systems and recommend their appropriate applications;
- construct a simple model for analysis of hydraulics and water quality of a drainage system;

  interpret simple model results and use them for decision making in design, renewal and upgrading systems.

Topics and Learning Activities

Urban drainage and Sewerage (UDS) systems
purpose, types and historical development, system components and layout.

Urban drainage/sewerage (input) types and characterization
Sources and characteristics of storm water drainage and sewerage, drainage engineering services.

Quantification of Inputs
rainfall and surface runoff, rainfall-runoff transformation, rainfall frequency analysis, extreme values and design storms, waste water generation;

Hydraulics of drainage systems
pipe/channel flow, unsteady hydraulics, pumping stations;

Modelling of urban drainage hydraulics
modelling principles, modelling tools, application of SWMM model.

Urban Drainage Design
Sewer system layout, approaches to urban drainage system design, design criteria, sewer design calculations

Special topics in urban drainage and sewerage
road drainage, alternative drainage systems; /low-cost sewerage systems (topics vary by year)

Lecturing Material

Assessment

- **40%: Written Exam (open book)**
- **20%: Homework**
- **40%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/SE/UWEM/05: Urban Drainage and Sewerage											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Introduction										
	Total										

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: C.M. Lopez Vazquez, PhD, MSc

Module Sheet

Module Name Biological Wastewater Treatment	Module Code MWI/SE/06	Credits 5

Target Group	Prerequisites
MSc participants enroled in the Municipal Water Infrastructure program from the Sanitary Engineering Specialization (MWI-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 MWI-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.

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 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, membrane bioreactors and biofilm systems.
- make process selection of wastewater treatment processes and systems to meet the required effluent discharge requirements in a cost-effective manner.

Topics and Learning Activities

Wastewater characterization and sampling

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.

Primary treatment

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

Learning Activities:

Lecture, field trip.

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

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.

Final settling

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.

Innovative nitrogen removal processes

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.

Membrane bioreactors and biofilm systems

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

Learning Activities:

Lecture.

Anaerobic wastewater treatment

Overview of the main characteristics, features and advantages of anaerobic wastewater treatment technologies. Description of the different processes involved in anaerobic digestion and their interactions among them. Development of the most commonly applied anaerobic wastewater treatment systems, their main features, configurations, and operating conditions. Fundamentals and basic considerations of the relevant parameters for the design and operation of anaerobic wastewater treatment systems.

Learning Activities:

Lecture.

Lecturing Material

• M. Henze, MCM van Loosdrecht, G. Ekama and D. Brdjanovic â€˜Biological Wastewater Treatment: Principles, Modelling and designâ€™ 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>

Assessment

• 100%: Written Exam (closed book)

UNESCO-IHE - MSc Module 2011/2013-MWI/SE/06: Biological Wastewater Treatment											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**Wastewater chracterization and sampling**	5			1				6	14	Prof. Dr. Damir Brdjnovic
2	**Primary treatment**	3							3	9	Prof. Dr. Damir Brdjanovic
3	**Organic matter removal**	5	3		1		1	1	9	18	Dr. Carlos M. Lopez Vazquez / Prof. George
4	**Nitrification**	3	2		1		1	1	7	13	Dr. Carlos M. Lopez Vazquez / Prof. George
5	**Denitrification**	3	2		1		1	1	7	13	Dr. Carlos M. Lopez Vazquez / Prof. George
6	**Enhanced biolological phosphorus removal**	5	3		1		1	1	9	18	Dr. Carlos M. Lopez Vazquez / Prof. George
7	**Final settling**	3	2		1				6	11	Dr. Carlos M. Lopez Vazquez
8	**Filamentous bulking sludge**	2							2	5	Eng. Dick Eikelboom / Eng. Arjan Borger
9	**Side-stream nitrogen removal**	3							3	9	Prof. Dr. Mark van Loosdrecht
10	**Anaerobic wastewater treatment**	5							5	14	Prof. Dr. Jules van Lier
11	**Membrane bioreactors**	5	2						6	15	Dr. Hector Garcia Hernandez
12	**Wastewater treatment plants and configurations**	3							3	9	Prof. Dr. Damir Brdjanovic
	Total	**45**	**14**		**6**		**4**	**6**	**66**	**148**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: B. Petrusevski, PhD, MSc

Module Sheet

Module Name Groundwater Treatment and Resources	Module Code MWI/WSE/06	Credits 5

Target Group	Prerequisites
describe here your target group.	describe prerequisites..

Learning Objectives

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

Topics and Learning Activities

Lecturing Material

Assessment

UNESCO-IHE - MSc Module 2011/2013-MWI/WSE/06: Groundwater Treatment and Resources											
Nr	Course/Topic	lecture	exercise	workshop	labwork	fieldwork	fieldtrip	selfstudy	contact hours	studyload hours	Lecturer(s)
	Total										

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: M. Rusca, PhD, MSc

Module Sheet

Module Name Water Sector and Utility Management	Module Code MWI/WSUM/06	Credits 5

Target Group	Prerequisites
Young and Mid-career professionals who are 1) working at middle and upper management level in an organization in the water sector, 2) employed in policy making institutions in the water sector or 3) working for organizations engaged in management of water resources and water services.	Preferably a relevant bachelorâ€™s degree or equivalent; basic PC-computer knowledge (MS-Windows, MS-Office); good English command.

Learning Objectives

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

- Analyze key characteristics of the water services sector;
- Identify and examine different institutional options for service provision;
- Analyze policies and policy making in the water services sector;
- Analyze regulation and regulatory regimes in the water services sector.

Topics and Learning Activities

Introduction to Water Sector and Utility Management

Water Services Delivery - General concepts,
Institutional options for service delivery,
Private Sector participation,
Benchmarking,
Water Utility Simulation Game.
Learning Activities:
Lectures, Tutorials, Movie, Simulation Game.

Reforms in the Water Sector

Various reform strategies and options for service provision,
ANDA Role Play.

Learning Activities:
Lectures, Role Play.

Water Governance

Discussion on the concept of governance/good governance and implication for the water sector.
Learning Activities:
Lecture, Debate.

Lecturing Material

- PPT presentations, Lecture Note, Movies

Assessment

- **50%: Written Exam (closed book)**
- **40%: Assignment**
- **10%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/WSUM/06: Water Sector and Utility Management											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**Introduction to WSUM**	1								1	Rusca
	Institutional options for water services management (1)	2								6	Rusca
	Institutional options for water services management (2)	2								6	Libaudiere
	Film: Thirst			2						2	Libaudiere
	Water Sector and Development Policies	3								9	Rusca
	Formalization of informal providers	2								6	Schwartz
	Institutional Analysis	2								6	Ahlers
	Case study: Service provision in Lilongwe peri-urban	2								6	Rusca
	Case study: sanitation services in Kampala slums	2								6	Rusca
	Water Sector Reforms	2								6	Rusca/Libaudiere
	Anda Role Play	4	16							20	Rusca/Libaudiere
	Water Utility Simulation	10	10							20	Rusca/Libaudiere
	Water Sector Regulation	2								6	van Dijk/Libaudiere
	Benchmarking in the Water Sector	2								6	Blokland
	Assignment (1): Presentations	2								30	Rusca/Libaudiere
	Assignment (2): Presentations	2								2	Rusca/Shwartz/Ahlers
	Exam									3	
	Total	**40**	**26**	**2**						**141**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: WSE
Module Coordinator: S.Salinas, PhD, MSc

Module Sheet

Module Name Advanced Water Treatment	Module Code MWI/WSE/07	Credits 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.

Learning Objectives

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

- the basic principles of micro-filtration and ultra-filtration membrane processes and the capabilities/constraints of using low pressure membrane processes in water treatment applications, and have practical knowledge on the design and operation of these processes;
- the basic principals of desalination reverse osmosis, and be capable of selecting appropriate membrane process for a specific application, and identify appropriate pre-treatment and post treatment schemes, and cleaning protocols for desalination processes;
- UV disinfection and Advanced Oxidation Process, THM formation, Activated Carbon Adsorption, Ion Exchange technology and softening processes.

Topics and Learning Activities

Lecturing Material

• J. Schippers, M. Kennedy & G. Amy â€“ Low Pressure Membrane Technology - Lecture Notes & CD
• J. Schippers, M. Kennedy G. Amy, Desalination Technology: Reverse Osmosis Membrane Systems- Lecture Notes
• J.P Buiteman â€“ Ion Exchange & Softening Technology
• G. Amy â€“ Advanced Disinfection & Oxidation Processes
• Selected papers written by guest lecturer(s)

Assessment

- **70%: Written Exam (closed book)**
- **20%: Assignment**
- **10%: Lab Report**

UNESCO-IHE - MSc Module 2011/2013-MWI/WSE/07: Advanced Water Treatment											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Introduction	1								1	Prof. M.D. Kennedy, PhD
	Water quality	1								1	S. Salinas, PhD, MSc
	Microfiltration / ultrafiltration technology	9		4	2		1	1		16	Prof. M.D. Kennedy, PhD
	Desalination technology	9	4	6			1	1		20	Prof. M.D. Kennedy, PhD
	Chemical softening and Ion exchange	2	2							4	J.P. Buiteman, MSc
	Advanced oxidation	2	1							3	Joop Kruithof, PhD
	Total	**24**	**7**	**10**	**2**		**2**			**45**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: P.D.A. Pathirana, PhD, MSc

Module Sheet

Module Name Integrated Asset Management Systems	Module Code MWI/UWEM/07	Credits 5

Target Group	Prerequisites
describe here your target group.	describe prerequisites..

Learning Objectives

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

- appreciate the historical processes that made asset management approach important for urban infrastructure engineers and managers;

â€¢ describe the drivers (e.g. climate variability/change, urbanization, increasing poverty, etc...) that make asset management crucial for sustainable provision of water related infrastructure services;

â€¢ able to define asset management in one's own words and List and describe the essential steps of an asset management plan;

â€¢ able to provide example problems from one's own experience (professional or personal) which asset management approach would be/would have been able to solve;

â€¢ describe the techniques used in asset inventories (e.g. condition rating);

â€¢ 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;

â€¢ appraise the use of data driven models in Asset Management. Describe sample approaches (e.g. ANN, Decision Trees);

â€¢ explain a decision prioritisation plan based on the analysis of significance and condition of asset components;

â€¢ apply hydraulic modelling to establish significance of asset components of water distribution/drainage systems;

â€¢ describe asset condition modelling approaches. Recommend suitable modelling approaches for practical problems;

â€¢ appraise the recent developments in the field of Asset Management of water infrastructure.

Topics and Learning Activities

Lecturing Material

Assessment

- **60%: Oral Exam**
- **40%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/UWEM/07: Integrated Asset Management Systems											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**Introduction + Overview of the course**								4	8	Pathirana
2	**Asset Inventory**								4	8	Gersonius/Seyoum
3	**Data/Databases**								4	8	Pathirana/Seyoum
4	**Making sense of data**								4	8	Seyoum/Pathirana
5	**Workshop 1**								16	16	Pathirana/Seyoum
6	**Condition Modelling**								10	20	Kliener
7	**Condition Modelling excercise**								8	8	Kliener
8	**Criticality, Significance and Condition**								8	16	Pathirana
9	**Advancements in Asset Management**								8	16	Pathirana/Seyoum
	Total								**66**	**108**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME
Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: N.P. van der Steen, PhD, MSc

Module Sheet

Module Name Resource Oriented Sanitation	Module Code MWI/SE/07	Credits 5

Target Group	Prerequisites
describe here your target group.	describe prerequisites..

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

Topics and Learning Activities

Lecturing Material

Assessment

- **80%: Written Exam (closed book)**
- **20%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/SE/07: Resource Oriented Sanitation

Nr	Course/Topic	lecture	exercise	workshop	labwork	fieldwork	fieldtrip	selfstudy	contact hours	studyload hours	Lecturer(s)
	Anaerobic Reactor Technology	6		6	4						Prof. J.B. van Lier, Dr. N.P. van der Steen
	Constructed Wetlands	8									Dr. D. Rousseau
	Ecological Sanitation	16		4			8	8			Dr. M. Ronteltap
	Soil Aquifer Treatment	4									Dr. S.K. Sharma
	Stabilisation Ponds	4		2							Dr. N.P. van der Steen
	Technology Selection	2									Prof. D. Brdjanovic
	Pharmafilter	2					4	4			N. Wortel
	Total	**42**		**12**	**4**		**12**				

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: C.M. Hooijmans, PhD, MSc

Module Sheet

Module Name Modelling of Wastewater Treatment Processes and Plants	Module Code MWI/SE/08	Credits 5

Target Group	Prerequisites
The module primarily targets professionals working in water and sewerage companies, consulting firms, industry, municipalities, universities and ministries.	Besides matching IHEâ€™s general admission criteria, participants should possess a B.Sc. degree in preferably Civil Eng., Env. Eng., Microbiology, Chemistry or Chemical Engineering

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
- Can 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.
- Can 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: a treatment plant in Mexico. Can put the model into BioWin and can discuss and explain the outcome of the model.
- Can explain the modeling of anaerobic digestion. Memorize how the model works in BioWin.
- Can explain the modeling of natural systems and the difference with activated sludge modeling. Can develop a simplified model for a pond system. Can simulate an existing model using Delft3D and explain the results.
- Can explain the modeling of MBR and biofilm systems. Can simulate an existing model using AQUASIM and explain the results.

Topics and Learning Activities

Wastewater treatment modelling

The basis of wastewater treatment modelling kinetics, stoichiometry, mass balances, hydraulics and matrix notations. Introduction of the computer program AQUASIM as a tool for modelling wastewater treatment processes.

Learning Activities:

Presentations, tutorial and AQUASIM computer exercises.

Modelling activated sludge processes: ASM approach

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.

Modelling of an activated sludge plant using BioWin

Optimization of an existing wwtp in Mexico, supported by presentations on the approach and procedures.

Learning Activities:

Presentations, computer exercise.

Modelling anaerobic reactors using BioWin

Modelling of anaerobic reactors by applying the Anaerobic Digestion Model (ADM)

Learning Activities:

Presentations, computer exercise.

Modelling pond systems using Delft3D

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

Learning Activities:

Presentations, computer exercise.

Modelling membrane bioreactors and biofilm systems using AQUASIM

Modelling following the ASM approach

Learning Activities:
Presentations, computer exercises.

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);
Delft3D modelling (Exercise);
3D Model for a Secondary Facultative Pond (Paper).
• Modelling anaerobic wastewater treatment plants (Presentation)
BioWin Modelling (Exercise)
• Modelling membrane bioreactors and biofilm systems (Presentation);
AQUASIM modelling (Exercise).

Assessment

- **40%: Assignment**
- **60%: Written Exam (closed book)**

UNESCO-IHE - MSc Module 2011/2013-MWI/SE/08: Modelling of Wastewater Treatment Processes and Plants											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**Modelling of wastewater treatment**	2							2	6	Hooijmans
2	**Set-up matrix**		2						2	2	Hooijmans
3	**Intr. to aquatic systems modelling**	2	16						18	22	Hooijmans
4	**Modelling activated sludge processes**	4							4	12	van Loosdrecht
5	**Evaluation of Bio-P removal**	1	4						5	7	Lopez Vazquez
6	**Data and process evaluation**	2							2	6	Meijer
7	**Case study modelling**	3							3	12	Brdjanovic
8	**Modelling activated sludge plant**		20						20	20	Meijer
9	**Modelling ponds and wetlands**	2	4						6	10	Sah
10	**Modelling MBR and biofilm reactors**	2	4						6	10	Saroj
11	**Modelling anaerobic reactors**	2	4						6	10	van Lier, Spanjers
12	**Assignment**									12	
13	**Exam**									12	
	Total	**20**	**54**						**74**	**141**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Water Supply Engineering, Urban Water Engineering and Management
Module Coordinator: N. Trifunovic, MSc

Module Sheet

Module Name Water Transport and Distribution I	Module Code MWI/WSE/UWEM/08	Credits 5

Target Group	Prerequisites
Mid-career professionals dealing with technical aspects of drinking water transport & distribution, working for municipal assemblies, water supply companies or consulting bureauâ€™s.	BSc degree in Civil Engineering or similar technical background; basic PC-computer knowledge (MS-Windows, MS-Office); good English command.

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 for specified demand scenario, by being able to select appropriate pipe diameters, indicate optimum location of reservoirs and identify the number and size of the pumps used to supply the demand in the network;
- apply the above thoretical knowledge by learning to perform computer-aided hydraulic calculations and predict the consequences of demand growth on the hydraulic performance of particular water transport and distribution 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 of the network that will integrate economic aspects, choose adequate components and pipe materials, and judge technical solutions dealing with the network maintenance, rehabilitation, and expansion.

Topics and Learning Activities

Introduction to Water Transport and Distribution

Introduction: main objectives and components of water transport and distribution systems. Water demand: categories, patterns, calculation, forecasting. Hydraulics of pressurised flows: basic equations, single pipe calculation, branched and looped networks, system- and pump characteristics, pressure related demand. Hydraulics of storage and pumps. Main components of hydraulic design: design parameters, choice of supply scheme, network layouts. Engineering design: choice of pipe materials, valves and other equipment. Network construction: pipe laying, testing and disinfection. Operation & maintenance: regular & irregular supply, unaccounted-for water & leakage, network cleaning and rehabilitation procedures.

Learning Activities:

The mode of transfer in the module is by a form of blended learning. All participants are supplied with the book covering the subject and the CD containing all other lecturing notes, MS PowerPoint presentations, assignments, (interactive) exercises and the software used. The contact hours start with lectures. The participants continue their study at home by using materials from the CD (alternatively, from the Internet). The core here is the MS PowerPoint slideshow prepared with audio presentation of the teacher. These are accompanied by MS Excel spreadsheet hydraulic lessons, made available while working on the workshop problems. During the computer exercise, operation of simple network is analysed by using the EPANET programme (US Environmental Protection Agency, Ver.2). Finally, a seminar is organised to present typical operation and maintenance practices (in The Netherlands).

Pumping Stations

Pumps & mechanical equipment: review of pump types and their applications, design of pumping stations, power requirements and energy consumption, auxiliary equipment.

Learning Activities:

A simple design exercise of a transportation pumping station layout is to be completed. It is advisable to pass the first four chapters of the course 'Introduction to Water Transport and Distribution' prior to undertaking this exercise. The examples in hydraulic spreadsheet lessons 6 and 7 can be useful aid to understand the design

exercise.

Water Loss Management and Control

The objective of this course is to provide basic knowledge on the water losses in the distribution system, their causes and measures to reduce them. The course includes definitions of the terminologies used in the sector (unaccounted for water UFW, non-revenue water NRW), components of water losses, methods of reducing and controlling real and apparent losses in the water distribution system. Furthermore, leakage in distribution system, their quantification, leak location and repair techniques as well as pressure management are also discussed.

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. TrifunoviÄ‡ â€“ Introduction to Urban Water Distribution, Taylor & Francis, 2006, reprint 2008
• Sharma – Water Losses in Distribution Systems, lecture notes UNESCO-IHE 2010
• Electronic materials: slide presentations (MS PowerPoint), computer/design/laboratory assignments, computer workshop network model (EPANET Ver.2), spreadsheet hydraulic lessons (MS Excel)

Assessment

- **50%: Written Exam (open book)**
- **30%: Assignment**
- **20%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/WSE/UWEM/08: Water Transport and Distribution I											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**Introduction to Water Transport and Distribution**	20	12	8					40	90	N.Trifunovic, A.Pathirana
2	**Pumping Stations**		8						8	30	N.Trifunovic, A.Pathirana
3	**Water Loss Management and Control**	6		2					8	20	S.Sharma
	Total	**26**	**20**	**10**					**56**	**140**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: H. Garcia, PhD, MSc

Module Sheet

Module Name International Fieldtrip and Fieldwork	Module Code MWI/09	Credits 5

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

Learning Objectives

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

- International Field Trip:
  To expose the participants, during a two week fieldtrip to a number of different European countries, to different internation practises in the design, operation and management of water supply, wastewater, solid waste and urban civil infraestructure networks.
- Field Work:
  The fieldwork, carried out typically within the Netherlands but on location, is a one week work to make the students familiar with performing research on location, how to process real data, and to apply the newly acquired knowledge to a practical situation.

Topics and Learning Activities

International Field Trip

The internatioanl Field Trip will take up two weeks, during which we will jointly be traveling within Europw yet not in the Netherlands.

Learning Activities:

Field work, field visits, lectures, participant observation, debates, company and product demonstrations, and basi qualitative research.

Fieldwork

During the Fieldwork, the students will travel during a small number of days, together with a team of staff members including laboratory staff.

Learning Activities:

Field work, field visits, lectures, participant observation, debates, company and product demonstrations, and basi qualitative research.

Lecturing Material

- A handout is provided with relevant information on the sites to be visited

Assessment

- **100%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/09: International Fieldtrip and Fieldwork											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	International Field Trip						93	93		93	
	Field Work					47				47	
	Total					**47**	**93**			**140**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: MWI-SE, MWI-UWEM
Module Coordinator: H. Garcia, PhD, MSc

Module Sheet

Module Name Industrial Effluents Treatment and Residuals Management	Module Code MWI/SE/UWEM/10	Credits 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

Learning Objectives

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

- Understand principles of pollution prevention and control including the 3R principle: Reduce, Reuse, Recycle.
- Understand principles of various processes applicable to industrial wastewater treatment
- Acquire basic knowledge on industrial wastewater characterization, and understand the role of industrial pre-treatment.
- Get insight in waste(water) generation within number of selected industries, and identify different technologies for the treatment of industrial effluents.
- Understand different options for sludge treatment, disposal, and reuse. Calculate mass balances taking place in the process of sludge generation and its treatment.
- Acquire the foundamental knowldege for designing aerobic and anaerobic sludge digestors.

Topics and Learning Activities

Cleaner Production

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

Industrial Water Management

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

Toxicity in Industrial Wastewater

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

Learning Activities:

Lectures including case studies

Physical Chemical Processes

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

Learning Activities:

Lectures and laboratory work

Anaerobic Industrial Wastewater Treatment

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

Learning Activities:

Lectures

Sludge Management and Treatment

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

Learning Activities:

Lectures and excercises

Case studies

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)

Assessment

- **40%: Assignment**
- **10%: Homework**
- **50%: Written Exam (open book)**

UNESCO-IHE - MSc Module 2011/2013-MWI/SE/UWEM/10: Industrial Effluents Treatment and Residuals Management											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**Cleaner Production**	3		8					3	14	Dr. M.S. Moussa
2	**Industrial Water Management**	5							5	10	Dr. M.S. Moussa
3	**Toxicity in Industrial Wastewater**	1							1	2	Dr. M.S. Moussa
4	**Physical Chemical Processes**	3							3	6	Dr. H. Garcia
5	**Coagulation/Flocculation**	3			3				3	9	Dr. H. Garcia
6	**Anaerobic Industrial Wastewater Treatment**	1							1	2	Prof. J.B. van Lier
7	**Sludge Management**	9	2						9	20	Ir. A.A. Salome
8	**Sludge Treatment (Foundamentals)**	12	2						12	26	Prof. G.A. Ekama
9	**Case Study: Steel and Tannery Industries**	3							3	6	Dr. M.S. Moussa
10	**Case study: Aquaculture and Sludge Incineration**	3							3	6	Prof. D. Brdjanovic
11	**Case Study: Industrial Practices Potato, Sugar, Tannery, and Yeast**	3							3	6	Ir. A. Mulder
12	**Case Study: Sugar, Steel, and Water Reclamation Implementation**	1							1	2	Ing. J.J. Appelman ~~Ir. A. Mulder~~
13	**Case Study: Industrial Waste and Resource Recovery**	2							2	4	Ir. A. Mulder
14	**Case Study: Industrial Wastewater and Reuse**	1							1	2	J.W. Mulder, MSc
15	**Case Study: Oil Refinary Wastewater Tretment (Shell)**	2							2	4	van Straten
16	**Case Study: Leachate Treatment, Galvanic, and Brewery Industry**	3							3	6	Ir. D. Jaksic
17	**Case Study: Process Water and Reuse**	1							1	2	Vlaski
18	**Case Study: Sludge Handling**	2							2	4	Kuppe
19	**Case Study: Sludge Incineration**	1							1	2	Salzmann
20	**Case Study: Fieldtrip**						4	4		4	Dr. H. Garcia
	Total	**59**	**4**	**8**	**3**		**4**		**59**	**137**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: WSE
Module Coordinator: S. Salinas, PhD, MSc

Module Sheet

Module Name Water Treatment Processes and Plants	Module Code MWI/WSE/UWEM/10	Credits 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; basic PC-computer knowledge (MSWindows); good English command; basic knowledge of water treatment methods.

Learning Objectives

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

- To creatively apply (gained) knowledge and experience regarding water quality and conventional treatment methods in design and engineering, operation & maintenance and rehabilitation of conventional water treatment processes and plants.
- to critically analyse water quality data and to select the most attractive raw water resource
- to design and engineer a surface water intake and a water treatment plant
- to execute plant performance studies and to evaluate results, as well as to propose improvements in order to rehabilitate a malfunctioning plant
- to show professional knowledge and know-how for operating (process & quality control, troubleshooting) and maintaining of manually and semi-automated water treatment plants
- In addition participantsâ€Ÿ skills will be improved through aspects such as: problem solving, decision making, oral presentations, writing reports, working in small task forces

Topics and Learning Activities

Surface Water Collection & Storage

Direct intake, raw water reservoirs, bank infiltration and artificial recharge.

Learning Activities:

Design Exercises

Water Treatment Processes and Plants

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:

Design exercise.

Operation & Maintenance of Water Treatment Plants

Importance of adequate O&M, O&M of individual units, equipment and plants, trouble shooting, organising O&M, safety aspects, cost of O&M, O&M at plants in rural areas.

Learning Activities:

Exercises.

Process and Quality Control

Basics of process and quality control, water quality control during all steps of water supply system, integral quality control, organisation and cost of quality control.

Learning Activities:

Exercises

Rehabilitation of Water Treatment Plants

Reasons for rehabilitation, execution of plant performance studies, proposals for process and plant improvement.

Learning Activities:

Exercise

Sludge Treatment & Disposal

Treatment of backwash water and sludge from coagulation units. Disposal and re-use.

Learning Activities:

Exercise.

Didactics

Group work, lectures, guided class room exercises, guided self study, field trip, design exercises using spreadsheet programmes.

Lecturing Material

• J.P. Buiteman et al. Surface Water Collection and Storage, Part 1 (LN 0096/03/1) and Part 2 (LN 0095/01/1).
• 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).
• H.M.M. Koppers, Sludge Treatment & Disposal, Part 1 (LN 0100/95/1) and Part 2 (LN 0101/95/1).
• Separate hand-outs for exercises on: Surface Water Collection and Storage, O&M, Trouble Shooting, Process & Quality Control, Rehabilitation and Sludge Treatment.

Assessment

• 100%: Assignment

UNESCO-IHE - MSc Module 2011/2013-MWI/WSE/UWEM/10: Water Treatment Processes and Plants												
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Surface water collection and storage	4		2		6			12	12	K.A. Ghebremichael, PhD; J.P Buiteman, MSc
	Water treatment plants and processes	10		28					38	94	K.A. Ghebremichael, PhD; P. Hiemstra, MSc
	Process and quality control	4		2					6	12	J.P. Buiteman, MSc
	Rehabilitation	4		2					6	12	J.P. Buiteman, MSc
	Operation and maintenance	4		2					6	12	J.P. Buiteman, MSc
	Total	**26**		**36**		**6**			**68**	**142**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Elective Module (Open for all specializations)
Module Coordinator: S.K. Sharma, PhD

Module Sheet

Module Name Decentralised Water Supply and Sanitation	Module Code MWI/WSE/SE/11	Credits 5

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

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 a basic engineering or concept design for the small-scale water supply treatment and ecosan technologies
- facilitate planning, financing, implementation and operation and maintenance of decentralised water supply and sanitation infrastructures based on stakeholder participation and community management.

Topics and Learning Activities

Introduction

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

Decentralised Water Supply and Treatment Systems

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

Learning Activities:

Lectures, Workshop for calculations, Design Exercise

Decentralised Sanitation Systems

Ecological sanitation (introduction to ecosan approach, relationship with MDGs; 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, seggregation, disposal and reuse)

Learning Activities:

Lectures, Workshop/Discussion, Assignment, Field Trip

Management Aspects of Watsan

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

Presentation of the participants

All the participants in this course course will make a short 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 to learn from each others experience.

Learning Activities:

Individual presentations and discussion

Lecturing Material

• Sharma, S. (2011) Decentralised Water Supply and Sanitation: Selected Topics UNESCO-IHE Lecture Notes LN0368/11/1
• Sharma, S. (2007) Rainwater Harvesting. UNESCO-IHE Lecture Notes LN 0357/07/1
• IRC (2002) Small Community Water Supplies. IRC TP No. 40
• Rontelap, M. (2011) Ecological Sanitation. UNESCO-IHE Lecture Notes
• Ronteltap, M. (2011) Solid Waste Management. UNESCO-IHE Lecture Notes
• van Dijk, M.P. (2011) Handouts and powerpoint presentation on (i) Institutional Arranagements and (ii) Financing and Cost Recovery Aspects

Assessment

- **55%: Written Exam (closed book)**
- **35%: Assignment**
- **10%: Presentation**

UNESCO-IHE - MSc Module 2011/2013-MWI/WSE/SE/11: Decentralised Water Supply and Sanitation											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**Introduction**										Sharma
1.1	Module introduction	1							1	2	
1.2	Introduction to decentralised water supply and sanitation	2							2	6	
2	**Decentralised Water Supply and Treatment Systems**										Sharma
2.1	Water supply systems	4							4	10	
2.2	Rain water harvesting			6					6	10	
2.3	Small-scale water treatment	6	6						12	20	
3	**Decentralised Sanitation Systems**										Ronteltap, Schertenleib
3.1	Ecological sanitation	6		2			8	8	16	24	Ronteltap
3.2	Soild waste management in small towns and urban poor areas	4							4	10	Ronteltap
3.3	Sanitation planning and strategic tools			4					4	6	Schertenleib (EAWAG)
3.4	Fecal sludge management			6					6	8	Schertenleib (EAWAG)
4	**Management Aspects of DWSS**										Sharma, van Dijk, Ronteltap
4.1	Participatory planning and evaluation	2		2					4	8	Guest lecturer IRC
4.2	Institutional arrangements	2		2					4	8	van Dijk
4.3	Financing and cost recovery aspects	2		2					4	8	van Dijk
4.4	Operation and maintenance aspects	2		2					4	8	Sharma
5	**Presentation of the Participants**			8					8	12	Sharma, Ronteltap
	Total	**31**	**6**	**34**			**8**		**79**	**140**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: **2011-2013**
Specialization: **Core Programme**
Module Coordinator: **Solomon Seyoum**

Module Sheet

Module Name Modelling Urban Drainage and Sewerage	Module Code MWI/SE/11	Credits 5

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

Learning Objectives

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

- gain a sound overall understanding on the modelling of the hydrologic/hydraulic processes that is necessary for understanding, analysis and planning of urban drainage systems.
- describe and model the Urban hydrological systems including: Processes: Mainly Infiltration, Overland flow, Urban Watershed modelling, Sewershed modelling;
- to appraise the numerical methods used in UDS methods, identify numerical issues in modelling;
- conduct modelling of Urban drainage Networks: Use advanced simulation software for urban drainage systems (e.g. SWMM), including 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
- construct Urban Inundation models, for damage estimation due to sewer overflow, risk-based modelling (includig SOBEK).

Topics and Learning Activities

Theory and Workshops
Learning Activities:
Lecture, Exercise, Workshop

Hydrology for Urban Drainage
Learning Activities:
Lecture

Water Quality for Urban Drainage
Learning Activities:
Lecture, Exercise

Urban flood damage estimation
Learning Activities:
Lecture, Exercise

Lecturing Material

- Lecture notes (provided by each lecturer)

Workshop material (include Infiltration WS, SWMM 5.0 WS, Inundation WS
Additional material provided on the module web site.

Assessment

- **50%: Oral Exam**
- **50%: Homework**

UNESCO-IHE - MSc Module 2011/2013-MWI/SE/11: Modelling Urban Drainage and Sewerage											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Theory and Workshops	20	10	20					50	120	P.D.A. Pathirana, PhD, MSc
	Hydrology for Urban Drainage	4							4	10	Prof. S. Uhlenbrook, PhD, MSc
	Water Quality for Urban Drainage	2	4						6	15	Z. Vojinovic, PhD, MSc
	Urban flood damage estimation	1	3						4	4	S. Seyoum, MSc
	Total	**27**	**17**	**20**					**64**	**149**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME
Academic Year: **2011-2013**
Specialization: **Elective module**
Module Coordinator: **N. Trifunovic, MSc**

Module Sheet

Module Name Water Transport and Distribution II	Module Code MWI/WSE/11	Credits 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 technical background; a few years of relevant experience; knowledge of steady state hydraulics of pressurised flows; basic use of computer models; PC-computer knowledge (MS-Windows, MS-Office); English command. Participants without any experience in the field of water distribution should first complete the module Water Transport and Distribution I.

Learning Objectives

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

- develop a preliminary network design and to apply the basic engineering economy principles in evaluation of various design alternatives, and assess the reliability of supply,
- have a fundamental understanding of the GIS and remote sensing technologies,
  understand the basic principles underlying the GIS/model-based management of water distribution systems and be familiar with the GIS-based analytical and problem-solving techniques for sustainable planning and management of water distribution systems.
- analyse transient flows and plan the measures to prevent or control water hammer,
- understand the source of corrosion and correspondiong water quality problems in distribution networks,
- learn the theory of advanced hydraulic and water quality modelling,
- use state-of-the-art network software and understand its application in data and asset management of transport and distribution systems.

Topics and Learning Activities

GIS in Water Distribution

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 WaterCAD/GEMS software.

Water Quality in Distribution Networks

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 I is tested on water quality parameters, namely the water age, source tracing and chlorine residuals, by using WaterCAD/GEMS software.

Optimisation and Asset Management of Water Distribution Networks

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 I is calibrated and tested on irregular supply and demand scenarios by using WaterCAD/GEMS software.

Introduction to Water Hammer

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 I is teseted on water hammer using WaterCAD/GEMS software.

Lecturing Material

• Collection of UNESCO-IHE exercise handouts.

Assessment

- **20%: Assignment**
- **20%: Assignment**
- **40%: Assignment**
- **20%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/WSE/11: Water Transport and Distribution II											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
1	**GIS in Water Distribution**	4	10						14	28	Z.Vojinovic
2	**Water Quality in Distribution Networks**	8	4						12	26	S.Sharma, N.Trifunovic
3	**Optimisation and Asset Management of Distribution Networks**	8	18						26	60	A.Pathirana, N.Trifunovic
4	**Introduction to Water Hammer**	4	8						12	26	S. de Kleermaeker, N.Trifunovic
	Total	**24**	**40**						**64**	**140**	

N.Trifunovic

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: M. Ronteltap, PhD, MSc

Module Sheet

Module Name Group Work Sint Maarten	Module Code MWI/12	Credits 5

Target Group	Prerequisites
Students from MWI Programme	MWI Specialisations

Learning Objectives

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

- apply and integrate his or her knowledge obtained during the Specialisation to solve water and sanitation related issues.
- compare the complex water and sanitation issues applied to a real case scenario with the examples from the classes
- defend his or her input in a team of specialists as well as in an interdisciplinary team.
- assess his/her own strengths and weaknesses with respect to working in a group.
- efend the groups' findings to a team of experts in the field.

Topics and Learning Activities

Didactics

Participants will work in teams. The integrated group work is based on a real-life case, the Caribbean island of Sint Maarten. Groups will identify issues and problems, identify potential solutions and related data needs, work out engineering solutions for individual problems and, at the end, define an integrated package of solutions. The final result is to be presented to a panel of experts that includes a representative of the Island Government of Sint Maarten.
Groups are supported by mentors (process) and can consult academic staff members as resource persons.

Lecturing Material

• All material is available on the Moodle platform for Module 12, 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. Additional data is provided on request.

Assessment

- **50%: Assignment**
- **30%: Assignment**
- **20%: Presentation**

UNESCO-IHE - MSc Module 2011/2013-MWI/12: Group Work Sint Maarten											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Introduction Groupwork	2									Ronteltap
	Class on Master Planning	4									Vlaski
	Class on Engineering Consultancy	4									Buijs
	Specialist Group work			40							Group work mentors
	Interdisciplinary Group work			60							Group work mentors
	Final presentations								8		Panel members
	Total	**10**		**100**					**8**		

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: C.M. Hooijmans, PhD, MSc / E.A. de Jong, MA..

Module Sheet

Module Name Research methodology for MWI	Module Code MWI/13	Credits 3

Target Group	Prerequisites
All participants of the programme	The successful completion of at least 8 of the first 11 modules of the programme

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.

Topics and Learning Activities

Research methodology

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

Summer courses

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:
â€¢ Water and Climate
â€¢ Environmental Flows
â€¢ Conflict Resolution
â€¢ Flood resilient planning and building

Learning Activities:

Lectures, workshops, assignments

Lecturing Material

- To be announced

Assessment

- **100%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/13: Research methodology for MWI											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Research methodology									28	various
	Summer course									56	various
	Total									**84**	

MUNICIPAL WATER AND INFRASTRUCTURE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: C.M. Hooijmans, PhD, MSc / E.A. de Jong, MA

Module Sheet

Module Name Summer courses / MSc research proposal development for MWI	Module Code MWI/14	Credits 7

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

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.

Topics and Learning Activities

Selection of research topic

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

Proposal drafting

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

Proposal presentation

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

Assessment

- **100%: Presentation**

UNESCO-IHE - MSc Module 2011/2013-MWI/14: Summer courses / MSc research proposal development for MWI											
Nr	**Course/Topic**	**lecture**	**exercise**	**workshop**	**labwork**	**fieldwork**	**fieldtrip**	**selfstudy**	**contact hours**	**studyload hours**	**Lecturer(s)**
	Â MSc research proposal drafting										
	Â MSC research proposal presentation										Mentor and professor
	Total							**1**			

ENVIRONMENTAL SCIENCE

MASTERS PROGRAMME

Academic Year: 2011-2013
Specialization: Core Programme
Module Coordinator: H.J. Lubberding, PhD, MSc

Module Sheet

Module Name MSc Research	Module Code MWI/15	Credits 36

Target Group	Prerequisites
Programme target group	Programme prerequisites

Learning Objectives

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

- 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;
- 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;
- 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.

Topics and Learning Activities

Lecturing Material

Assessment

- **100%: Assignment**

UNESCO-IHE - MSc Module 2011/2013-MWI/15: MSc Research											
Nr	Course/Topic	lecture	exercise	workshop	labwork	fieldwork	fieldtrip	selfstudy	contact hours	studyload hours	Lecturer(s)
	MSc Research									1008	de Jong
	Total									1008	