University of Debrecen

Faculty of Engineering

Environmental Engineering MSc Program

Environmental Technology, Planning, Constructions Specialization

Built Environment Specialization

2026

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DEAN'S WELCOME

Welcome to UD's Faculty of Engineering!

The Faculty of Engineering of the University of Debrecen has become an outstanding centre of education and research in the Eastern Hungarian region. Following the footsteps of our predecessors, the academic and administrative staff of the Faculty work hand in hand to make our training programmes and researches meet both national and international standards.

The Faculty of Engineering is one of Hungary's most significant institutions of higher-education, and its 3000 students make it a dominant faculty of the University of Debrecen which - having the most international students, offering the most academic programmes among Hungarian universities and having been classified as a research university, the highest of qualifications - is officially listed among the best universities in the country.

We welcome the most outstanding and inquisitive students of the region with an enthusiastic and professional team of academics and researchers, and a set of laboratories unique in the country. We consciously aspire to develop the quality of education and research further, based on a close cooperation between the Faculty and the industry. Our students enter many prestigious competitions and they are becoming increasingly successful and acclaimed, while our instructors are working on a growing number of national and international projects of basic and applied research.

The Faculty bridges the gap between theory and practice and provides a high-quality theoretical background merged into practice-oriented training based on industrial relations. We do our best to maintain the high prestige of the engineering diplomas awarded by the University of Debrecen and to make sure that the knowledge and achievements of students who graduate from our Faculty continue to be recognised in the labour market.

All things considered, you are kindly advised to read this bulletin which hopefully reflects our endeavours appropriately and provides all the information you need to know about your chosen training programme. We are looking forward to supporting the personal and professional growth of our future engineers.

With the best of wishes for the years to come,

Géza Husi

Dean

HISTORY OF THE UNIVERSITY

The history of Debrecen's higher education dates back to the 16th century. The Calvinist Reformed College, established in 1538, played a central role in education, teaching in the native language and spreading Hungarian culture in the region as well as in the whole country. The College was a sound base for the Hungarian Royal University, founded in 1912. Apart from the three academic faculties (arts, law, theology) a new faculty, the Faculty of Medicine was established, and the University soon became one of the regional citadels of Hungarian higher education. Today, University of Debrecen is classified as "University of National Excellence" and offers the highest number of academic programs in the country, therefore it is considered to be one of the best universities in Hungary. Its reputation is the result of its quality training, research activities and the numerous training programs in different fields of science and engineering in English. With 14 faculties and a student body of almost 30.000, out of which about 3700 are international students, the University of Debrecen is one of the largest higher education institutions in Hungary.

The history of the Faculty of Engineering dates back to 1965, when the Technical College was established. In 1972 it was renamed Ybl Miklós Polytechnic and in 1995 it became part of Kossuth Lajos University. In 2000 the Faculty of Engineering became part of the integrated University of Debrecen.

In 2005 the Bologna System was introduced which supports the competitiveness of qualifications received at the University of Debrecen against universities all over Europe.

The Faculty of Engineering is practice-oriented and develops skills required for the current needs of the national and international labour market. The teaching staff is involved in numerous domestic and international research and design projects. The recently-opened new building wing with its ultra-modern design hosts several lecture halls, seminar rooms and laboratories equipped with the latest technology. Our students are provided with practical knowledge, training and field practice from numerous prestigious domestic and multi-national industry partners. The internship periods are excellent opportunities for students to experience how theory is put into practice at the most renowned industry representatives and become more successful in the labour market of this highly competitive sector. Students learn how to work in the working environment of multi-national companies and adapt to challenges easily. After graduation they will be able to work at a strategic decision-making level, giving priority to efficiency and engineering ethics.

The Faculty of Engineering offers a great variety of BSc, MSc courses and post-graduate training courses tailored to the needs of the rapidly changing world of engineering and focusing on European and international trends. In 2011 the Faculty of Engineering launched engineering trainings in English. In order to optimize the quality of training, the Faculty continuously strives to expand the number of industrial and educational partners at home and abroad.

The Faculty of Engineering has been a pioneer in the introduction of Quality Management System at faculty level to measure and evaluate the efficiency of its education and

teaching staff in order to improve the quality of education and training from the feedback received.

The Faculty of Engineering has a vivid student life. There is a film club waiting for movie buffs and the door of the Faculty library is always open. The library is not only the host to the latest technical books, exhibitions and tea afternoons with invited speakers, but students can also purchase theatre and concert tickets from the librarians. The Borsos József Dormitory is also a hub of activities for students.

The increasing number of international students brings cultural and ethnic diversity to the faculty.

Our aim is to aid students to become efficient members of the labour market and enrich the world of engineering in Hungary and abroad with their knowledge and expertise.

ADMINISTRATION UNITS FOR INTERNATIONAL PROGRAMMES

COORDINATING CENTER FOR INTERNATIONAL EDUCATION

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Admission Officer (for scholarship students)	Ms. Lilla Almási-Fónai Ms. Annamária Rácz
Administrative Assistant (for fee paying students)	Ms. Enikő Réka Balogh Ms. Arife Katalin Davarci Mr. Ádám Losonczi
Administrative Assistant (for scholarship students)	Mr. Norbert Tanki

The Coordinating Centre for International Education supports the international degree programmes of the University of Debrecen by providing new students with information on admissions and entrance examinations. Its promotional and administrative responsibilities include enrolment, study contracts, modifying student status or degree programmes, and activating student status at the beginning of the academic year. Furthermore, the Centre manages the modification of students' personal data, provides certificates for the Immigration Office (for residence permits), issues student status letters and transcripts of records, handles health insurance contracts and cards, and assists students with the visa application process.

STUDENT ADMINISTRATION CENTER (HAK)

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The Student Administration Center (HÁK) at the University of Debrecen is the main hub for managing students' official academic and administrative matters. It handles essential tasks such as issuing permanent and temporary student cards, Unipass cards, managing Neptun-related administration, and supporting students with procedures like scholarship administration, and graduation paperwork (pre-degree certificates).

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Dean's Representative for Foreign Affairs	Mr. Zsolt Tiba PhD tiba@eng.unideb.hu

The International Office has been functioning since 2014 in order to ensure the smooth running of the international degree courses. The office is responsible for student administration (full-time students, full-time transfer students, visiting/Erasmus students), providing certificates for students, considering and accepting requests, solving problems related to course registration, giving information **about internship, final exam, thesis, etc.**

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Department of Building Services and Building Engineering
Department of Civil Engineering
Department of Electrical Engineering and Mechatronics
Department of Engineering Management and Enterprise
Department of Environmental Engineering
Department of Mechanical Engineering
Department of Vehicles Engineering

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Academic Calendar
Faculty of Engineering

2026/2027

FALL SEMESTER	
Joint Opening Ceremony for the Academic Year	September 6, 2026
Registration week	August 31-September 6, 2026
Exam weeks for exam courses scheduled for the 1st semester of the academic year 2026/2027	August 31-September 11, 2026
“Orientation Day” event	September 15, 2026
“MSc Open Day” event	October 6, 2026
“Autonomous Machines and Intelligent Robotics Applications 2026” conference	October 13, 2026 – October 14, 2026
“Innovation Forum on Digital Design and Manufacturing 2026” exhibition	October 14, 2026
“Professional exhibition and ISCAME – International Scientific Conference on Advance in Mechanical Engineering” – organized by Department of Mechanical Engineering	November 5, 2026 – November 6, 2026
Scientific Students’ Associations Conference (TDK)	November 21, 2026
“Taste the World – International Desserts and Traditions” event	December 8, 2026
“Open Day and Parent-Teacher Meeting” event	January 20, 2027
“Engineering Graduates’ Ball" event	January 29, 2027
For non-graduating students	
Study period	September 14–December 18, 2026 (14 weeks)
Drawing week 1 – for completing semester design tasks	October 19–22, 2026
Drawing week 2 – for completing and improving assignments except for final-semester subjects	December 7–11, 2026
Exam period	December 14, 2026–January 29, 2027 (7 weeks)

For graduating students	
Study period	September 7–November 6, 2026 (9 weeks)
Drawing week 1 – for completing semester design tasks	October 19–22, 2026
Exam period	November 9–December 11, 2026 (5 weeks)
Thesis submission deadline	Based on departmental decision, on at most the 14th day counting back from the final exam.
Final exam (state exam) period	Based on departmental decision, at least once between December 14-18, 2026 or January 4-22, 2027.
SPRING SEMESTER	
Registration week	February 1–7, 2027
"Industry Day in Debrecen" event	March 17, 2027
"Professional Days and Exhibition in the Field of Building Services" organized by the Department of Building Services and Building Engineering	March 18–19, 2027
"New Trends and Challenges in Management – Management of Global Business Processes"– conference by Department of Engineering Management and Enterprise	March 18, 2027
"6th Environment, Health, Safety (EHS) International Symposium 2027 / ISEHS 2027" - organized by the Department of Environmental Engineering	March 18, 2027
For non-graduating students	
Study period	February 8–May 14, 2027 (14 weeks)
Drawing week 1 – for completing semester design tasks	March 16–19, 2027
Drawing week 2 – for completing and improving assignments except for final-semester subjects	May 10–14, 2027
Exam period	May 18–July 2, 2027 (7 weeks)
For graduating students	
Study period	February 8–April 9, 2027 (9 weeks)

Drawing week 1 – for completing semester design tasks	March 16–19, 2027
Exam period	April 12–May 14, 2027 (5 weeks)
Thesis submission deadline	Based on departmental decision, on at most the 14th day counting back from the final exam.
Final exam (state exam) period	Based on departmental decision, at least once between May 18 and June 11, 2027.
Closing ceremony of the academic year, graduation ceremony	Based on the faculty’s decision, between 17 June and 4 July 2027.

THE ENVIRONMENTAL ENGINEERING MASTER PROGRAM

INFORMATION ABOUT THE PROGRAM

Name of master's program:	Environmental Engineering Master Program
Specializations available:	(1) Environmental Technology, Planning, Constructions (2) Built Environment
Field, branch:	engineering; bio-, environmental- and chemical engineering
Level:	MSc
Qualification:	Environmental Engineer
Mode of attendance:	Full-time
Faculty:	Faculty of Engineering
Program coordinator:	Prof. Dr. János Tamás, Full Professor
Person in charge of the specialization:	Environmental Technology, Planning, Constructions: Prof. Dr. János Tamás, Full Professor Built Environment: Ildikó Bodnár PhD, College Professor
Program length:	4 semesters
Credits total:	120 (thesis: 30, optional subjects: 6)

Aim of the master program and professional competencies

The objective of the program is to train environmental engineers with up-to-date scientific, ecological, engineering, economic and management knowledge who are able to identify and assess the existing and potential environmental threats, to prevent or reduce environmental damage, and to prepare and control damage control projects. They are able to provide complex engineering and scientific design and analytical procedures as a result of their up-to-date knowledge of informatics with the help of design, modelling and simulation software. They are prepared to set out and apply adequate technological solutions to prevent environmental pollution and to provide engineering design and managing tasks in the field of waste processing and recycling. They are able to optimize

environmental technologies and environmental impacts. Thus, the program also functions as preparation for students interested in doing a PhD.

Professional competencies to acquire

An environmental engineer

a) knowledge

- knows and applies scientific and engineering theory and practice in the field of environmental engineering.
- has acquired the comprehensive knowledge of measurement techniques and measurement theory.
- knows and applies the procedures of environmental protection (operations, equipment, device) and remediation methods.
- is aware of the operations and the units of environmental premises (especially water and water treatment plants, hazardous and communal landfill sites, incinerator plants) and the possible options for their development.
- knows and applies the rules of environmental engineering documentation and carrying out an environmental impact assessment.
- knows the organisational and motivational devices related to management, and the methods and laws required to pursue the profession.
- knows and applies the methods and tools of environmental informatics and modelling in a complex manner.
- knows the fundamentals, boundaries and requirements of the professional fields of work and fire safety, safety, information technology, law, economics and management related to environmental engineering.
- knows the promotional and opinion-forming methods in the field of environmental engineering.

b) abilities

- is able to apply his/her acquired the general and specific principles, rules, interrelations and procedures of natural and social sciences and mathematics to solve environmental problems.
- is able to carry out publication activities and negotiations in his/her mother tongue and in at least one foreign language (English) in his/her field of profession.
- is able to achieve tasks related to leadership and consultancy.
- is able to accomplish tasks in international or cross-border projects and to present his/her test results and elaborated design documentation at social and professional forums.
- studies the possible objectives in research, development and innovation While carrying out his/her work, and endeavours to implement them.

- is able to design, implement and maintain the occurring engineering interventions in a complex way in the fields of soil, geological formation, water, air, noise and vibration protection, ecosystem protection, remediation and waste reduction, treatment and recycling.
- is able to arrange and implement environmental sample taking, complex laboratory tests and analyses, the application of monitoring systems and the evaluation and documentation of test results.
- is able to apply damage control methods in a complex manner, to prepare and coordinate damage control.
- is able to design and implement environmental impact assessment and to set up a plan for carrying out and managing an impact study.
- is able to apply integrated knowledge in the field of environmental equipment, processes, technologies and in the related areas of electronics and informatics.
- is able to model, operate and control environmental engineering systems and processes.
- is able to design, launch and operate environmental management systems.
- is able to conduct energy efficiency analyses, surveys and audits, and to define the necessary measures and support their implementation.
- is able to arrange and accomplish complex (environmental, economic, social) tasks.

c) attitude

- open and apt to learn, accepts and credibly mediate professional and technological developments and innovations in the field of environmental engineering.
- identifies with the professional and moral values of environmental engineering.
- endeavours to plan and implement all his/her tasks at a high professional level both individually and as member of a team.
- endeavours to take a complex approach when working which is based on a system-based perspective and process-oriented thinking.
- endeavours to increase both his/her own and his/her colleagues' knowledge through lifelong learning.
- determined to work at a professional level, and endeavours to convey this approach to his/her colleagues as well.
- shares his/her experience with his/her colleagues to promote their development.

d) autonomy and responsibility

- is able to accomplish environmental engineering tasks on his/her own. He/she makes decisions carefully, discussing them with the experts of other relevant fields (primarily law, economics and energetics), and taking overall responsibility for them.
- when making a decision, he/she respects the regulations of workplace health and safety, engineering, economics and law and the fundamental principles of engineering ethics.
- takes a pro-active role in solving environmental problems, identifies the faults of the applied technology and the risks of the processes and initiates actions to reduce them.
- shares his/her acquired knowledge and experience with other experts of the field through formal and informal media.
- respects the efforts of his/her subordinates, and promotes their professional development by sharing his/her critical remarks with them, and encourages responsible and moral professional work among them.
- constantly follows the legal, technical and technological changes of his/her field of expertise.

COMPLETION OF THE ACADEMIC PROGRAM

Credit System

Majors in the Hungarian Education System have generally been instituted and ruled by the Act of Parliament under the Higher Education Act. The higher education system meets the qualifications of the Bologna Process that defines the qualifications in terms of learning outcomes: statements of what students know and can do on completing their degrees. In describing the cycles, the framework uses the European Credit Transfer and Accumulation System (ECTS).

ECTS was developed as an instrument of improving academic recognition throughout the European Universities by means of effective and general mechanisms. ECTS serves as a model of academic recognition, as it provides greater transparency of study programmes and student achievement. ECTS in no way regulates the content, structure and/or equivalence of study programmes.

Regarding each major, the Higher Education Act prescribes which professional fields define a certain training program. It contains the proportion of the subject groups: natural sciences, economics and humanities, profession-related subjects and differentiated field-specific subjects.

The following professional fields define the training program of the **Environmental Engineering MSc**:

Professional fields which define the training program:

- Natural Sciences: 10-40 credits;
- Economics and Humanities: 10-20 credits;
- Knowledge of environmental engineering: 10-35 credits
- The specialization provided by the training institute including thesis comprises 50-60 credits that contains at least 6 credits for project practice in the complete master program.
- Credit points assigned to thesis: 30
- Credits total: 120

Taking into account the specializations available, specific knowledge can be acquired in the field of environmental technology design and implementation, environmental problems arisen in built environment, water quality protection, advanced noise and vibration measurement, advanced noise and vibration protection, air pollution control, waste management and recycling, health protection and work safety, protection of soil and geological medium, renewable energy, analysis of environmental impact, design and operation of environmental and quality management systems which meets the professional needs. The specialization provided by the training institute including thesis

comprises 50-60 credits that contains at least 6 credits for project practice in the complete master program.

During the program students have to complete a total amount of 120 credit points. It means approximately 30 credits per semester. The curriculum contains the list of subjects (with credit points) and the recommended order of completing them, which takes into account the prerequisite(s) of each subject. You can find the recommended list of subjects in chapter "Guideline".

Guideline (List of Subjects/Semesters)

The total number of credit points (120) of the training program can be obtained by completing the subjects of the curriculum. There is a certain degree of freedom in the order students can complete the subjects. However, it is recommended that the suggested order be followed because some subjects can only be taken after the completion of the prerequisite subject(s), and/or can be the prerequisites for other subjects.

The list of subjects to complete in the semesters according to the model curriculum of Environmental Engineering MSc programme **Environmental Technology, Planning, Constructions Specialization**:

1st semester	**2nd semester**
Applied Statistics	Mathematical modelling and optimization
Environment Biology and Nature Protection	Environmental Chemistry and Environmental Toxicity
Geosciences	Ecology for Engineers
Environmental Law and Economics	Production Management and Life Cycle Analysis
Environmental and Quality Management	Environmental Engineering Measurement Techniques, Monitoring
Environmental Modelling and Environmental Informatics	Environmental Health
Environmental Operations	Environmental Resource Management
Safety and Environmental Risk	Environmental State Assessment, Auditing
	Optional subject I
3rd semester	**4th semester**

Environmental Technologies I (Soil Protection)	Environmental Technologies II (Water Protection)
Environmental Technologies III (Air and Noise Protection)	Environmental Technologies IV (Waste Recycling)
Recovery Systems of Renewable Energy Sources I	Recovery Systems of Renewable Energy Sources II
Near-natural and Cleaner Production Technologies	Complex Environmental Engineer Planning II
Complex Environmental Engineer Planning I	Thesis II
Thesis I	Optional Subject II
Environmental Summer Professional Practice	

The list of subjects you have to complete in the semesters according to the model curriculum of Environmental Engineering MSc programme **Built Environment Specialization**:

1st semester	2nd semester
Applied Statistics	Mathematical Modelling and Optimization
Environment Biology and Nature Protection	Environmental Chemistry and Environmental Toxicity
Geosciences	Ecology for Engineers
Environmental Law and Economics	Production Management and Life Cycle Analysis
Environmental and Quality Management	Environmental Engineering Measurement Techniques, Monitoring
Environmental Modelling and Environmental Informatics	Environmental Health
Environmental Operations	Environmental Resource Management
Safety and Environmental Risk	Environmental State Assessment, Auditing
	Optional subject I
3rd semester	**4th semester**

Urban Climate	Urban Hydrology
Air Pollution Control	Waste Management
Bridges and Structures	Greenfield Management
Noise and Vibration Protection	Complex Environmental Engineer Planning II
Complex Environmental Engineer Planning I	Thesis II
Thesis I	Optional Subject II
Environmental Summer Professional Practice	

Work and Fire Safety Course

According to the Rules and Regulations of the University of Debrecen, students must complete the online course for work and fire safety. Registration for the course and its completion are necessary for graduation. For MSc students the course is only necessary if their BSc diploma has not been awarded by the University of Debrecen.

Registration in the Neptun system by the subject: MUNKAVEDELEM

Students have to watch/read an online material to get the signature on Neptun for the completion of the course. The link of the online course is available on the website of the Faculty.

Internship

Internship is a mandatory and integral part of the course of studies and strongly related to thesis. The duration of internship is at least 4 weeks and undertaken at a production company.

Credit points: 0

Internship in Environmental Technology, Planning, Constructions Specialization

Aim of internship

To obtain specific practical skills from the field of environmental technologies, alternative environmentally-friendly technologies, solving problems of natural protection which form the basis for the final semester of the training program, the efficiency of thesis preparing and the period after graduation.

Focal tasks during internship

Students can be involved in work based on the skills acquired during their studies from the following fields: water, noise, soil, radiation and noise protection, waste management and treatment, investigations of environmental impact and environmental impact assessment, environmental remediation, fundamentals of energy management, energy production, main goals of the sustainable development, characteristics of the engineering software, regulations and methods of work and fire safety, safety and elimination.

Completion of internship

During the internship and while working in a given field, students must prepare a report the topic of which is selected by them with the assistance of their supervisor(s). The report can only contain publicly available data on the company, or information previously approved by the company.

The following skills shall be considered when evaluating student performance: professional and personal attitude, diligence, adaptive skills, and successfully completed specific tasks.

Internship in Built Environment Specialization

Aim of internship

The aim of the internship is to make it possible for students to obtain specific practical skills from the field of urban environment, alternative environmentally-friendly technologies, solving problems of natural protection which form the basis for the final semester of the training program, the efficiency of preparing thesis and the period after graduation.

Focal tasks during internship

Students can be involved in work as a result of the skills acquired during their studies from the following fields: urban hydrology, climate, noise, soil, radiation and noise protection, waste management and treatment, investigations of environmental impact and environmental impact assessment, the fundamentals of energy management, energy

production, renewable energy utilization, characteristics of the engineering software, regulations and methods of work and fire safety, safety and elimination.

Completion of internship

During the internship and while working in a given field, students must prepare a report the topic of which is selected by them with the assistance of their supervisor(s). The report can only contain publicly available data on the company, or information previously approved by the company.

The following skills shall be considered when evaluating student performance: professional and personal attitude, diligence, adaptive skills, and successfully completed specific tasks.

Physical Education

According to the Rules and Regulations of the University of Debrecen, students must complete Physical Education course at least in one semester during his/her Master's training. Our University offers a wide range of facilities to complete them. Further information is available from the Sport Centre of the University, its website: http://sportsci.unideb.hu.

Optional Courses

According to the Rules and Regulations of the University of Debrecen, students must complete elective courses during their MSc studies. These elective courses are opened by the Departments at the Faculty of Engineering at the beginning of the actual semester. The list of such subjects for a given semester is to be found under "Current Students" >" Useful Information about your Study" >" Optional subjects" on the Faculty's website.

Students can also select optional courses offered by other faculties of University of Debrecen to complete.

In the Environmental Engineering MSc program, one must gain at least 6 credits by completing elective subjects.

Pre-degree Certification

A pre-degree certificate is issued by the Faculty after completion of the master's (MSc) program. The pre-degree certificate can be issued if a student has successfully completed the study and exam requirements as set out in the curriculum, the requirements relating to Physical Education as set out in Section 10 in Rules and Regulations, internship (mandatory) – with the exception of thesis preparing – and gained the necessary credit points (120). The pre-degree certificate verifies (without any mention of assessment or grades) that the student has fulfilled all the necessary study and exam requirements defined in the curriculum and the requirements for Physical Education. Students who obtained the pre-degree certificate can submit the thesis and take the final exam.

Thesis

A Thesis is the creative elaboration of a professional task (scientific, engineering, design, development, research or research development) in a written form. By solving the task, the student relies on his/her studies using national and international literature under the guidance of an internal and external supervisor (referee). By writing and successfully defending a thesis, students of the Environmental Engineering Master program prove that they are able to apply the acquired knowledge in practice, to summarize the work done and its results in a professional way, to solve the tasks related to their topic creatively, and to complete individual professional work.

Students in the master program must write a thesis as a prerequisite of the final exam. Requirements regarding the content of the thesis, the general aspects of evaluation and the number of credits assigned to it are defined based on the requirements of the program. In case of the Environmental Engineering Master Program, the number of credits assigned to the thesis is 30.

Thesis topics are announced by the departments no later than the end of the fourth week of the study period of the last but one semester. Students may also offer a topic for the thesis, which the competent head of department may accept or reject. The conditions on the acceptance of a SSS (Student Scientific Society) paper as a degree thesis are defined by the Faculty. SSS papers are supposed to meet the requirements of a thesis both in form and content. Furthermore, it is necessary that the committee of the Pre-SSS make suggestions on the SSS papers to be accepted as theses.

Formal requirements of thesis shall be designated by the Department of Environmental Engineering and must be announced in writing together with other thesis-related assignments.

The preparation of a thesis shall be overseen by an internal supervisor approved by the department, and may be assisted by an external supervisor (also approved by the department).
The thesis submission deadline is defined in the academic calendar of the Faculty (issued by the Vice-Rector for Education) or, failing that, it is 12 a.m. on the 14th day before the first day of the final exam. The thesis can be submitted only if both the internal and the external supervisors approve. It is evaluated by an independent external reviewer, and the Head of the Department of Environmental Engineering makes a suggestion to the final examination board on its classification based on a five-grade scale.
If the reviewer evaluates the thesis firmly as fail, the student may not take the final exam and must create a new thesis. Students must be informed about it. Conditions on resubmitting the thesis are designated by the head of the relevant educational unit responsible for the major or specialization.

Final exam

After receiving the pre-degree certificate, students conclude their studies by taking the final exam of Environmental Engineering master program. The final exam shall test and assess the knowledge, skills and abilities requisite to the award of the degree, whereby students shall also prove their ability to apply the acquired knowledge in practice. The conditions for taking the final exam and the parts of the final exam itself shall be defined in the requirements for the training program (see entry 'Completion of studies').

The final exam shall be taken in front of a board in the examination period following the award of the pre-degree certificate. If a candidate does not pass the final exam until the termination of his/her student status, that student can sit for the final exam any time after the termination of his/her student status according to the provisions regarding the final exam, effective at the time of taking the final exam.

The Final exam consists of 3 parts:

1. The core material of the final exam, which includes the assessment of environmental status and the technological introduction of their solutions.
2. Filed-specific knowledge, the topics of which are based specialization chosen by the candidate. These topics are built heavily on the workshops assigned to the MSc training programme, providing the elaboration of realistic engineering tasks.
3. Thesis defence, based on an oral exam.

The procedure of the final exam in the Environmental Engineering Master program goes according to the traditions of engineer training.
Requirements and number of credits assigned to the thesis: 30 credits

According to the prerequisites of taking a final exam:

- compiling all the subjects provided from semester 1 to 4 in the model curriculum, obtaining at least 120 credits including subjects of criterion on the basis of curriculum;
- fulfilling internship in full-time programme (minimum of 4 weeks);
- writing and submitting a thesis.

The final exam (oral exam):
Subjects:

The core material of the final exam (B):

- Assessment and modelling of environmental status
- Environmental Operations.

Filed-specific knowledge (B, on the basis of the specialization):

- B1: Built environment
- B2: Environmental Technology, Planning, Constructions

Thesis defence (C)

Calculation of the diploma grade (SE) according to this formula:

$$SE= (A+B+C)/3$$

where A: cumulative grade-point average of all grades during the whole study, B: average result of the final (oral) exam, C: grade of the thesis determined by the final Exam board.

The requirements for the oral part of the final exam and the agenda of the topics with the indication of their literature are announced by the department no later than the last week of the study period. The oral examination shall be assessed on a five-grade scale by the members of the final examination board. The board shall then consult behind closed doors and vote about the final grade for the final exam. In case of equal division of the votes, the chairperson shall be given the casting vote. The result of the final exam shall be announced by the chairperson of the board. Minutes shall be taken during the final examination. The Department awards an Academic Award for Environmental Protection to the student who achieves the best result at the final exam, which shall be conferred to him/her at the graduation ceremony.

Retaking a failed final exam

If any part of the final exam is evaluated as fail, according to the existing rules of the university, it can be retaken. The retake of the final exam may be attempted in the following examination period at the earliest. If a thesis is evaluated unanimously as fail, the student may not take the final exam and shall write another thesis. The final exam can be retaken twice per each subject.

Final exam board

The members of the final examination board shall be delegated and commissioned with the consent of the Faculty Council by the dean of the faculty. They are selected from among the acknowledged internal and external experts of the professional field. Traditionally, a chairperson and, in case of his/her absence or indisposition, a vice-chair shall be commissioned. The final examination board shall have a minimum of two members apart from the chairperson and as many questioners as needed. At least one of the members of the board shall be a university or college professor. The length of the appointment of membership in the final exam board shall be one year. The division of students to individual commissioned final exam boards shall be announced by the Department of Environmental Engineering.

COURSE DESCRIPTIONS FOR ENVIRONMENTAL ENGINEERING MSC

The order of subject follows the subject list in the model curriculum above.

Subject group "Basic Natural Sciences" for all Specialization

Mathematical Modelling and Optimization

Code: MK5MMO1A04KX17-EN

ECTS Credit Points: 4

Evaluation: mid-semester grade

Year, Semester: 1st year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+2

Prerequisite: -

Topics:

Survey of the basic notions of linear algebra, Matrices, operations, determinants, eigen values, eigen vectors. Differentiation and integration for real functions; some applications in physics. Searching of local and global extremas. Differentiation and integration of multivariable and vector-valued functions. Linear programming: simplex algorithm, duality.

Literature:

Required: -

Recommended:

- Thomas' Calculus, Addison Wesley (11th edition, 2005), ISBN: 0-321-24335-8
- S. Minton, Calculus Concept and Connections, McGraw Hill (2006), ISBN 0-07111200-6
- M. D. Greenberg, Fundamentals of engineering analysis, Cambridge University Press, ISBN 978-0-521-80526-1

Schedule

1st week Registration week	
2nd week: **Lecture:** The arithmetic of matrices, determinants and their properties. The notion of linear (or vector) space, linear combinations of vectors, linearly	**3rd week:** **Lecture:** Linear functions: eigenvalues, eigenvectors. The linear transformation on the plane and in the place.

dependent and independent systems, basis, dimension, coordinates. **Practice:** The algebra of vectors in 2 and 3 dimensions: operations. Cross product, scalar product.	**Practice:** Determination of eigenvalues, eigenvectors.
4th week: **Lecture:** Differential calculus of the real functions: differentiation, L'Hospital's rule, tangent line, linear approximation, analysis of differentiable functions. **Practice:** Determination of tangent line and local and global extremas of a differentiable real function.	**5th week:** **Lecture:** Differentiation of multivariable vector-valued functions. Parametric curves, curvature, torsion. Scalar field, gradient. Directional derivative. Parametrized surface, Vector fields, divergence and curl. **Practice:** Determination of curvature, torsion, directional derivative, divergence, curl.
6th week: **Lecture:** Integral calculus of the real functions: primitive function (antiderivative), indefinite integral, the Riemann integral, the Newton-Leibniz theorem. **Practice:** Calculations of area, volume, covered distance.	**7th week:** **Lecture:** Double and triple integrals, applications in physics. **Practice:** Calculations of volume, mass, centre of the mass, surface area. Determination of potential function of a vector field.
8th week: 1st drawing week	
9th week: **Lecture:** Line integral, surface integral. Connection between integrals: The theorems of Gauss and Stokes. **Practice:** Calculation of line integral, surface integral.	**10th week:** **Lecture:** Ordinary differential equations. **Practice:** Numerical solution methods.
11th week: **Lecture:** Linear regression, interpolation **Practice:** Least squares method, Taylor polynomials.	**12th week:** **Lecture:** Linear programming, primal problem. **Practice:** graphical solution method.
13th week: **Lecture:** Simplex algorithm, duality. **Practice:** Simplex algorithm, duality.	**14th week:** **Lecture:** About some mathematical software. **Practice:** Calculations by software.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practices is compulsory. Attendance at lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed practice classes have to be made up for at a later date previously discussed with the tutor.

B, for a grade:

The course ends in a written end-term test.

The minimum requirement of the end-term test is 50%. The grade is given according to the following (score/grade): 0-49 = fail (1); 50-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5). If the score of the test is below 50, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Applied Statistics

Code: MK5AST1A04KX17-EN

ECTS Credit Points: 4

Evaluation: mid-semester grade

Year, Semester: 1st year, 1st semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

The series of lectures are based on the topics of engineering statistics. It reviews the concepts and methods used in stochastic modelling of technical systems and processes. Sample spaces and events. Axioms of probability. Conditional probability. Multiplication and total probability rules. Independence. Discrete and continuous random variables, probability distribution, density function. Numerical characteristics of random variables. Limit theorems. Joint probability distributions. Correlation, independence. Descriptive statistics. Point and interval estimation. Confidence interval. Hypothesis testing (probability, mean, standard deviation), normality test, ANOVA. Regression analysis. System reliability. Time series. Markov chain. Statistical process control. Statistical tools in 6σ process improvement.

Literature:

Required:

- Montgomery, D. C., Runger, G. C., Applied Statistics and Probability for Engineers, John Wiley & Sons Inc., 2003
- Soong, T. T., Fundamentals of probability and statistics for engineers, John Wiley & Sons, Inc., 2004

Recommended:

- DeCoursey, W. J., Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003
- Allen, T. T., Introduction to Engineering Statistics and Six Sigma, Springer, 2006
- Pham, Hoang (Ed.), Springer Handbook of Engineering Statistics, Springer, 2006, ISBN 978-1-85233-806-0
- NIST/SEMATECH e-Handbook of Statistical Methods, http://www.itl.nist.gov/div898/handbook/

Schedule

1st week Registration week	
2nd week: **Lecture:** Sample spaces and events. Axioms of probability. Conditional probability. Multiplication and total probability rules. Independence. **Practice:** Calculation of probability.	3rd week: **Lecture:** Discrete and continuous random variables, probability distribution, density function. **Practice:** Random variables.
4th week: **Lecture:** Numerical characteristics of random variables. Limit theorems. **Practice:** Random variables.	5th week: **Lecture:** Joint probability distributions. **Practice:** Joint probability distributions.
6th week: **Lecture:** Correlation, independence. **Practice:** Correlation, independence.	7th week: **Lecture:** Descriptive statistics. **Practice:** Descriptive statistics.
8th week: 1st drawing week	
9th week: **Lecture:** Point and interval estimation. Confidence interval. **Practice:** Point and interval estimation. Confidence interval.	10th week: **Lecture:** Hypothesis testing (probability, mean, standard deviation), normality test, ANOVA.

	Practice: Hypothesis testing (probability, mean, standard deviation), normality test, ANOVA.
11th week: **Lecture:** Regression analysis. **Practice:** Regression analysis.	**12th week:** **Lecture:** System reliability. **Practice:** System reliability.
13th week: **Lecture:** Time series. Markov chain. **Practice:** Time series. Markov chain.	**14th week:** **Lecture:** Statistical process control. Statistical tools in 6σ process improvement. **Practice:** Statistical process control. Statistical tools in 6σ process improvement.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attendance at **lectures** is recommended, but not compulsory.

Attending practices is compulsory. Students have to attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date previously discussed with the tutor. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are two tests: a mid-term test on the 8th week and an end-term test on the 15th week. Students have to sit for the tests.

B, for a grade:

The course ends in an **end-term grade**, it is based on the total scores of the mid-term and the end-term tests.

The minimum requirement for the mid-term and end-term tests is 60%. Based on the score of the tests, the grade is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If the score of tests is below 60%, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Environmental Chemistry and Environmental Toxicity

Code: MK5KKTOK04KX17-EN

ECTS Credit Points: 4

Evaluation: exam

Year, Semester: 1st year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+2

Prerequisite: -

Topics:

Within the framework of the Environmental Chemistry part, students become familiar with the fundamental concepts of environmental chemistry, its significance, and its role in environmental engineering practice. The course covers the formation of the Universe, the Solar System, and the Earth, the processes of element nucleosynthesis, as well as the basic principles of isotopes and radioactivity.

The course presents the biogeochemical cycles of the major non-metallic elements (carbon, nitrogen, oxygen, sulfur, and phosphorus), the environmental role of metallic elements, and the chemistry of the atmosphere, including atmospheric processes, the importance of the stratospheric ozone layer, and the chemical background of the greenhouse effect and global climate change.

In the field of hydrosphere chemistry, students study the properties and natural cycle of water, equilibrium processes occurring in natural waters, and the major water pollutants. The chemistry of the lithosphere includes the characteristics of minerals and rocks, weathering processes, soil composition, and the most important anthropogenic sources of soil contamination.

In the environmental toxicity we discuss the basic knowledge of toxicology, the grouping options of the poison and the poisoning, and the mechanism of the action of the poisons. Furthermore, we present the students to the role and the significance of environmental toxicology and ecotoxicology in the environmental engineering training. We describe the methods, tasks and the possibilities of carrying out of the different types of eco toxicological tests (single species and multispecies) and we discuss the risk of environmental toxicity and chemicals and risk assessment possibilities.

Literature:

Required:

- Environmental Chemistry; Stanley Manahan, 10th Edition, Taylor & Francis Group, 2017, ISBN 13: 978-1-4987-7693-6

- Introduction to Environmental Engineering and Science; Gilbert M. Masters, Wendell P. Ela, 3rd Edition, Pearson Education Limited 2014, ISBN 13: 978-1-292-02575-9
- Lecture and Practice Notes by the instructors (Presentation materials will be available in the Moodle system. Available at: https://elearning.unideb.hu/)
- M. Doble, A. Kumar Kruthiventi: Green Chemistry and Engineering, Elsevier, USA, 2007; ISBN 987-0-12-372532-5
- Peter G. C. Campbell, Québec, Peter V. Hodson, Pamela M. Welbourn, David A. Wright: Ecotoxicology. Cambridge: Cambridge University Press. 2022, ISBN: 9781108834698; https://doi.org/10.1017/9781108819732
- Erik Jorgensen: Ecotoxicology (Cambridge, Academic Press, USA, 2010. ISBN13: 9780444536280)

Recommended:

- D. M. Whitacre: Reviews of Environmental Contamination and Toxicology (Springer, New York, 2013. ISBN: 978-1-4614-6898-1)
- Donald W. Sparling: Basics of Ecotoxicology (CRC Press Taylor & Francis Group, Boca Raton, USA, 2017. ISBN13: 9781138031715)

Schedule

1st week Registration week	
2nd week: **Lecture:** Introduction to Environmental Chemistry: definition, scope, and significance of environmental chemistry. **Practice**: Discussion of the details of the assignment. Presentation of the procedure and schedule for the laboratory practical. The definition, and the classification possibilities of toxicology. Adverse effects to be measured by environmental toxicology.	3rd week: **Lecture:** Formation of the Universe, the Solar System, and the Earth. Element nucleosynthesis. Fundamentals of isotopes and radioactivity. **Practice:** The definition, the scope, the importance and the classification possibilities of ecotoxicology Categorization of the contaminants.
4th week: **Lecture:** Biogeochemical cycles of non-metallic elements: carbon, nitrogen **Practice:** Description of the ecological test using a single species: acute and chronic test. The methods and the tasks of ecotoxicological tests.	5th week: **Lecture:** Biogeochemical cycles of non-metallic elements: oxygen, sulfur, and phosphorus. **Practice:** Description of the ecological test using multispecies: microcosm and mesocosm tests.
6th week: **Lecture:** Metallic elements (Hg, Pb, Zn, Cd, Cr etc.) in the environment. **Practice:** Ecotoxicology and the risk of chemicals.	7th week: **Lecture:** Atmospheric chemistry: composition and structure of the atmosphere. Thermal and

	photochemical processes, free-radical reactions in the atmosphere. **Practice:** Mid-term exam from environmental toxicity part.
8th week: 1st drawing week	
9th week: **Lecture:** Stratospheric ozone: the Chapman model, the ozone layer, and catalytic ozone depletion. The greenhouse effect and global climate change. **Practice: Blocked lab practice (4-hour):** germination test	**10th week:** **Lecture:** Hydrosphere chemistry: properties of the water molecule and their environmental significance, global distribution of water, and the hydrological cycle. Solubility of gases in water. **Practice: Blocked lab practice (4-hour):** Evaluation of germination test
11th week: **Lecture:** Acid–base equilibria in aquatic systems and the acidification of natural waters (lakes and oceans). Redox reactions in aqueous enviroment. Water pollutants. **Practice: -**	**12th week:** **Lecture:** Lithosphere chemistry: minerals and rocks, physical and chemical weathering processes. **Practice:-**
13th week: **Lecture:** Soil and its components, anthropogenic soil contaminants. **Practice:-**	**14th week:** **Lecture:** The role and the location of environmental toxicology in the environmental protection. Fate and behaviour of chemical substances in the environment. **Practice:-**
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attendance at practical classes is mandatory. Students are required to attend all seminars and laboratory sessions and may miss no more than three classes during the semester. Students who exceed this limit will not receive a course signature and will be required to repeat the course.

During the semester, students are required to complete two mid-term tests: the **Environmental Toxicology** test in **Week 7** and the **Environmental Chemistry** test in **Week 14**. Each test may be retaken once, if necessary. To obtain the course signature, students must also successfully complete the laboratory practical and submit the required assignment to an acceptable standard.

B, for a grade:

Students are required to successfully complete the laboratory practice, submit the corresponding laboratory report, and pass the laboratory mid-term test.

Students must take a **written exam in Environmental Toxicology** and an **oral exam in Environmental Chemistry**, based on the published examination topics.

The final grade is based equally on the two course components: 50% of the final grade is determined by the result of the Environmental Toxicology written examination and 50% by the result of the Environmental Chemistry oral examination.

Environment Biology and Nature Protection

Code: MK5KBTVK04KX17-EN

ECTS Credit Points: 4

Evaluation: exam

Year, Semester: 1st year, 1st semester

Number of teaching hours/week (lecture + practice): 2+2

Prerequisite: -

Topics:

The aim of the environmental biology curriculum we are discussing about the parts of biosphere where the living organisms play an important role. "Soil, water, air as well as environment" - a way of life. We present biomass and ecosystems as well as abiotic and biotic components of ecosystems.

Soil habitats play an important role in the formation of soil (the first step in biological melting), soil organic matter transformation (humus formation) and degradation processes (mineralization), circulation of elements and ecosystem energy flow. The impact of human activity on the soil. We present the processes in river and standing waters. Water quality. The impact of human activity on living waters. Protecting the biosphere. Our goal is to enable students to integrate new knowledge about soil, water and air. As we pass on knowledge, we strive to emphasize the harmony of sustainable, environmentally friendly farming, environmental and nature conservation.

Within the nature conservation part of the curriculum we are discussing the main nature conservation directives, the development of nature protection regulation and administration and the international status of nature conservation.

Students will get acquainted with the central and regional organizations of the Nature Conservation Administration, nature conservation groups, their status and the possibilities of their protection.

Students acquire the basics of conservation biology and the essential elements of biodiversity protection.

Students acquire knowledge of the most important practices of nature conservation, the operation of national parks, and the importance of nature conservation in practice, international nature conservation conventions and the European Union's nature conservation regulations.

Literature:

Required:

- Bardgett, R.: (2005) The Biology of Soil. A Community and Ecosystem Approach. Oxford University Press
- The material of the lectures is available in the form of ppt.

Recommended:

- Paul, E. A. (ed) 2007. Soil Microbiology, Ecology and Biochemistry Academic Press is an imprint of Elsevier.
- Wall, D. H. et al. (eds.) (2012) Soil Ecology and Ecosystem Services, Oxford University Press
- R. B. Primack (2014): Essentials of Conservation Biology. Sinauer Associates, Inc. ISBN: 978-1-0535-293-3

Schedule

1st week Registration week	
2nd week: Lecture: The significance, tasks and basic concepts of environmental biology. Practice: The significance, tasks and basic concepts of nature conservation.	3rd week: Lecture: Ecosystems. Practice: The significance, tasks and basic concepts of nature conservation.
4th week: Lecture: Abiotic and biotic components of ecosystems. Practice: Essential elements of biodiversity protection.	5th week: Lecture: Characterization of soils. Practice: Nature conservation directives.
6th week: Lecture: Soil organic matter transformation (humus formation) and degradation processes (mineralization). Practice: Nature conservation directives.	7th week: Lecture: Circulation of elements and ecosystem energy flow. Practice: Development of nature protection regulation and administration.
8th week: 1st drawing week	
9th week: Lecture: The impact of human activity on the soil.	10th week: Lecture: The structure, composition and properties of the hydrosphere.

Practice: The international status of nature conservation.	**Practice:** Central and regional organizations of the Nature Conservation Administration.
11th week:	**12th week:**
Lecture: The impact of human activity on hydrosphere.	**Lecture:** The impact of human activity on living waters.
Practice: Nature conservation groups.	**Practice** Basics of conservation biology and the essential elements of biodiversity protection.
13th week:	**14th week:**
Lecture: The impact of human activity on biosphere.	**Lecture:** Protecting the biosphere.
Practice: Basics of conservation biology and the essential elements of biodiversity protection.	**Practice:** European Union's nature conservation regulations.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practices is compulsory. Students have to attend lectures or practice classes and may not miss more than three lectures or practices during the semester. In case a student misses more than three, the subject will not be signed and the student must repeat the course. The attendance of lectures and practices is recorded by the practice leader. Being late counts as an absence. In case of further absences, a medical certificate needs to be presented. Students are required to bring the printed materials of the lectures with them to each lecture and practice class. Active participation is evaluated by the teacher in every class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence due to the lack of active participation in class.

B, for an exam grade:

The minimum requirement of the written exam test is 60% separately. The grade for each test is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If the score of any test is below 60%, the student once can take a retake test of the whole semester material.

Ecology for Engineers

Code: MK5MOKLK03KX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 1st year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+2

Prerequisite: -

Topics:

Within the course of the Engineering Ecology students become acquainted with the ecological and biological basics necessary for environmental work. Students learn about the relationship between living and inanimate environmental factors.

The curriculum covers ecological water management, water quality protection, river corridor restoration technologies, rehabilitation methods and solutions of the aquatic, wetland and terrestrial habitats.

Students acquire a basic ecological knowledge for environmental technologies, waste management, sewage treatment, and nature conservation interventions.

Other important parts of the curriculum: application of microbial ecology in environmental practice, ecological based management of artificial wetlands, management of organic and inorganic waste and reduction of environmental impacts.

Literature:

Required:

- The material of the lectures is available in the form of ppt.

Recommended:

- Mitsch, W.J.; Jørgensen, S.E (2003): Ecological Engineering and Ecosystem Restoration ISBN: 978-0-471-33264-0
- Riisgård, H. U. (2017): General Ecology: Outline of contemporary ecology for university students. Bookboon.com ISBN 978-87-403-1821-0

1st week Registration week	
2nd week:	3rd week:
Lecture: Introduction, Ecology and Engineering ecology Subject and Tasks.	Lecture: Abiotic and biotic environmental factors. The most important element cycles.
Practice: The principles of ecology. The history of ecology.	Practice: C, N, P, S, H_2O roundabouts. Pollution.
4th week:	5th week:
Lecture: Spatial properties of populations.	Lecture: The temporal properties of populations.

Practice: Spatial distribution, zoning, stratification.	**Practice:** Prospectuses, succession, eutrophication, etc. Changes in populations.
6th week: **Lecture:** Interactions between populations. Bioindication. **Practice:** Predation, symbiosis, parasitism, etc. The Lotka-Volterra equations.	**7th week:** **Lecture:** Life strategies. **Practice:** R and K strategists. The Malthus Principle.
8th week: 1st drawing week	
9th week: **Lecture:** Hydro ecological basics. Types of water bodies. **Practice:** Types of aquatic habitats, aquatic life and living things. Water, hydraulic and water chemistry bases.	**10th week:** **Lecture:** Ecology of aquatic and wet habitats. Ecological basics of river basin management. **Practice:** Material flow in the waters. Eutrophication and water pollution. Ecology of irrigation and water supply systems.
11th week: **Lecture:** Water resource management and water quality protection. Rehabilitation of aquatic and wet habitats. **Practice:** Technological methods of water quality control. Coastal protection. Prevention and treatment of pollution. River bed-morphological and hydraulic interventions.	**12th week:** **Lecture:** Ecological applications in sewage treatment. **Practice**. Ecology of biological wastewater treatment. Nature-Close Methods. Treatment of artificial wetlands.
13th week: **Lecture:** Ecological aspects of landfill and biological waste management. **Practice:** Environmental impacts of waste and landfills. Treatment of leachate waters. Air purity protection and depot gas. Ecology of biogas production and composting.	**14th week:** **Lecture:** Rehabilitation and ecological management of terrestrial habitats. Use of bioindication in environmental qualification. **Practice:** Closure and after-care of landfills. Rehabilitation of defectors. Treatment of forest fire affected areas. Biotic indices. MMCP. Biological Quality Elements, BQEs WFD., 10/2010. (VIII.18.) VM decree. Biodiversity.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practices is compulsory. Students have to attend lectures or practices and may not miss more than three lectures or practices during the semester. In case a student misses more than three, the subject will not be signed and the student must retake the course. Attendance at lectures and practice classes will be recorded by the practice leader. Being late counts as an absence. In case of further absences, a medical certificate needs to be presented. Students are required to bring the printed materials of the lectures with them to each lecture and practice class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence due to the lack of active participation in class.

B, for a mid-semester grade:

The minimum requirement of the written mid-semester test is 60% separately. The grade for each test is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If the score of any test is below 60%, the student once can take a retake test of the whole semester material

Geosciences

Code: MK5FDTIS03KX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 1st year, 1st semester

Number of teaching hours/week (lecture + practice): 2+0

Prerequisite: -

Topics:

Geological and geotechnical exploration; sampling, description of localities, field measurements and their instruments. Geological, hydrogeological data collection, archive data bases, and their application. Protection of the geological environment and the groundwater sources. Pollutants and limits. Pollution transport, risk analysis and assessment. Documentation of concerning the geological environment and groundwater systems (preliminary studies, environmental impact assessment, revision, steady state analysis, site assessment, remediation). Review of remediation and treatment technologies; planning and performance of remediation; monitoring. Basic concepts of protection of water resources, diagnostics and securing of water resources. Geological and hydrogeological background of waste disposal.

Literature:

Required:

- Reichard, J.S. 2011: Environmental Geology. McGraw-Hill, 2nd edition, p. 544.

Recommended:

- Knödel, K, Lange, G, Voigt, H-J 2007: Environmental Geology Handbook of Field Methods and Case Studies. Springer, p. 818.

Schedule

1st week Registration week	
2nd week: **Lecture:** Rock cycle. Genetic grouping of rocks, petrographic characteristics. Igneous rocks, rock bodies. Classification and formation of sedimentary rocks and rock bodies. Petrographic and petrogenetic groups of metamorphic rocks, characteristics of rock bodies. Recognition of rocks. **Practice: -**	3rd week: **Lecture:** Characterization of the Earth's surface. Dynamic processes form and act on slopes. Examination of the effects of wind erosion and methods of protection against it. Water erosion, water damage, water protection. **Practice: -**
4th week: **Lecture:** Slope classification of relief maps, analysis of slope shapes. Relief energy, surface exposure. Preparation and analysis of DTMs. **Practice: -**	5th week: **Lecture:** Structure and development history of the Pannonian-Carpathian region. General characterization of the surface and structure of the Earth's crust. Overview of mappable surface forms and the structure of the geological environment. Methodology of collecting and reviewing geological literature: geological explanatory notes, topographic and geological maps. Geotechnical maps, layout plans, documentation of structures, and underground facilities. **Practice: -**
6th week: **Lecture:** The most important examination methods used in environmental geology. The importance and concept of soil in environmental geology. Soil and sediment examinations. **Practice: -**	7th week: **Lecture:** Hydrogeological foundations in environmental geology. Water cycle, hydrogeological equation, types of groundwater, and pressure states. Subsurface water seepage, Darcy's law, permeability, hydraulic conductivity. **Practice: -**
8th week: 1st drawing week	
9th week: **Lecture:** Mid-term test 1. Concept of pollution, contamination, and pollutants. Pollutant sources	10th week: **Lecture:** Halogenated hydrocarbons in the environment. Physical and chemical properties of the most important chlorinated

in the geoenvironment. Toxic metals-metalloids, inorganic pollutants. Organic pollutants.
Practice: -

11th week:
Lecture: Rock and soil drilling exploration, characterization of drilling techniques, application possibilities. Borehole, water sampling point, monitoring well, production well, and well nests. Theoretical and practical approach to rock, soil, and water sampling.
Practice: -

13th week:
Lecture: Inanimate natural values, geological and hydrological values. Geological value protection. *Ex lege* protected natural values. Geomorphological values, protected minerals, geological reference section, and natural trails.
Practice: -

aliphatic hydrocarbons. Spread of contamination in the subsurface environment: advection, diffusion, adsorption, reaction.
Practice: -

12th week:
Lecture: Environmental geological investigation strategies. Main actors of environmental protection and environmental geology. Basic aspects to be taken into account when planning field diagnostic investigations. Physical foundations of environmental geophysics. Theoretical background and practical significance of the most frequently used geophysical methods.
Practice: -

14th week:
Lecture: Mid-term test 2.
Practice: -

15th week: 2nd drawing week

Requirements

A, for a signature: Preparing a homework assignment on a relevant, chosen topic.

B, for a grade: The course ends with a mid-term grade based on two tests. The student evaluation consists of two parts: 70% – the results of mid-term exams, 30% – the student's performance during the semester, his/her semester activity, i.e., based on the homework.

Subject group “Economics and Humanities” for all Specialization

Environmental Law and Economics

Code: MK5KJGDK04KX17-EN

ECTS Credit Points: 4

Evaluation: mid-semester grade

Year, Semester: 1st year, 1st semester

Number of teaching hours/week (lecture + practice): 2+2

Prerequisite: -

Topics:

At the beginning of the semester, students are introduced to global ecological issues, environmental problems, and the new concepts that these issues have given rise to (e.g., Great Acceleration, tipping point, planetary boundaries, carrying capacity, circular economy, Anthropocene). We will focus specifically on the relationship between economic growth and environmental quality. We will introduce alternative indicators designed to address the shortcomings of GDP. We will also focus on non-monetary accounting, the macroeconomic model of material flow analysis, and its potential applications. The course also covers the possibilities for monetizing the environment and the economic consequences of externalities. With this background, we discuss environmental policy instruments (direct and indirect regulatory instruments; green taxes and subsidies).

Literature:

Required:

- Stuart Bell, Donald McGillivray, Ole Pedersen, Emma Lees, and Elen Stokes: Environmental Law (Ninth Edition). Published: 01 June 2017, Oxford University Press, 872 Pages ISBN: 9780198748328.
- Harris, Jonathan M. – Roach, Brian: Environmental and Natural Resources Economics: A Contemporary Approach (4rd Edition), Routledge, 2017, 667 p.
- https://elearning.unideb.hu/pluginfile.php/184345/mod_resource/content/1/%5BJonathan_M._Harris%2C_Brian_Roach%5D_Environmental_an%28bookzz.org%29.pdf

Recommended:

- Costanza, R., Norgaard, R., Daly, H., Goodland, R., & Cumberland, J. (2007). An Introduction to Ecological Economics (e-book). Available at: http://www.eoearth.org/view/article/150045

- Perman, R., Ma, Y., McGilvray, J., & Common, M. 2003. Natural resource and environmental economics. Pearson, 726 p.
- Common, M. & Stagl, S. Ecological Economics. An introduction. 2005, Cambridge University Press, 560 p.

Schedule

1st week Registration week	
2nd week: Lecture: Introduction Practice: The Subject Matter, Methods, and Value Choices of Environmental Economics and Ecological Economics	3rd week: Lecture: Watching the movie 'Quest for meaning' Practice: Welfare Economics and Market Failures
4th week: Lecture: What is environmental law? The methods and general system of environmental regulation Practice: Addressing Market Failures: The Pigouvian Tax and the Coase Theorem	5th week: Lecture: The principles of environmental law Practice: Patterns in the Use of Natural Resources
6th week: Lecture: Environmental assessment Practice: Monetary Valuation of the Environments	7th week: Lecture: International law and environmental protection - the significance, history, sources and dispute settlement of the international environmental law Practice: Environmental Policy Instruments
8th week: 1st drawing week	
9th week: International climate change law and air pollution Lecture: Practice: Economic instruments: a comparison of their effectiveness with direct regulation	10th week: Lecture: An introductory guide to European Union law Practice: Measuring environmental conditions and environmental macro-indicators
11th week: Lecture: Horizontal EU environmental law measures (impact assessment and access to information) Practice: Natural resources and economic growth	12th week: Lecture: EU water protection, air pollution and waste management law in a nutshell Practice: Environmental protection and trade
13th week: Lecture: Presentations of the students Practice: Sustainable development and ESG	14th week: Lecture: Presentations of the students Practice: Systematic overview
15th week: 2nd drawing week	

Requirements

A, for a signature:

The signature requirement is a presentation on the topic of Environmental Economics, prepared and delivered at the beginning of the semester.

B, for a grade:

The final grade is determined based on performance in both course components. The Environmental Economics course concludes with a midterm written exam. The grade of environmental law is based upon pesentation and class attendance/participation.Attendance and class participation: Students are obliged to attend classes regularly. 3 misses are possible. Extra marks will be added to the final exam grade of those who participate consistently and thoughtfully in class discussion. Presentation: students are needed to make a presentation on a selected topic previously fixed with the lecturer. The presentation should be: 15-20 minutes in length; Power point slides are necessary.

Environmental and Quality Management

Code: MK5KMMMM03KX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 1st year, 1st semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

Basics of management review, forms of organization, management styles, etc.

Operating management concepts, types of functions, input-output approach. Strategy, goals, Hayes and wheelwright model, development of operational strategies. The relationship between production and service, common properties, differences. Process engineering: process models, environmental planning. Product and service design: ingredients, the basic process, screening, assessment methods, aggregate planning. Supply chain in operating management: Basic concepts, decisions, aspects of do or buy decision. Process technologies: typing, general features, criteria of selection.

Scheduling, managing, controlling of the production (service). Management strategies. Statistical process control, continuous improvement. Inventory management, inventory management models. Features of inventories formed by economic and production considerations. ABC inventory analysis. Consumption definition, overview of MRP, MRP

input - output data, identify capacity requirements. Queueing models. Principles and objectives of lean manufacturing.

The requirements for quality management systems (ISO 9001: 2008). The development of operation (ISO 9004: 2010). Environmental Management System (ISO 14001: 2005). MSZ 28001: 2008 occupational health and safety management system. ISO / IEC 27001: 2005 elements and structure of information security management system.

Literature:

Required:

- Kim-Soon Ng (2012): Quality Management and Practices. InTech, Chapters published. ISBN 978-953-51-0550-3
- Garg A. K. (2011): Production and Operations Management. McGraw-Hill. ISBN-13 9780071077927
- Sven Erik Jørgensen, Joao Carlos Marques, Søren Nors Nielsen, Integrated Environmental Management: A Transdisciplinary Approach, CRC Press, 2015, ISBN 9781498705103

Recommended:

- Kanishka Bedi: Quality Management, Oxford University Press, 2016, ISBN 9780195677959

Schedule

1st week Registration week	
2nd week: Lecture: Basics of Quality management. Practice: Analysing examples.	3rd week: Lecture: The role of quality management in the industry. Practice: PDCA project.
4th week: Lecture: Process Management. Practice: Create a flowchart.	5th week: Lecture: Quality Planning. Practice: Developing a Quality Plan.
6th week: Lecture: Quality Management Methods I. Practice: Ishikawa, Pareto Analysis, 5W.	7th week: Lecture: Quality Management Methods II. Practice: QFD, Kano model, 5s, 8D report.
8th week: 1st drawing week	
9th week: Lecture: Industrial ecology and sustainability. Practice: Investigating case studies.	10th week: Lecture: Environmental factors and environmental impacts.

	Practice: Impact Sheet, Leopold Matrix, ABC Analysis, Eco-mapping.
11th week: **Lecture:** Life cycle assessment, analysis of life-cycle phases. **Practice:** Life cycle analysis.	**12th week:** **Lecture:** Environmental audit and benchmarking. **Practice:** Creating an audit plan.
13th week: **Lecture:** ISO 14001 standard. **Practice:** Legislation for acquisition of information and data about different waste streams.	**14th week:** **Lecture:** Process of assessing environmental performance. **Practice:** The relationship between environmental indicators and performance appraisal.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practices is compulsory. Attendance at lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed practice classes have to be made up for at a later date previously discussed with the tutor.

B, for a grade:

Students have to write two midterm tests during the semester. The first (40 points max) in the 8th, the second (40 points max) in the 14th week.

The minimum requirement of the tests is 60%. The grade is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If students fail to pass a test, they have to write both tests in the 1st week of the exam period again. If the result is 40 points (50%) or better, then he can take an exam.

There will be homework from week to week. Only students who have handed in all their homework at the time of the midterm test will be allowed to write it. The problems in the midterm tests will be selected from the homework assignments.

Production Management and Life Cycle Analysis

Code: MK5TMEEM03KX17-EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 1st year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

The course focuses on the advanced aspects of the production and service management. Emphasis is placed on the practical implementation of recommendations generated from the advanced modelling and system's understanding gained in the full range of Industrial engineering. The primary goal of the course is to allow students to see the applications of theories in a more realistic and intricate setting to gain a broader view of production and service management. The course covers the following topics: business forecasting and product lifecycle, time series forecasting, capacity analysis of machine, models and indicators in production system, inventory design, aggregate planning, life cycle assessment (LCA). At the end of the semester students should have a basic understanding of design, and schedule manufacturing system.

Literature:

Required:

- W. J. Stevenson: Operations management 12th ed. (2014) Boston, McGraw-Hill/Irwin
- Stephen N. Chapman, J. R. Tony Arnold, Ann K. Gatewood, Lloyd M. Clive: Introduction to Materials Management, 8th. global ed., (2016) New Jersey, Pearson

Recommended:

- S. Nahmias: Production and Operations Analysis. 5th Edition. (2004) McGraw Hill/Irwin

Schedule

1st week Registration week	
2nd week:	3rd week:
Lecture: Introduction to operation management.	Lecture: Building of process management systems.
Practice: Examples, case studies.	Practice: Examples, case studies.
4th week:	5th week:
	Lecture: Capacity analysis of machine.

Lecture: Production planning, creating value flow. **Practice:** Examples, case studies.	**Practice:** Examples, case studies.
6th week: **Lecture:** Business forecasting, time series forecasting. **Practice:** Examples, case studies.	**7th week:** **Lecture:** Design of goods, product lifecycle. **Practice:** Test 1
8th week: 1st drawing week	
9th week: **Lecture:** Inventory Planning Deterministic Models EOQ models. **Practice:** Examples, case studies.	**10th week:** **Lecture:** Inventory control: MRP I-II, ERP. **Practice:** Examples, case studies.
11th week: **Lecture:** JIT comparison of push and pull systems, MTO-MTS dilemma. **Practice:** Examples, case studies.	**12th week:** **Lecture:** Service and production development (Six sigma). **Practice:** Examples, case studies.
13th week: **Lecture:** Life cycle assessment – LCA. **Practice:** Examples, case studies.	**14th week:** **Lecture:** LCA programming. **Practice:** Test 2
15th week: 2nd drawing week	

Requirements

A, for a signature:

Participation at practice is compulsory. Students have to attend lectures and may not miss more than three of them during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at lectures will be recorded by the lecturer. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed lectures have to be made up for at a later date previously discussed with the tutor.

During the semester there are two tests: a mid-term test and an end-term test. Students must sit for both tests. The minimum requirement of the mid-term and the end-term test is 60% respectively. If the score of any test is below 60%, students can retake the test of the whole semester material only once. If somebody fails, he/she has to write both tests in the 1st week of the exam period again. If the result is 60 % or better the retake test is considered successful.

B, for a grade:

The course ends in an examination in the exam period.

The grade is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If the score of the test is below 60, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Subject group "Professional Subjects" for all Specialization

Environmental Engineering Measurement Techniques, Monitoring

Code: MK5KMMMK04KX17-EN

ECTS Credit Points: 4

Evaluation: mid-semester grade

Year, Semester: 1st year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+2

Prerequisite: -

Topics:

In the field of environmental engineering measurement and monitoring, students will be able to learn the basic concepts related to the monitoring system, the process and purpose of the analysis, the correct sampling and the importance of the basic concepts in environmental analytics, the topic of analytical chemistry.

The subject details the methods of measurement used in environmental analytics.

This course will be described the classical analytical methods, electroanalytical, atom spectrometry, molecular spectroscopy, chromatographic, mass spectrometry and coupled mass spectrometry methods (GC-MS, HPLC-MS, ICP-MS). Lastly, the elemental speciation methods and the monitoring systems will be presented.

During the practice part, the following topics are addressed: application of electroanalytical methods in environmental analytics, UV / VIS spectrophotometry, zeta potential measurement, investigation of soil samples by calcimeter.

Literature:

Required:

- Dr. Mahmood M. Barbooti (2015) Environmental Applications of Instrumental Chemical Analysis, CRC Press, Boca Raton, ISBN 978-1-4822-6264-3

- Roger N. Reeve: Introduction to Environmental analysis, John Wiley & Sons Ltd. 2002. ISBNs: 0-471-49294-9 (Hardback); 0-470-84578-3 (Electronic)
- David Harvey: Modern Analytical Chemistry, McGraw-Hill Higher Education, 2000. USA, ISBN 0–07–237547–7
- C. N. HEWITT: INSTRUMENTAL ANALYSIS OF POLLUTANTS, ELSEVIER APPLIED SCIENCE, 1991, ISBN 1-85166-548-X

Recommended:

- Gilbert M. Masters Wendell P. Ela: Introduction to Environmental Engineering and Science, Pearson Education Limited, England, 2014. ISBN 10: 1-292-02575-1

Schedule

Registration week	
1st week: **Lecture:** Basic concepts in analytical chemistry. The task of environmental analytical investigations. The process of environmental analysis: Good Sampling and Importance, Analysis Process and Monitoring in Environmental Analytics.	**2nd week:** **Lecture:** Sample Processing and Sample Preparation Procedures: sample processing used in environmental analysis (air and water test).
3rd week: **Lecture:** Sample Processing and Sample Preparation Procedures: sample processing used in environmental analysis (soil and waste test).	**4th week:** **Lecture:** Selecting an Analytical Method: accuracy, specification and validation of measurement methods.
5th week: **Lecture:** Classical analytical measurement methods used in environmental analysis: titrimetry and gravimetry.	**6th week:** **Lecture:** Classifying Environmental Analytical Techniques. Measurement methods used in environmental analytics: Electroanalytical methods.
7th week: 1st Reporting Period/drawing week	
8th week: **Lecture:** Atomic Spectroscopy	**9th week:** **Lecture:** Molecular Spectroscopy: UV/VIS spectrophotometry, IR Spectroscopy ***Blocked Practice:*** *in 218 laboratory*
10th week: **Lecture:** Chromatography ***Blocked Practice:*** *in 218 laboratory*	**11th week:** **Lecture:** Chromatography ***Blocked Practice:*** *in 218 laboratory*
12th week: **Lecture:** Mass Spectrometry, coupled systems in Mass	**13th week:**

Spectrometry (GC-MS, HPLC-MS, ICP-MS techniques). Elemental specification testing methods. ***Blocked Practices:*** *in 218 laboratory*	**Lecture:** Monitoring: Practical implementation of environmental monitoring. Visit to an accredited Laboratory

14th week: 2nd Reporting Period/drawing week: Written end-term test

Practices in blocks!

1. General rules of laboratory work and using of laboratory equipment: 1.1. Laboratory work and safety training

1.2. Introduction to laboratory equipment

Schedule of Laboratory Practice:

1. Determination of iron content in the environmental sample by UV/VIS spectrophotometry (IPM)
2. Determination of salicylic acid content by UV/VIS spectrophotometry (SPM)
3. Measurement and application of Zeta potential in water treatment solutions (ZPM)
4. Determination of carbonate content of soil samples by calcimeter (CAL)
5. Determination of phosphoric acid concentration by potentiometric titration (PPT)

Requirements

A, for a signature:

The lab grade is prerequisite of the signature and the mid-semester grade, too!

Participation at practice classes is compulsory. Students must attend practice classes and may not miss any practice class during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Being late is equivalent with an absence. In case of absence due to health issues, a medical certification needs to be presented. Missed practice classes must be made up for at a later date, being discussed with the tutor. The weekly syllabus covers the particular topics and gives a full description of the experiments.

Each week the laboratory session begins or closes with a short test (no more than 20 minutes) based exclusively on the preparatory material of that week of the experiments carried out. There are four short tests during the semester.

Lab grading is based on a five-level scale: 1 (fail), 2 (pass), 3 (satisfactory), 4 (good), 5 (excellent) calculated as an average of the tests' results and measurement reports. The minimum requirement for the short tests is 50%.

B, for a mid-semester grade:

The course ends in mid-semester grade, the theoretical part ends in **a written end-term test** at the 2nd drawing week. The minimum requirement for the written test is 50%. Based on the total score, the grade is given according to the following table:

Score	Grade
0-49	fail (1)
50-62	pass (2)
63-75	satisfactory (3)
76-87	good (4)
88-100	excellent (5)

If the case of failure, students can take retake written tests in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS. **In the mid-term grade, the score for the theoretical part counts is 60% and the lab grade counts is 40%. (Satisfactory level is the criterion in both parts).**

Environmental Health

Code: MK5KEGTK03KX17-EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 1st year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+0

Prerequisite: -

Topics:

During the course, students become familiar with the scope and methods of environmental health sciences, as well as the potential adverse health effects of pollutants commonly occurring in air, surface water, groundwater, drinking water, food, soil, environmental noise, radiation, and hazardous and non-hazardous wastes. Environmental health problems caused by global climate change and opportunities for the prevention of environmentally related diseases are also discussed. Students acquire the theoretical foundations and methodological approaches of environmental toxicology and environmental epidemiology.

Literature:

Required:

- Lecture slides available on the e-learning platform of the Institute of Public Health and Epidemiology and notes taken during lectures.

Recommended:

- Nadakavukaren A, Caravanos J. Our Global Environment: A Health Perspective. 8th ed., Waveland Press, Long Grove, 2020.
- Moeller DW. Environmental Health, 4th ed., Harvard University Press, Cambridge, 2011.

Schedule

1st week Registration week	
2nd week: **Lecture:** Scope and methods of environmental health **Practice: -**	**3rd week:** **Lecture:** Introduction to toxicology **Practice: -**
4th week:	**5th week:**

Lecture: Air pollution and health **Practice: -** **6th week:** **Lecture:** Environmental noise exposure and health **Practice: -**	**Lecture:** Water pollution and health **Practice: -** **7th week:** **Lecture:** Environmental radiation exposure and health **Practice:** -
8th week: 1st drawing week	
9th week: **Lecture:** Food-borne diseases, food poisoning **Practice: -** **11th week:** **Lecture:** Soil contamination and health **Practice: -** **13th week:** **Lecture:** Environmental epidemiology, environmental risk assessment **Practice:** -	**10th week:** **Lecture:** Global climate change and human health **Practice:** - **12th week:** **Lecture:** Waste management **Practice: -** **14th week:** **Lecture:** Workplace environment and health **Practice: -**
15th week: 2nd drawing week	

Requirements
A, for a signature: -

B, for a grade: Written examination.

Environmental Modelling and Environmental Informatics

Code: MK5KMKIK04KX17-EN

ECTS Credit Points: 4

Evaluation: exam

Year, Semester: 1st year, 1st semester

Number of teaching hours/week (lecture + practice): 2+2

Prerequisite: -

Topics:

Environmental protection GIS projects; environmental informatics systems, data warehouses and metadata; elaboration and operation of environmental management information systems; digital data acquisition and data structures; spatial uncertainty; soil and environmental modelling; elevation modelling; hydrological, surface water and groundwater modelling; landscape protection and land evaluation models; geostatistical

background of spatial and temporal changes; remote sensing; single-factor and complex multi-factor decision support systems. The practical part introduces environmental modelling concepts and models related to soil, water, air and pollution, including risk assessment, impact studies, remediation, monitoring and simulation software.

Literature:

Required:

- Brimicombe, A. (2010): GIS, Environmental Modeling and Engineering. 2nd edition. CRC Press / Routledge. ISBN: 9780367577193.
- Skidmore, A. ed. (2002): Environmental Modelling with GIS and Remote Sensing. Taylor & Francis / CRC Press. ISBN: 9780415241700.
- European Commission (2017): Environmental Impact Assessment of Projects. Guidance on the preparation of the Environmental Impact Assessment Report. Publications Office of the European Union.
- US EPA (2019): Guidelines for Human Exposure Assessment. EPA/100/B-19/001.
- FAO: Geospatial information for sustainable food systems.

Recommended:

- Kamilaris, A. et al. eds. (2021): Advances and New Trends in Environmental Informatics. Springer.
- Thakur, J. K. et al. eds. (2012): Geospatial Techniques for Managing Environmental Resources. Springer.
- FAO / United Nations (2023): Handbook on Remote Sensing for Agricultural Statistics.
- Raju, N. J. – Gossel, W. – Sudhakar, M. eds. (2015): Management of Natural Resources in a Changing Environment. Springer. ISBN: 9783319125589.
- Lichtfouse, E. – Goyal, A. eds. (2015): Sustainable Agriculture Reviews. Springer. ISBN: 9783319169873.
- Jakeman, A. J. – Voinov, A. A. – Rizzoli, A. E. – Chen, S. H. eds. (2008): Environmental Modelling, Software and Decision Support: State of the Art and New Perspectives. Elsevier.

Schedule

1st week Registration week	
2nd week: Lecture: National and international environmental protection GIS projects. Practice: Principles of modelling; importanc of environmental risk assessment.	3rd week: Lecture: Environmental informatics systems o the Internet, data warehouses and metadata. Practice: Characteristics of the soil-plant atmosphere system.
4th week: Lecture: Elaboration and operation of environmental management information	5th week:

systems; environmental elements and IT connections. **Practice:** Modelling impacts on soil and groundwater. **6th week:** **Lecture:** Soil and environmental modelling. **Practice:** Modelling impacts on atmosphere.	**Lecture:** Characterization and acquisition of digital data in environmental management; data structures and spatial uncertainty. **Practice:** Modelling impacts on surface water. **7th week:** **Lecture:** Elevation modelling. **Practice:** Modelling impacts on biomass and landscape.
8th week: 1st drawing week	
9th week: **Lecture:** Environmental models in hydrology Surface and groundwater modelling. **Practice:** Modelling impacts on human health. **11th week:** **Lecture:** Geostatistical background of spatial and temporal changes. **Practice:** Preparation of environmental impact studies. **13th week:** **Lecture:** Geoinformatics model of single-factor decision support systems. **Practice:** Remediation of soil, groundwater and surface water.	**10th week:** **Lecture:** Landscape protection and land evaluation models. **Practice:** Socio-economic consequences of environmental impacts. **12th week:** **Lecture:** Basics of remote sensing. **Practice:** Practical application of pollution transmission models; remediation and monitoring processes. **14th week:** **Lecture:** Applied complex multi-factor decision support systems; solutions of decision support systems. **Practice:** Cost-benefit analysis of remediation development of simulation and modelling software.
15th week: 2nd drawing week	

Requirements

A, for a signature: Participation in practices is compulsory. The signature is granted if students fulfil the attendance requirements according to the Education and Examination Rules and Regulations of the University of Debrecen and complete the required practical tasks/documentation.

B, for a grade: The course ends with an exam. The final grade is based on the result of the exam and the fulfilment of the practical requirements during the semester.

Environmental Operations

Code: MK5KVMK04KX17-EN

ECTS Credit Points: 4

Evaluation: exam

Year, Semester: 1st year, 1st semester

Number of teaching hours/week (lecture + practice):2+2

Prerequisite: -

Topics:

Substance of environmental operations. Unit operations of environmental engineering. Thermodynamics basis of environmental operations. Description of environmental operations. Measurement, units and dimensions of environmental engineering. Transport processes. Mass, component, heat and momentum streams. The general transport equation. The classification of operational units. The theory of similitude, dimensional analysis.

Flow of fluids, energy and momentum relationships. Pumping of fluids. Separation of heterogeneous systems: Sedimentation, filtration, centrifugation, mixing of liquid, gas cleaning. General characterization of transfer processes. Classification of transfer processes.

Heat transfer. Heat transfer by convection, conduction and radiation. Heating and cooling. Heat transfer at standard- and changeable temperature difference. Unsteady- and steady state transfer of heat. Heat exchangers.

Evaporation and crystallization. Evaporators and crystallizers. Cooling and coolers. Mass transfer processes. The two-film theory. Common interpretation of the operating line and the equilibrium curve. Mass transfer processes. Absorption. Evaporation. Distillation. Rectification. Extraction. Adsorption. Chemical reaction engineering. Chemical reactors. Classification of reactors and choice of reactor type in environmental protection.

During the practice in the first part of the semester, students will solve calculation problems related to the theoretical material. In the second half of the semester, within the framework of blocked laboratory sessions, they will become familiar with filtration, sieve analysis, absorption, and ion exchange.

Literature:

Required:

- Lecture and Practice Notes by the instructors (Presentation materials will be available in the Moodle system. Available at: https://elearning.unideb.hu/)
- H. F. Hemond; E. J. Fechner-Levy: Chemical Fate and Transport in the Environment. Second Edition, AP. 2000. ISBN-13: 978-0-12-340275-2
- Bruce E. Logan: Environmental Transport Processes. John Wiley and Sons, Inc. 1999. ISBN: 0471188719
- Waren L. McCabe; Julian C. Smith; Peter Harriott: Unit Operation of Chemical Engineering. Seventh Edition, McGraw Hill Higher Education. 2005. ISBN 007-124710-6
- Christie J. Geonkoplis: Transport Processes and Separation Processes Principles. (Includes Unit Operations). Forth Edition, 2008. ISBN 0-13-101367-X

- Yanus A. Cengel – John M. Cimbala: Fluid Mechanics Fundamentals and Applications. Second Edition. McGraw Hill Higher Education, 2010, ISBN 978-0-07-352926-4
- H. Scott Fogler: Elements of Chemical Reaction Engineering. Fourth Edition, 2006.Personal Education International 2006. ISBN 0-13-127839-8

Recommended:

- D. W. Green – R. H. Perry: Perry's Chemical Engineers' Handbook. 8th Edition, McGraw-Hill 2008. ISBN 978-0-07-142294-9

Schedule

1st week Registration week	
2nd week: Lecture: Subject of environmental operations. Unit Operations of Environmental Engineering. Description of unit operations. Measurement, units and dimensions. Practice: Problems and problem solving.	3rd week: Lecture: Transport processes. Mass, component, heat and momentum streams. Transport equations. Classification of operational units. Theory of similitude, dimensional analysis. Practice: Problems and problem solving.
4th week: Lecture: Flow of fluids, energy and momentum relationships. Practice: Problems and problem solving.	5th week: Lecture: Sedimentation, filtration, centrifugation, mixing of liquid. Practice: Problems and problem solving.
6th week: Lecture: General characterization and classification of transfer processes. Practice: Problems and problem solving.	7th week: Lecture: Heat transfer Practice: mid-term exam from environmental operations.
8th week: 1st drawing week	
9th week: Lecture: Mechanical operations: sieving and classification Practice: Blocked lab practice (3-hour): Sand filtration	10th week: Lecture: Mechanical operations: possibilities of size reduction and size enlargement Practice: Blocked lab practice (3-hour): Sieve Analysis
11th week: Lecture: Mass transfer processes. Operating line and equilibrium curve. Adsorption, Ion exchange Practice: Blocked lab practice (3-hour): Ion exchange	12th week: Lecture: Extraction. Absorption. ion exchange, Distillation, Rectification. Practice: Blocked lab practice (3-hour): Adsorption
13th week: Lecture: Membrane separation processes Practice:-	14th week: Lecture: Chemical reactors in environment and in environmental protection.

Practice:-

15th week: 2nd drawing week

Requirements

A, for a signature:

Attending practices is compulsory. Students have to attend lectures or practices and may not miss more than three lectures or practices during the semester. In case a student misses more than three, the subject will not be signed and the student must repeat the course. Attendance at lectures and practice classes will be recorded by the practice leader. Being late counts as an absence. In case of further absences, a medical certificate needs to be presented. Students are required to bring a calculator and the printed materials of the lectures with them to each lecture and practice class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence due to the lack of active participation in class.

During the semester there is one test: a mid-term test in the 7th week. A student can retake the test once, if it is necessary. A further condition for obtaining the signature is the completion of the laboratory practicals and the preparation of the reports to an acceptable standard.

B, for a grade:

The course ends with a written exam test in the exam period. Based on the average of the grades of the end-term exam and the grades of reports and the examination, the exam grade is calculated as an average of them:

- the average grade of the two exams
- the result of the examination

The minimum requirement for the mid-term and end-term exams and the examination respectively is 60%. Based on the score of the exams separately, the grade for the exams and the examination is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If the score of any exam is below 60, students can retake that exam in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

If the score of any test is below 60%, the student once can take a retake test of the whole semester material.

Environmental Resource Management

Code: MK5KEGDK03KX17-EN

ECTS Credit Points: 4

Evaluation: exam

Year, Semester: 1st year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+1

Topics:

Description of the most important non-renewable (fossil, soil), renewable (atmospheric, water, biomass) resources. Sustainability of resource utilization, energy balance calculation, environmental impact analysis with life-cycle perspective.

Literature:

Required:

- Lectures by Prof. Éva Lehoczky (ppt presentations – e-learning – lectures via Skype)
- Conroy, M. J., Peterson, T.: Decision Making in Natural Resource Management: A Structured, Adaptive Approach. Published: 2013. ISBN:9780470671757 |Online ISBN:9781118506196 |DOI:10.1002/9781118506196 Copyright © John Wiley & Sons, Ltd. 2013.
- Zhongchao, Tan: Air Pollution and Greenhouse Gases 2014. From Basic Concepts to Engineering Applications for Air Emission Control. ISBN 978-981-287-212-8 Springer, 2014.
- Mika, János: Climate change, impacts and responses. http://www.tankonyvtar.hu/hu/tartalom/tamop425/0038_foldrajz_MikaJanos-eghajlat-EN/ch01s05.html

Recommended:

- Faragó T., Láng I., Csete L. (Eds): Climate Change and Hungary: Mitigating the Hazard and preparing for the Impacts (The VAHAVA Report) Budapest 2010

Schedule

1st week Registration week	
2nd week: **Lecture:** Sustainable development, History of sustainability (1987 - Montreal Protocol, IPCC, 1972 - UN Conference in Stockholm, 1972 - Club of Rome "Limits to Growth") **Practice:** Practical discussion and case studies related to the lecture topic.	**3rd week:** **Lecture:** Sustainable development, Ecological Footprint **Practice:** Practical discussion and case studies related to the lecture topic.
4th week: **Lecture:** General questions of the sustainable use of natural resources, classification of natural resources **Practice:** Practical discussion and case studies related to the lecture topic.	**5th week:** **Lecture:** Renewable resources: solar energy, wind energy, energy of flowing water **Practice:** Practical discussion and case studies related to the lecture topic.

6th week: **Lecture:** Social and environmental problems associated with the use of non-renewable natural resources **Practice:** Practical discussion and case studies related to the lecture topic.	7th week: **Lecture:** Ozone in the stratosphere and the troposphere **Practice:** Practical discussion and case studies related to the lecture topic.
8th week: 1st drawing week	
9th week: **Lecture:** Global Warming, Environmental Problems Related to Global Warming **Practice:** Practical discussion and case studies related to the lecture topic.	10th week: **Lecture:** Relationship between resource utilization and the carbon cycle **Practice:** Practical discussion and case studies related to the lecture topic.
11th week: **Lecture:** Greenhouse effect, greenhouse gases: carbon-dioxide (CO2); methane (CH4); nitrous-oxide (N2O) **Practice:** Practical discussion and case studies related to the lecture topic.	12th week: **Lecture:** Air-, water- and soil related environmental problems: acidification, eutrophication **Practice:** Practical discussion and case studies related to the lecture topic.
13th week: **Lecture:** Climate change, impacts and responses **Practice:** Practical discussion and case studies related to the lecture topic.	14th week: **Lecture:** Water resources **Practice:** Practical discussion and case studies related to the lecture topic.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practice classes is compulsory. Attendance at lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. In case a student misses more than three practice classes, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the instructor. Being late is equivalent to an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes have to be made up for at a later date previously discussed with the instructor. Active participation in practical classes is required.

B, for a grade:

The course ends with a written exam. The minimum requirement of the written exam is 60%. The grade is given according to the following scale: 0–59% = fail (1); 60–69% = pass (2); 70–79% = satisfactory (3); 80–89% = good (4); 90–100% = excellent (5). If the score of the exam is below 60%, students can retake the exam in accordance with the Education and Examination Rules and Regulations.

Environmental State Assessment, Auditing

Code: MK5KAEAK03KX17-EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 1st year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

The goal of this subject is to provide possibility for students to do image analyses and to learn the basics of remote sensing and hydrological data collection. Within this subject students get acquainted with the modern spatial resolution support methods as well. They can build up and manage several geo-database systems and learn the theoretical and practical essentials of water management models.

The general purpose of the practice is to make students able to carry out environmental data collection and processing independently by applied geoinformatics and remote sensing. They will also be able to build and maintain independent geodatabase systems. They will learn about the main water management models and their theoretical and practical background.

Literature:

Required:

- Li, Z., Zhu, Q., Gold, C. (2005): Digital terrain modeling: Principles and Methodology. CRC Press. 318 p. (ISBN: 0-415-32462-9)
- Khorram, S., van der Wiele, C. F., Koch, F. H., Nelson, S. A. C., Potts, M. D. (2016): Principles of Applied Remote Sensing. Springer. 307 p. (ISBN: 978-331-922-593)

Recommended:

- Maquire, D. J. (2005): GIS, Spatial Analysis and Modeling. ESRI Press. 479 p. (ISBN: 978-158-948-130-5)p.

Schedule

1st week Registration week	
2nd week: **Lecture:** Spatial objects. **Practice:** GIS modelling in environmental status assessment.	3rd week: **Lecture:** GIS models. **Practice:** Lengthwise profile levelling.
4th week: **Lecture:** Primer data collection methods. **Practice:** Cross-section profile levelling.	5th week: **Lecture:** Secondary data collection methods.

	Practice: The structure of surface water geo database. The structure of ground geo database.
6th week: **Lecture:** The structure of geo-database for surface waters. **Practice:** Digital elevation modelling.	**7th week:** **Lecture:** The structure of geo-database for underground waters. **Practice:** Runoff modelling.
8th week: 1st drawing week	
9th week: **Lecture:** Spatial decision support in water management. **Practice:** Infiltration modelling.	**10th week:** **Lecture:** Spatial uncertainty and risk analysis in water management. **Practice:** Evaporation modelling.
11th week: **Lecture:** Physically background of remote sensing. **Practice:** Climate modelling.	**12th week:** **Lecture:** Space borne and airborne remote sensing. **Practice:** Spatial uncertainties and risk analysis in water management.
13th week: **Lecture:** Image analysis and land use. Image analysis and water quality management. **Practice:** Image analyses and water quality protection. Hydrological modelling.	**14th week:** **Lecture**: Hydrological modelling. Hungarian and international hydrology databases and data mining. **Practice:** National and international hydrological databases and data mining.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practices is compulsory. Attendance at lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed practice classes have to be made up for at a later date previously discussed with the tutor.

B, for a grade:

The course ends in a written exam test.

The minimum requirement of the end-term test is 60%. The grade is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If the score of the test is below 60, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Safety and Environmental Risk

Code: MK5BTKKK03KX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 1st year, 1st semester

Number of teaching hours/week (lecture + practice): 2+0

Prerequisite: -

Topics:

Within the framework of this course, students learn about the following topics: The concept of risk, its types, environmental risk. Risk metrics, activity groups of risk analysis. Identification, analysis of risk sources, response strategies, risk management. Environmental risk of companies, effective risk policy. Used risk analyses, non-technical and technical risks. Types and analysis of errors: fault tree analysis, error mode and impact analysis. Analysis of health risks. Analysis of ecological risks. Risk of natural hazards and disasters. Environmental risk of toxic elements. The concept and conditions of work safety. Personal protective equipment, accidents.

Literature:

Required:

- Ian Sutton: Plant Design and Operations, Gulf Professional Publishing, 2015
- Mark Brusseau Ian Pepper Charles Gerba, Environmental and Pollution Science, 3rd Edition, Academic Press, 2019

Recommended:

- Richard P. Pohanish: Sittig's Handbook of Toxic and Hazardous Chemicals and Carcinogens (Seventh Edition), 2017, ISBN: 978-0-323-38968-6
- John Ridley and John Channing: Safety At Work (Sixth Edition), 2003, ISBN: 978-0-08-047429-8
- Elearn: Managing Health, Safety and Working Environment Revised Edition, 2011, ISBN: 978-0-08-055740-3

- Shroder, John F and Sivanpillai, Ramesh: Biological and Environmental Hazards, Risks, and Disasters, Elsevier, 2015

Schedule

1st week Registration week	
2nd week: Lecture: Subjects of safety and environmental risk. Safety in Design.	3rd week: Lecture: Risk management. Fire Safety. Area classification based on risk.
4th week: Lecture: Occupational Safety. Incident Reporting. Behavior-based Safety. Timeout policies. Emergency Showers and Eyewashes.	5th week: Lecture: Personal Protective Equipment. Clothing. Head Protection. Foot Protection. Eye/Face protection. Respiratory Protection. Fall Protection.
6th week:. Lecture: Health and Risk: Asbestos, Noise, NORM, Heat and cold stress, Food and Galley Hygiene	7th week: Lecture: CLP Regulation. CLP Pictograms. ADR
8th week: Mid-term exam (1st test).	
9th week: Lecture:. Risk Assessment. The Process of Risk Assessment. Application of Risk Assessment.	10th week: Lecture: Hazard Identification. Exposure Assessment.
11th week: Lecture Dose-Response Assessment	12th week: Lecture: Risk Characterization. Risk Projections and Management.
13th week: Lecture: Ecological Risk Assessment. Stressor. Major Environmental Stressors.	14th week: Lecture: Receptors. Exposure Pathways. Risk Assessment Process
15th week: End-term exam (2nd test).	

Requirements

A, for a signature:

Attendance at lectures is recommended, but not compulsory.

During the semester there are two **tests**: a mid-term test around the 8th week and an end-term test in the 15th week. Students have to sit for the tests and earn at least 51% of the maximum points.

B, for a grade:

The grade is determined based on the total points of the two mid-semester tests. The minimum requirement is 51% of the total points. Based on the score of the tests, the grade for the course is given according to the following (score/grade): 0-50 = fail (1); 51-62 = pass (2); 63-75 = satisfactory (3); 76-88 = good (4); 89-100 = excellent (5).

If the score of the test is below 50, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Subject group "Differentiated Professional Subjects" for Environmental Technology, Planning, Constructions Specialization

Environmental Technologies I (Soil Protection)

Code: MK5KVT1K03K117-EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 2nd year, 1st semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

This course provides an introduction to soil science with a focus on the physical, chemical, and environmental properties of soils. Students gain practical experience in determining key soil parameters, including bulk density, particle density, porosity, particle size distribution, hydraulic conductivity, permeability, and infiltration rates. The course also introduces data analysis and visualization techniques using Grapher software for drawing, fitting, and interpreting soil-related datasets. In addition, the course covers soil formation processes, weathering mechanisms, and different types of soil erosion, including water, wind, and chemical erosion. Students learn about biological, physical, thermal, and chemical remediation methods for polluted soils through calculations, demonstrations, and case studies. Practical exercises include soil sampling, composting optimization, contamination assessment, and the use of soil databases such as the European Soil Data Centre (ESDAC).

Literature:

Required:

- *Morgan, R. P. C. (2005): Soil Erosion and Conservation, Third Edition, Wiley-Blackwell, 316. p., ISBN: 978-1-405-11781-4*
- *Hillel, D. (2003): Introduction to Environmental Soil Physics, ISBN: 978-0123486554.*

Recommended:

- *Huang, P. M., Li, Y., Sumner, M.E. (2012): Handbook of Soil Sciences: Properties and Processes, Second Edition, Elsevier, 1442 p., ISBN: 9781439803059.*

Schedule

1st week Registration week	
2nd week: Lecture: Introduction to soil science Practice: Calculation of bulk density, particle density and porosity	3rd week: Lecture: Major soil physical properties I. Practice: Density determination by pycnometer
4th week: Lecture: Major soil physical properties II. Practice: Calculation and drawing of particle size distribution and particle density function	5th week: Lecture: Background of Grapher software Practice: Drawing and fitting in Grapher software
6th week: Lecture: Remediation methods of polluted soils: Biological treatment Practice: Optimization of composting key parameters	7th week: Lecture: Remediation methods of polluted soils: Physical/Thermal treatment Practice: Calculation of infiltration depth of oil pollution
8th week: 1st drawing week	
9th week: Lecture: Remediation methods of polluted soils: Chemical treatment Practice: Calculation of the volume of the contaminated soil	10th week: Lecture: Soil formation: Physical/Mechanical weathering Practice: Universal Soil Loss Equation (USLE)
11th week: Lecture: Soil formation: Chemical weathering Practice: Demonstration of soil sampling	12th week: Lecture: Soil water erosion Practice: Demonstration of hydraulic conductivity, permeability and infiltration rate of soils
13th week: Lecture: Soil wind erosion Practice: Demonstration of texture, plasticity and structure of soils	14th week: Lecture: Soil chemical erosion Practice: European Soil Data Centre (ESDAC)
15th week: 2nd drawing week, Test	

Requirements
A, for a signature: -

B, for a grade: written test

Environmental Technologies II (Water Protection)

Code: MK5KVT2K03K117-EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 2nd year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite(s): -

Topics:

Completing the course, students will be familiar with the actual issues and challenges, as well as programs, laws, and technical solutions concerning qualitative and quantitative water resource protection and environmental damage prevention, particularly for water. Considering water demand and supply characteristic, the course includes related elements of urban water management. The teaching material deals with the urban hydrology, water withdrawal aspects, water and wastewater treatment technologies and by-product management.

Completing the practice, students will gain skills on water analytical methods, they will understand and be able to apply modelling of water technological monitoring.

Literature:

Required:

- Mackenzie L. Davis: Water and Wastewater Engineering, Design Principles and Practice, McGraw-Hill Companies, Inc. New York, 2010, ISBN: 978-0-07-171385-6

Recommended:

- Frank R. Spellman: Handbook of Water and Wastewater Treatment Plant Operations (Third Edition), CRC Press by Taylor & Francis Group, Boca Raton, 2014, ISBN-13: 978-1-4665-5338-5 (eBook - PDF)
- Jerry A. Nathanson, Richard A. Schneider: Basic Environmental Technology (Sixth Edition), PEARSON, USA, 2015, ISBN: 978-0-13-284014-9

Schedule

1st week Registration week	
2nd week:	3rd week:

Lecture: The origin and quality of water, water resources, water demand, water use issues.

The natural and artificial cycle of water.

Practice: Practices in blocks!0

4th week:

Lecture: Urban hydrology: Climatic characteristics in urban environments. The impact of urbanization on water management. Problems, present solutions.

Practice: -

6th week:

Lecture: Drinking water treatment, waterworks operations.

Practice: -

8th week:

Lecture: Wastewater treatment technology, methods II

Practice: -

10th week:

Lecture: Future challenges of urban hydrology.
The role of green infrastructures in urban water management. Remote sensing and GIS in urban hydrology.

Practice: -

Lecture: The composition of waters, their pollutants, water quality control/protection. Water quality control.

Practice: -

5th week:

Lecture: Urban water management. Water demand, water withdrawal.

Practice: -

7th week:

Lecture: Wastewaters, its collection systems. Wastewater treatment technology, methods I

Practice: -

9th week:

Lecture: Natural water treatment processes. Treated wastewater disposal. By-products management of water treatment.

Practice: -

Practices in blocks!

Laboratory work and safety training

Schedule of Laboratory Practice:

- Application of breakpoint chlorination for ammonium removal from water (**BPC**)
- Modelling of coagulation-flocculation in water treatment using a flocculator (Jar-test) (**COAG**)
- Examination of the microbiological characteristics of waters (**MBT**)

Requirements

A, for a signature and lab grade:

The lab grade is prerequisite of the signature!

Participation at practice classes is compulsory. Students must attend practice classes and may not miss any practice class during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Being late is equivalent with an absence. In case of absence due to health issues, a medical certification needs to be presented. Missed practice classes must be made up for at a later date, being discussed with the tutor. The weekly syllabus covers the particular topics and gives a full description of the experiments.

Each week the laboratory session begins or closes with a short test (no more than 20 minutes) based exclusively on the preparatory material of that week of the experiments carried out. There are three short tests during the semester. Lab grading is based on a five-level scale: 1 (fail), 2 (pass), 3 (satisfactory), 4 (good), 5 (excellent) calculated as an average of the tests' results and measurement reports. The minimum requirement for the short tests is 50%.

B, for an exam grade:

The theoretical part ends in oral exam based on predetermined topic list. The signature is prerequisite of the oral exam! The oral examination shall be assessed on a five-grade scale. If oral exam is failed, students can retake it in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

The course ends in exam grade, the grade for the theoretical part counts is 66.66% and the lab grade counts is 33.33% (Satisfactory level is the criterion in both parts).

Environmental Technologies III (Air and Noise Protection)

Code: MK5KVT3K03K117-EN

ECTS Credit Points: 3

Evaluation: mid-term grade

Year, Semester: 2nd year, 1st semester

Number of teaching hours/week (lecture + practice): 0+3

Prerequisite: -

Topics:

Within the course, students become familiar with the principles of urban air quality monitoring and assessment, the characteristics of transport-related air pollution, biofuels, modern technologies for measuring and reducing vehicle emissions and calculation tasks related to these topics. Furthermore, students learn about the characteristics of odour as

an air pollution problem, the environmental behaviour of persistent organic pollutants (POPs) and aerosols.

The noise protection part covers the following topics: The concept of noise. Basic Concepts. Levels. Frequency distribution. Sound propagation in free space. Indoor propagation. Room acoustics. Sound absorption, reverberation. Sense acoustics. Strategic noise maps.

Literature:

Required:

- Noel de Nevers: Air Pollution Control Engineering, (Third Edition, 2017) ISBN 978-1-4786-2905-4
- Lev S. Ruzer and Naomi H. Harley: Aerosol Handbook: Measurement, Dosimetry, and Health Effects, (Second Edition, 2013) ISBN 978-1-4398-5510-2
- Lawrence K. Wang, Norman C. Pereira, Yung-Tse Hung: Advanced Air and Noise Pollution Control, 2007, ISBN 1-59259-779-3
- David A. Bies, Colin Hansen, Carl Q. Howard, Kristy L. Hansen: Engineering Noise Control, 6th Edition, 2023, ISBN 9780367414788

Recommended:

- Enda Murphy, Eoin A King: Environmental Noise Pollution - Noise Mapping, Public Health, and Policy, 2nd Edition, 2022, ISBN: 9780128201015

Schedule

1st week Registration week	
2nd week: Practice: Air chemistry basic concepts. The most important air pollutants and their environmental and health effects. Calculations.	3rd week: Practice: Urban air quality monitoring and assessment. Calculations.
4th week: Practice: Transport-related air pollution, biofuels, modern technologies for measuring and reducing vehicle emissions. Calculation	5th week: Practice: Odour as an air pollution problem. Calculations
6th week: Practice: Environmental behaviour of persistent organic pollutants (POPs) and aerosols.	7th week: Practice: Mid-term test.
8th week: 1st drawing week	
9th week: Practice: The concept of noise. Basic Concepts. Levels. Operations with levels.	10th week: Practice: Free space propagation, modifying terms. Point, line, and

Frequency analysis (octave, 1/3 octave bands, FFT. Calculations.	surface sound sources. Vibration measurements and instruments.
11th week:	**12th week:**
Practice: Indoor propagation. Sound absorption, reverberation time, energy distribution in enclosed space. Acoustic insulation, noise reduction.	**Practice:** Effects on humans. Sense acoustics. Phon, Son. Fletcher-Munson curves. Filters. Basic concepts of vibration. Human vibrations. Workplace vibration measurement (instruments, sensors). Modes of vibration reduction.
13th week:	**14th week:**
Practice: Noise mapping.	**Practice:** Test.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practices is compulsory. Students have to attend the practice classes and submit the prescribed tasks.

Students have to submit two **reports** from the noise part as scheduled minimum at a sufficient level.

B, for a grade:

The grade is determined based on the average results for the air and noise part.

Environmental Technologies IV (Waste Recycling)

Code: MK5KVT4K03K117-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 2nd year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

Legislation and regulation of wastes. Municipal solid waste (MSW), hazardous waste, sewage sludge, other wastes. Life cycling analysis of materials recycling. Green engineering and sustainable design aspects. Integrated waste management strategies. Waste containers, collection systems, transport. The logistics of solid waste collection. Types of collection systems, equipment, and personnel requirements.

European Union waste management policy, waste strategy in the EU. The economics of waste management. Options of waste treatment and disposal. Waste landfill, types of waste landfilled. Waste incineration, incineration technologies. Other waste treatment

technologies: pyrolysis, gasification, composting, anaerobic digestion. Composting of municipal solid wastes. Environmental, public, and industrial health considerations. Hazardous waste definition, classification and generation.

Literature:

Required:

- Jerry A. Nathanson, Richard A. Schneider: Basic Environmental Technology: Water Supply, Waste Management and Pollution Control. Prentice Hall (6th Edition, 2015), 456 pages, ISBN-13: 9780132840149
- George Tchobanoglous and Frank Kreith: Handbook of Solid Waste Management. McGraw-Hill Education (2nd edition, 2002), 950 pages, 2002, ISBN-13: 9780071356237

Recommended:

- Paul T. Williams, Waste Treatment and Disposal. John Wiley & sons, Ltd. (2nd edition, 2005), 392 pages, ISBN-13: 9780470849132
- Trevor Letcher, Daniel Vallero: Waste: A Handbook for Management. Academic Press (1st edition, 2011), 604 pages, ISBN 9780123814753
- Alireza Bahadori: Waste Management in the Chemical and Petroleum Industries, Wiley, 2013. ISBN: 978-1-118-73175-8

Schedule

1st week Registration week	
2nd week: Lecture: The current situation and challenges of waste management in the world. Environmental, public, and industrial health considerations. Practice: Progress and challenges to the global waste management system.	3rd week: Lecture: Legislation and regulation of wastes. European Union waste management policy, waste strategies. Practice: Challenges in legislation, recycling system and technical system of waste electrical and electronic equipment in China.
4th week: Lecture: Options of waste treatment and disposal. The economics of waste management. Waste management plans. Practice: Toward the implementation of new regional bio-waste management plans: Environmental assessment of	5th week: Lecture: The logistics of solid waste collection. Waste containers, types of collection systems, equipment, and personal requirements. Practice: Municipal solid waste collection optimization in Singapore.

different waste management scenarios in Catalonia.

6th week:

Lecture: Waste landfill, types of waste landfilled. Landfills for hazardous waste, for non-hazardous waste, and for inert waste.

Practice: Modelling of energy consumption and environmental life cycle assessment for incineration and landfill systems of municipal solid waste management - A case study in Tehran Metropolis of Iran.

7th week:

Lecture: Waste incineration, incineration technologies. Negative effects on the environment caused by the incineration of waste. Operational conditions, technical requirements, and emission limit values for incineration and co-incineration plants.

Practice: Waste to energy – key element for sustainable waste management.

8th week:

Lecture: Life cycling analysis of materials recycling. Recyclable materials, municipal recycling facilities. Turning waste into a resource and build up a circular economy. Green engineering and sustainable design aspects. Integrated waste management strategies.

Practice: A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems.

9th week:

Lecture: Composting, anaerobe digestion. Composting of municipal solid wastes. Treatment methods for biodegradable waste. Processing and utilizing plastic and rubber wastes, degradable plastics and their significance in waste management.

Practice: Comparison of the organic waste management systems in the Danish–German border region using life cycle assessment (LCA).

10th week:

Lecture: Other waste treatment technologies: pyrolysis, gasification. Shipment of waste around the world. Waste from the chemical industry, their handling and utilization.

Practice: Comparative assessment of municipal sewage sludge incineration, gasification and pyrolysis for a sustainable sludge-to-energy management in Greece.

Requirements

A, for a signature:

Attending practices is compulsory. Attendance at the lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice class with another group.

Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed practice classes have to be made up for at a later date previously discussed with the tutor.

B, for a grade:

Everybody has to take two mid-term tests during the semester.

The minimum requirement for the mid-term tests is 60%, respectively. Based on the scores of the mid-term tests, the grade for each test is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5). All the two tests have to be performed at least pass (grade 2). Students can make up or improve their grades at the last week of the semester. At the end of the semester everybody will get a final grade on the basis of the average of the grades.

Recovery Systems of Renewable Energy Sources I

Code: MK5MEF1L04KX17-EN
ECTS Credit Points: 4
Evaluation: Exam
Year, Semester: 2nd year, 1st semester
Number of teaching hours/week (lecture + practice): (lecture + practice): 2+1
Prerequisite:-

Topics:

This course provides an introduction to renewable energy systems with a primary focus on solar energy technologies. Students gain an understanding of energy policy, primary and renewable energy sources, meteorological fundamentals, solar radiation, and the influence of orientation, tilt angle, and shading on energy production. The course covers the design and application of solar thermal systems for domestic hot water, space heating, and swimming pool heating, as well as the operating principles and design of photovoltaic systems, including grid-connected and stand-alone installations, inverters, and system losses. Practical sessions develop engineering skills through energy calculations, system sizing, and the application of professional photovoltaic design software.

Literature:

Required:

- Renewable Energy Engineering Nicholas Jenkins, Janaka Ekanayake Cambridge University Press, 2017.

Recommended:

- Twidell, J., Weir, T. Renewable Energy Resources. Routledge, 2021.

Schedule

1st week Registration week	
2nd week: **Lecture:** Energy policy of the European Union. Energy balances. **Practice:** Analysis of energy data	3rd week: **Lecture:** Primary energy sources and renewable energy sources. **Practice:** Exercises related to the lecture
4th week: **Lecture:** Basics of meteorology. Characteristics of solar radiation. **Practice:** Solar geometry calculations	5th week: **Lecture:** Effects of orientation, tilt angle and shading. **Practice:** Solar energy potential calculations
6th week: **Lecture:** Applications of solar energy utilization. **Practice:** Solar yield calculations	7th week: **Lecture:** Solar thermal collectors: construction, operation and types. **Practice:** Efficiency and solar fraction calculations
8th week: 1st drawing week	
9th week: **Lecture:** Solar domestic hot water systems. **Practice:** Design exercises	10th week: **Lecture:** Solar assisted space heating and swimming pool heating systems. **Practice:** Storage tank sizing
11th week: **Lecture:** Structure and operation of photovoltaic modules. **Practice:** Analysis of I–V curves	12th week: **Lecture:** Design of photovoltaic systems. **Practice:** PV system sizing
13th week: **Lecture:** Grid-connected and off-grid photovoltaic systems. **Practice:** Introductory PVsyst or PVGIS exercise	14th week: **Lecture:** Electrical aspects of photovoltaic systems: inverters and system losses. **Practice:** Midterm test
15th week: 2nd drawing week	

Requirements

A, for a signature: Attendance at practical classes according to the regulations.
The minimum requirement of the end-term test is 50%. The grade is given according to the following (score/grade): 0-49 = fail (1); 50-62 = pass (2); 63-75 = satisfactory (3); 76-88 = good (4); 89-100 =
excellent (5).

B, for a grade: Final grade = (Midterm test 50% + exam grade 50%.)

Recovery Systems of Renewable Energy Sources II

Code: MK5MEF2L03KX17-EN
ECTS Credit Points: 3
Evaluation: Exam
Year, Semester: 2nd year, 2nd semester
Number of teaching hours/week (lecture + practice): (lecture + practice): 2+1
Prerequisite:-

Topics:

Building upon the knowledge acquired in Renewable Energy Recovery Systems I, this course focuses on advanced renewable energy technologies for building applications. Students study geothermal energy utilization, shallow geothermal systems, heat pump technologies, biomass and biofuels, wind energy conversion, energy storage technologies, and hybrid renewable energy systems. The course also addresses the integration of renewable energy technologies into modern building energy systems. Practical sessions emphasize engineering calculations, performance evaluation, and the sizing and design of renewable energy systems based on real engineering applications.

Literature:

Required:

- Renewable Energy Engineering Nicholas Jenkins, Janaka Ekanayake Cambridge University Press, 2017.

Recommended:

- Twidell, J., Weir, T. Renewable Energy Resources. Routledge, 2021.

Schedule

1st week Registration week	
2nd week: **Lecture:** Fundamentals of geothermal energy. **Practice:** Lindal diagram.	**3rd week:** **Lecture:** Shallow geothermal systems. **Practice:** Ground heat exchanger sizing.
4th week: **Lecture:** Direct utilization of geothermal energy. **Practice:** Design exercises.	**5th week:** **Lecture:** Heat pumps: operating principles and types. **Practice:** COP and EER calculations.
6th week: **Lecture:** Building services applications of heat pump systems. **Practice:** Design exercises.	**7th week:** **Lecture:** Energy utilization of biomass. **Practice:** Fuel property calculations.
8th week: 1st drawing week	
9th week:	**10th week:**

Lecture: Biomass boilers, pellet systems and wood-gasification systems. **Practice:** Buffer tank sizing. **11th week:** **Lecture:** Fundamentals of wind energy. **Practice:** Evaluation of wind data. **13th week:** **Lecture:** Energy storage and hybrid renewable energy systems. **Practice:** Design exercises.	**Lecture:** Biogas and biofuels. **Practice:** Energy calculations. **12th week:** **Lecture:** Types and operation of wind turbines. **Practice:** Wind energy calculations. **14th week:** **Lecture:** Integrated renewable energy systems in buildings. **Practice:** Midterm test.
15th week: 2nd drawing week	

Requirements
A, for a signature: Attendance at practical classes according to the regulations.
The minimum requirement of the end-term test is 50%. The grade is given according to the following (score/grade): 0-49 = fail (1); 50-62 = pass (2); 63-75 = satisfactory (3); 76-88 = good (4); 89-100 =
excellent (5).

B, for a grade: Final grade = (Midterm test 50% + exam grade 50%.)

Near-natural and Cleaner Production Technologies

Code: MK5TKTTK03K117-EN
ECTS Credit Points: 3
Evaluation: written end-term test
Year, Semester: 2nd year, 1st semester
Number of teaching hours/week (lecture + practice): 1 + 2
Prerequisite: -

Topics:
Students attending the course become acquainted with the importance of near-natural and cleaner production technologies. The course presents the life-cycle approach to products and services, including cleaner production options, cleaner production and its relation to similar concepts, environmental management systems, integrated product policy, extended producer responsibility and integrated pollution prevention and control. Students learn the basic concepts and practical application of Cleaner Production (CP), clarify common misconceptions about CP, and review the main obstacles to successful CP policy development and mainstreaming. Selected technologies are discussed through practical examples, including paper production, biogas production, composting, poultry

rearing, eco-farming, slaughterhouses and animal by-products, and food, drink and milk industries.

Literature:

Required:

- UNEP International Resource Panel (2024): Global Resources Outlook 2024: Bend the Trend – Pathways to a Liveable Planet as Resource Use Spikes. United Nations Environment Programme, Nairobi.
- European Commission (2020): A new Circular Economy Action Plan: For a cleaner and more competitive Europe. Brussels.
- Regulation (EU) 2024/1781 of the European Parliament and of the Council establishing a framework for setting ecodesign requirements for sustainable products.
- GIZ (2021): RECP Navigator: Resource Efficiency and Cleaner Production.
- UNIDO / EU4Environment (2021): Resource Efficient and Cleaner Production: A Tool for Sustainable Industrial Development.

Recommended:

- European Commission / JRC (2019): Best Available Techniques Reference Document for the Food, Drink and Milk Industries.
- European Commission / JRC (2023/2024): Best Available Techniques Reference Document for Slaughterhouses, Animal By-products and/or Edible Co-products Industries.
- European Commission (2023): Commission Implementing Decision (EU) 2023/2749 establishing BAT conclusions for slaughterhouses, animal by-products and/or edible co-products industries.
- European Commission / JRC (2015): Best Available Techniques Reference Document for the Production of Pulp, Paper and Board.
- European Commission / JRC (2017): Best Available Techniques Reference Document for the Intensive Rearing of Poultry or Pigs.
- European Commission (2024): Revised Industrial Emissions Directive / IED 2.0 background materials.

Schedule

1st week Registration week	
2nd week: **Lecture:** Introduction into cleaner production. Industrial impacts on the environment. **Practice:** Case study.	3rd week: **Lecture:** Environmental management systems, environmental management tools, LCA. **Practice:** Environmental tools in decision support systems; LCA in practice.
4th week: **Lecture:** Cleaner Production policy development cycle.	5th week: **Lecture:** Recent trends in Cleaner Production policy. **Practice:** Background regulations.

Practice: Policy tools and instruments; analysis and planning.	
6th week: **Lecture:** Promoting Cleaner Production. **Practice:** Case studies; corporate social responsibility.	7th week: **Lecture:** Air, water and soil pollution reduction; energy conservation; waste reduction. **Practice:** Case studies; sustainability reports.
8th week: 1st drawing week	
9th week: **Lecture:** Green engineering and cleaner production practices. **Practice:** Case study and practical analysis; end-of-pipe and clean(er) technologies.	10th week: **Lecture:** Food industry. **Practice:** Best available techniques; case studies.
11th week: **Lecture:** Intensive rearing of poultry, slaughterhouses and animal by-products industries. **Practice:** BAT technologies.	12th week: **Lecture:** Biogas production. **Practice:** BAT for biogas production.
13th week: **Lecture:** Eco-farming. **Practice:** Eco-farming in practice: crop production and animal husbandry.	14th week: **Lecture:** Production of paper. **Practice:** Paper production technologies; BAT technologies.
15th week: 2nd drawing week	

Requirements

A, for a signature: Attending practices is compulsory. Attendance at lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. If a student exceeds this limit, the subject will not be signed and the student must repeat the course. Students cannot make up any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent to an absence. In case of further absences, a medical certificate must be presented. Missed practice classes have to be made up at a later date previously discussed with the tutor.

B, for a grade: The course ends with a written end-term test. The minimum requirement of the end-term test is 60%. The grade is given according to the following scale: 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5). If the score of the test is below 60%, students can retake the test in conformity with the Education and Examination Rules and Regulations.

Complex Environmental Engineer Planning I.

Code: MK5KKP1K03KX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 2nd year, 1st semester

Number of teaching hours/week (lecture + practice): 0+3

Prerequisite: -

Topics:

Within the framework of this course students study and practice about the resolution of complex environmental and environmental engineering tasks

Literature:

Recommended:

- Christie G. Geonkopéis: Transport Processes and Separation Processes Principles (Includes Unit Operations) Forth Edition, 2008. ISBN 0-13-101367-X
- H. Scott Fogler: Elements of Chemical Reacton Engineering. Fourth Edition, 2006. Personal Education International. ISBN 0-13-127839-8
- Waren L.McCabe, Julian C Smith, Peter Harriott: Unit Operations of Chemical Engineering. Seventh Edition, McGraw Hill Higher Edition. 2005. ISBN 007-12-4710-6
- H. F. Hemond, E. J. Fechner-Levy: Chemical Fate and Transport in Environment. Second Edition, 2000. AP. ISBN-13: 978-0-12-340275-2.
- Bruce E. Logan: Environmental Transport Processes. JohnWiley and Son Inc. 1999. ISBN: 0-471-18871-9.
- Ekkehard Holzbecher: Environmental Modeling Using MATLAB, Springer, 2007. ISBN978-3-540-72936-5
- Ruth E Weiner, Robin A. Matthews: Environmental Engineering (Fourth Edition), Elsevier, 2003
- Shroder, John F and Sivanpillai, Ramesh: Biological and Environmental Hazards, Risks, and Disasters, Elsevier, 2015

Schedule

1st week Registration week	
2nd week: **Practice:** Environmental Systems Analysis Methods. Measurements in Environmental Engineering.	3rd week: **Practice:** Climate Modeling. Climate Change Impact Analysis for the Environmental Engineer. Adaptation Design to Sea Level Rise.
4th week: **Lecture:** Soil Physical Properties and Processes.	5th week: **Practice:** In Situ Soil and Sediment Remediation: Electrokinetic and Electrochemical Methods.

6th week: **Practice:** Natural or "Conventional" Water Quality Problems.	7th week: **Practice:** Wastewater Engineering. Wastewater Recycling.
8th week: 1st drawing week	
9th week: **Practice:** Design of Porous Pavements for Improved Water Quality and Reduced Runoff.	10th week: **Practice:** Air Pollution Control Engineering.
11th week: **Practice:** Waste Minimization and Reuse Technologies. Waste Reduction in Metals Manufacturing.	12th week: **Practice:** Industrial Waste Auditing.
13th week: **Practice:** Complex tasks.	14th week: **Practice:** Test
15th week: 2nd drawing week	

Requirements

A, for a signature:

Participation at **practice classes** is compulsory. Students have to attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date being discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Students have to submit one **homework assignment** as scheduled minimum at a sufficient level.

During the semester there is a **test:** the end-term test in the 14th week. Students have to sit for the tests and earn at least 51% of the maximum points.

B, for a grade:

The grade is determined on the basis of the test points. The minimum requirement is 51% of the total points. Based on the score of the tests, the grade for the course is given according to the following (score/grade):

- 0-50 = fail (1);
- 51-62 = pass (2);
- 63-75 = satisfactory (3);
- 76-88 = good (4);
- 89-100 = excellent (5).

If the score of the test is below 50, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Complex Environmental Engineer Planning II.

Code: MK5KKP1K03KX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 2nd year, 2nd semester

Number of teaching hours/week (lecture + practice): 0+3

Prerequisite: -

Topics:

Within the framework of this course, students learn about the identification, characterization, assessment and resolution of complex environmental and environmental engineering tasks.

Literature:

Recommended:

- Ruth E Weiner, Robin A. Matthews: Environmental Engineering (Fourth Edition), Elsevier, 2003
- Shroder, John F and Sivanpillai, Ramesh: Biological and Environmental Hazards, Risks, and Disasters, Elsevier, 2015
- Judit T. Kiss: Introduction to Corporate Financial Decisions for Engineers and Engineering Managers, Debrecen University Press, 2016

Schedule

1st week:	2nd week:
Practice: Fundamentals of financial planning.	Practice: Static methods for evaluating investment projects, managing the time value of money.

3rd week:	4th week:
Practice: Decision rules, calculations, sample tasks.	**Practice:** Dynamic Project Evaluation (Sensitivity Testing).
5th week:	6th week:
Practice: Dynamic Project Evaluation (Profit Threshold Analysis).	**Practice:** Dynamic Project Evaluation (Monte-Carlo Simulation, Decision Tree Method).
7th week:	8th week:
Practice: Complex tasks.	**Practice:** Complex tasks.
9th week:	10th week:
Practice: Complex tasks.	**Practice:** Test.

Requirements

A, for a signature:

Attending practices is compulsory. Students have to attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date being discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Students have to submit one **home assignment** as scheduled minimum at a sufficient level.

During the semester, there is a **test**: the end-term test on the 10th week. Students have to sit for the tests and earn at least 51% of the maximum points.

B, for a grade:

The grade is determined based on the test points. The minimum requirement is 51% of the total points. Based on the score of the tests, the grade for the course is given according to the following (score/grade): 0-50 = fail (1); 51-62 = pass (2); 63-75 = satisfactory (3); 76-88 = good (4); 89-100 = excellent (5).

If the score of the test is below 50, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Subject group "Differentiated Professional Subjects" for

Built Environment Specialization

Urban Climate

Code: MK5VKLTK03K217_EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 2nd year, 1st semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

Terminology of urban climatology; spatial and temporal extent and dynamics of urban climate, structure of urban atmosphere; the reasons of the development of urban climate; the modifications of the composition and pollution of the urban atmosphere are discussed in the frame of the lectures. Energy and water budgets of the urban surfaces, modifications in air humidity and precipitation in build-up areas; the urban heat island, its relationships to settlement size and morphology are examined. The heat island circulation is presented. Anthropogenic heat emissions from buildings with the dynamic balance of the heating season and positive feedbacks of the non-heating season; effects of urban green areas and issues of street comfort are discussed.

Methods of urban climate research, meteorological instruments used for urban climate measurements; tools for urban climate modelling; application of results of urban climate research in spatial planning are discussed in the frame of the practice.

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Literature:

Required:

- T. R. Oke: Boundary Layer Climates. Routledge (1997) ISBN-10: 0415043190
- T. R. Oke, G. Mills, A. Christen, J. A. Voogt: Urban climate Cambridge University Press (2017) ISBN-10: 1107429536

Recommended:

- R. G. Barry, P. D. Blanken: Microclimate and Local Climate Cambridge University Press; (2016) ISBN-10: 1107145627

Schedule

1st week Registration week	
2nd week:	3rd week:

Lecture: Terminology of urban climatology. Vertical structure of the urban boundary layer. **Practice:** Spatial and temporal scales of urban climate research. .	**Lecture:** Diurnal and annual dynamics of urban climate processes. **Practice:** Urban climate measurement: in situ measurement methods and instruments.
4th week: **Lecture:** Reasons of the development of urban climate 1, modifications in the urban energy budget. **Practice:** Urban climate measurement techniques 2: remote sensing techniques.	**5th week:** **Lecture:** The reasons of the development of urban climate 2, modifications in the urban water budget. **Practice:** Methods and instruments for the determination of the sky view factor.
6th week: **Lecture:** The reasons of the development of urban climate 3: the role of urban geometry. **Practice:** Tools for urban climate/human bioclimate modelling 1: the RayMan software.	**7th week:** Modifications of the composition and pollution of the urban atmosphere, urban air quality and its effects on urban climate. **Lecture:** **Practice:** Tools for urban climate/human bioclimate modelling: the ENVIMET software.
8th week: 1st drawing week	
9th week: **Lecture:** Modifications of the climate parameters in build-up spaces 1: air humidity, precipitation and fog. **Practice:** urban climate models 1: urban radiation, energy and water budget models.	**10th week:** **Lecture:** Modifications of the climate parameters in build-up spaces 2: the spatial and temporal dynamics of the urban heat island. Their relationships to settlement size and morphology. **Practice:** urban climate models 2: urban heat island models.
11th week: **Lecture:** Modifications of the climate parameters in build-up spaces 3: urban winds, heat island circulations. **Practice:** Urban climate models 3: urban air flow and dispersion models.	**12th week:** **Lecture:** Anthropogenic heat emissions from buildings; dynamic energy balance of the heating season and positive feedbacks of the non-heating season. **Practice:** Use of results of urban climate measurements and modelling (case studies) 1.
13th week:	**14th week:**

Lecture: Impacts of green spaces on urban climate, park climates. Effects of urban climate on human comfort and health. **Practice:** Use of results of urban climate measurements and modelling (case studies) 2.	**Lecture:** Opportunities in urban climate mitigation and modification on micro and local scale. **Practice:** Tools, techniques and best practises of urban climate modification.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practices is compulsory. Attendance at lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes have to be made up for at a later date previously discussed with the tutor.

B, for a grade:

The course ends in a written end-term test.

The minimum requirement of the end-term test is 60%. The grade is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If the score of the test is below 60, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Urban Hydrology

Code: MK5VHDRK03K217-EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 2nd year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

ompleting the course, students will be familiar with the actual issues and challenges, as well as programs, laws, and technical solutions concerning qualitative and quantitative water resource protection and environmental damage prevention, particularly for water. Considering water demand and supply characteristic, the course includes related elements of urban water management. The teaching material deals with the urban hydrology, water withdrawal aspects, water and wastewater treatment technologies and by-product management.

Completing the practice, students will gain skills on water analytical methods, they will understand and be able to apply modelling of water technological monitoring.

Literature:

Required:

- Mackenzie L. Davis: Water and Wastewater Engineering, Design Principles and Practice, McGraw-Hill Companies, Inc. New York, 2010, ISBN: 978-0-07-171385-6

Recommended:

- Frank R. Spellman: Handbook of Water and Wastewater Treatment Plant Operations (Third Edition), CRC Press by Taylor & Francis Group, Boca Raton, 2014, ISBN-13: 978-1-4665-5338-5 (eBook - PDF)
- Jerry A. Nathanson, Richard A. Schneider: Basic Environmental Technology (Sixth Edition), PEARSON, USA, 2015, ISBN: 978-0-13-284014-9

Schedule

1st week Registration week

2nd week: **Lecture:** The origin and quality of water, water resources, water demand, water use issues. The natural and artificial cycle of water. **Practice:** Practices in blocks!	3rd week: **Lecture:** The composition of waters, their pollutants, water quality control/protection. Water quality control. **Practice:** -
4th week: **Lecture:** Urban hydrology: Climatic characteristics in urban environments. The impact of urbanization on water management. Problems, present solutions. **Practice:** -	5th week: **Lecture:** Urban water management. Water demand, water withdrawal. **Practice:** -
6th week: **Lecture:** Drinking water treatment, waterworks operations. **Practice:** -	7th week: **Lecture:** Wastewaters, its collection systems. Wastewater treatment technology, methods I **Practice:** -
8th week:	9th week:

Lecture: Wastewater treatment technology, methods II **Practice:** -	**Lecture:** Natural water treatment processes. Treated wastewater disposal. By-products management of water treatment. **Practice:** -
10th week: **Lecture:** Future challenges of urban hydrology. The role of green infrastructures in urban water management. Remote sensing and GIS in urban hydrology. **Practice: -**	

Practices in blocks!
Laboratory work and safety training
Schedule of Laboratory Practice:

1. Application of breakpoint chlorination for ammonium removal from water (**BPC**)
2. Modelling of coagulation-flocculation in water treatment using a flocculator (Jar-test) (**COAG**)
3. Examination of the microbiological characteristics of waters (**MBT**)

Requirements
A, for a signature and lab grade:
The lab grade is prerequisite of the signature!
Participation at practice classes is compulsory. Students must attend practice classes and may not miss any practice class during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Being late is equivalent with an absence. In case of absence due to health issues, a medical certification needs to be presented. Missed practice classes must be made up for at a later date, being discussed with the tutor. The weekly syllabus covers the particular topics and gives a full description of the experiments.
Each week the laboratory session begins or closes with a short test (no more than 20 minutes) based exclusively on the preparatory material of that week of the experiments carried out. There are three short tests during the semester. Lab grading is based on a five-level scale: 1 (fail), 2 (pass), 3 (satisfactory), 4 (good), 5 (excellent) calculated as an average of the tests' results and measurement reports. The minimum requirement for the short tests is 50%.
B, for an exam grade:
The theoretical part ends in oral exam based on predetermined topic list. The signature is prerequisite of the oral exam! The oral examination shall be assessed on a five-grade scale. If oral exam is failed, students can retake it in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
The course ends in exam grade, the grade for the theoretical part counts is 66.66% and the lab grade counts is 33.33% (Satisfactory level is the criterion in both parts).

Air Pollution Control

Code: MK5LETVK03K217-EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 2nd year, 1st semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

Air pollution control. Emission, transport, receptors. Units and standards. Air pollution effects on human health, property and visibility. Air pollution measurements, emission estimates. Meteorology for environmental engineers. Air pollutant concentration models (Fixed-box models, diffusion models, long-term average applying Guassian Plume models etc.). General ideas in air pollution control. The nature of particulate pollutants (Primary and secondary particulates. Settling velocity and drag forces. Particle size distribution functions, Particles in our bodies). The motor vehicles problem. Air pollutants and global climate. Persistent organic compounds. Indoor air pollution. The radon problem. Environmental impact of waste-to-energy. The odour problem.

Literature:

Required:

- Noel de Nevers: Air Pollution Control Engineering, (Third Edition, 2017) ISBN 978-1-4786-2905-4
- Lev S. Ruzer and Naomi H. Harley: Aerosol Handbook: Measurement, Dosimetry, and Health Effects, (Second Edition, 2013) ISBN 978-1-4398-5510-2

Recommended:

- Kalogirou, Efstratios N.: Waste-to-energy technologies and global applications, ISBN 9781315269061.

Schedule

1st week Registration week	
2nd week: **Lecture:** Air pollution control. Emission, transport, receptors. Units and standards. **Practice:** Calculations.	**3rd week:** **Lecture:** Air pollution effects on human health, property and visibility. Animal experiments. Short-term exposure of

	human volunteers. Epidemiology. Regulations to protect human health. **Practice:** Calculations.
4th week: **Lecture:** Air pollution control laws and regulations, and air pollution control philosophies. Air quality standards. Regional problems. Emission trading. **Practice:** Problems and examples.	**5th week:** **Lecture:** Air pollution measurements, emission estimates. Representative sample. Getting the representative sample to the detector. Concentration determination. Averaging. Standard analytical methods. Determining pollutant flow rates. Isokinetic sampling. Emission factors. Visible emissions. **Practice:** Calculations.
6th week: **Lecture:** Meteorology for environmental engineers. Horizontal and vertical motion in the atmosphere. Winds. Temperature inversions. **Practice:** Calculations.	**7th week:** **Lecture:** Air pollutant concentration models: Fixed-box models. Diffusion models. Long-term average applying Guassian Plume models. Pollutant creation and decay in the atmosphere. Multiple cell multispecies models. Receptor-oriented and source-oriented air pollution models. **Practice:** Examples.
8th week: 1st drawing week	
9th week: **Lecture:** General ideas in air pollution control. Alternatives. Resource recovery. The nature of particulate pollutants: Primary and secondary particulates, Settling velocity and drag forces, Particle size distribution functions, Particles in our bodies **Practice:** Calculations.	**10th week:** **Lecture:** Environmental impact of Waste-to-Energy. Emissions. Properties and toxicity. Prevention and abatement. Sources and health effects. **Practice:** Problems and examples.
11th week: **Lecture:** The motor vehicles problem. Air pollutants and global climate. **Practice:** Problems and examples.	**12th week:** **Lecture:** Persistent organic compounds. **Practice:** Calculations.
13th week: **Lecture:** Indoor air quality. The radon problem.	**14th week:** **Lecture:** The main odour problems. **Practice:** Problems and examples.

Practice: Problems and examples.

15th week: 2nd drawing week

Requirements

A, for a signature:

Attending practices is compulsory. Attendance at the lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed practice classes have to be made up for at a later date previously discussed with the tutor.

B, for a grade:

The course ends with a written end-term test.

The minimum requirement of the end-term test is 51%. The grade is given according to the following (score/grade): 0-50 = fail (1); 51-62 = pass (2); 63-75 = satisfactory (3); 76-88 = good (4); 89-100 = excellent (5).

If the score of the test is below 50%, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Bridges and Structures

Code: MK5TAR1S3TX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 2st year, 1st semester

Number of teaching hours/week (lecture + practice): 2 + 0

Prerequisite: -

Topics:

History of bridges. Bridges classes. Norms and preliminary works. Foundations, substructures and equipment. Dilatations. Structure and building techniques of steel bridges. Steel beam bridges. Steel frame, arch and suspension bridges. Orthotropic plates. Structure and building techniques of concrete bridges. Concrete beam, frame and arch bridges. Prestressing techniques. Precast pretensioned girder bridges. Concrete box girders. Structures and building techniques of cable-stayed bridges. Composite and timber

bridges. Test loading, monitoring and maintenance and strengthening techniques. Reservoirs, bunkers water-towers.

Literature:

Required:

- M. J. Ryall, G. A. R. Parke, J. E. Harding (2000): The Manual of Bridge Engineering, Thomas Telford
- H. G. Tyrrell (2008): History of Bridge Engineering; Stubbe Press

Recommended:

- *fib Bulletin* N° 39. Seismic bridge design and retrofit - structural solutions. State-of-art report (300 pages, ISBN 978-2-88394-079-6, May 2007).
- *fib Bulletin* N° 32. Guidelines for the design of footbridges. Guide to good practice (160 pages, ISBN 978-2-88394-072-7, November 2005).
- *fib Bulletin N° 30. Acceptance of stay cable systems using prestressing steels. Recommendation (80 pages, ISBN 978-2-88394-070-3, January 2005)*
- *fib Bulletin* N° 29. Precast concrete bridges. State-of-art report (84 pages, ISBN 978-2-88394-069-7, November 2004).
- *fib Bulletin* N° 9. Guidance for good bridge design. Part 1 – Introduction. Part 2 – Design and construction aspects. Guide to good practice (190 pages, ISBN 978-2-88394-049-9, July 2000).

Schedule

1st week Registration week	
2nd week: Lecture: History of bridges. Bridges classes.	3rd week: Lecture: Norms and preliminary works.
4th week: Lecture: Foundations, substructures and equipment. Dilatations.	5th week: Lecture: Structure and building techniques of steel bridges. Steel beam bridges.
6th week: Lecture: Steel frame, arch and suspension bridges. Orthotropic plates.	
8th week: Lecture: Structure and building techniques of concrete bridges. Concrete beam, frame and arch bridges.	9th week: Lecture: Prestressing techniques. Precast pretensioned girder bridges. Concrete box girders. Reservoirs, bunkers water-towers.
10th week: Structures and building techniques of cable-stayed bridges. Composite and timber bridges. Test loading, monitoring	

and maintenance and strengthening techniques.

Requirements

Participation at lectures is compulsory. Students have to attend lectures and may not miss more than three occasions during the semester. In case a student misses more than three, the subject will not be signed and the student must repeat the course. Attendance at the lectures will be recorded by the staff of the department. Being late counts as an absence. In case of further absences, a medical certificate needs to be presented. Students are required to bring calculators and the printed materials of the lectures to each class. Active participation is evaluated by the teacher in every class. Active student participation should be required. Students have to submit the test and the presentation as scheduled minimum at a sufficient level.

A, for a signature:

Students have to reach at least 40 points from the 60 points on the test and at least 21 points from the 40 points on presentation. The presentation has to be handed in personally. One will get questions about the presentation.

B, for a mid-semester grade:

The course ends with a mid-semester grade. Based on the summa points of the test and the presentation, the mid-semester grade is defined in the following way:

Test:	Maximum:	60 points	Minimum:	40 points
Homework:	Maximum:	40 points	Minimum:	21 points
Summa points:	Maximum:	100 points	Minimum:	61 points

Score/Grade: 0-60 = fail (1); 61-70 = pass (2); 71-80 = satisfactory (3); 81-90 = good (4); 91-100 = excellent (5).

Noise and Vibration Protection

Code: MK5ZRVDK04K217-EN

ECTS Credit Points: 4

Evaluation: mid-semester grade

Year, Semester: 2nd year, 1st semester

Number of teaching hours/week (lecture + practice): 1+3

Prerequisite: -

Topics:

The theoretical part of the subject encompasses the following topics: The concept of noise. Basic Concepts. Levels. Frequency distribution. Sound propagation in the free space. Indoor propagation. Room acoustics. Sound absorption, reverberation. Sense acoustics. Strategic noise maps. Mechanical vibrations. Human vibrations.

Practice: noise and vibration measurements, calculations and noise mapping.

Literature:

Required:

- David A. Bies, Colin Hansen, Carl Q. Howard, Kristy L. Hansen: Engineering Noise Control, 6th Edition, 2023, ISBN 9780367414788
- Enda Murphy, Eoin A King: Environmental Noise Pollution - Noise Mapping, Public Health, and Policy, 2nd Edition, 2022, ISBN: 9780128201015

Recommended: -

Schedule

1st week Registration week	
2nd week: Lecture: The concept of noise. Basic Concepts. Levels. Operations with levels. Practice: Free space calculations.	3rd week: Lecture: Frequency analysis (octave, 1/3 octave bands, FFT). Practice: Free space calculations.
4th week: Lecture: Free space propagation, modifying terms. Practice: Indoor propagation calculations.	5th week: Lecture: Point, line, and surface sound sources. Practice: Indoor propagation calculations.
6th week: Lecture: Indoor propagation. Sound absorption, reverberation time, energy distribution in enclosed space. Practice: Noise measurements and instruments.	7th week: Lecture: Acoustic insulation, noise reduction. Practice: Noise measurements and instruments.
8th week: 1st drawing week	
9th week: Lecture: Effects on humans. Sense acoustics. Phon, Son. Fletcher-Munson curves. Filters. Practice: Test.	10th week: Lecture: Noise measurement and instruments. Environmental Noises, measurement backgrounds. Practice: Vibration measurements and instruments.
11th week: Lecture: Noise maps (strategic, environmental). Practice: Vibration measurements and instruments.	12th week: Lecture: Basic concepts of vibration. Practice: Noise mapping.
13th week: Lecture: Human vibrations. Practice: Noise mapping.	14th week: Lecture: Workplace vibration measurement (instruments,

	sensors). Modes of vibration reduction. **Practice:** Test.

15th week: 2nd drawing week

Requirements

A, for a signature:

Attendance at **lectures** is recommended, but not compulsory.

Attending practices is compulsory. Students has to attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date previously discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Students have to submit two **reports** as scheduled minimum at a sufficient level.

During the semester there are two **tests**: a mid-term test around the 8th week and an end-term test in the 15th week. Students have to sit for the tests and earn at least 51% of the maximum points.

B, for a grade:

The grade is determined on the basis of the total points of the two mid-semester tests. The minimum requirement is 51% of the total points. Based on the score of the tests, the grade for the course is given according to the following (score/grade): 0-50 = fail (1); 51-62 = pass (2); 63-75 = satisfactory (3); 76-88 = good (4); 89-100 = excellent (5).

If the score of the test is below 50, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Waste Management

Code: MK5HUGKK03K217-EN

ECTS Credit Points: 3

Evaluation: exam

Year, Semester: 2nd year, 2nd semester

Number of teaching hours/week (lecture + practice): 2+1

Prerequisite: -

Topics:

Legislation and regulation of waste types. Municipal solid waste (MSW), hazardous waste, sewage sludge, other waste types. Life cycling analysis of materials recycling. Green engineering and sustainable design aspects. Integrated waste management strategies. Waste containers, collection systems, transport. The logistics of solid waste collection. Types of collection systems, equipment, and personnel requirements.

European Union waste management policy, waste strategy in the EU. The economics of waste management. Options of waste treatment and disposal. Waste landfill, types of waste landfilled. Waste incineration, incineration technologies. Other waste treatment technologies: pyrolysis, gasification, composting, anaerobic digestion. Composting of municipal solid wastes. Environmental, public, and industrial health considerations. Hazardous waste definition, classification and generation.

Literature:

Required:

- Jerry A. Nathanson, Richard A. Schneider: Basic Environmental Technology: Water Supply, Waste Management and Pollution Control. Prentice Hall (6th Edition, 2015), 456 pages, ISBN-13: 9780132840149
- George Tchobanoglous and Frank Kreith: Handbook of Solid Waste Management. McGraw-Hill Education (2nd edition, 2002), 950 pages, 2002, ISBN-13: 9780071356237

Recommended:

- Paul T. Williams, Waste Treatment and Disposal. John Wiley & sons, Ltd. (2nd edition, 2005), 392 pages, ISBN-13: 9780470849132
- Trevor Letcher, Daniel Vallero: Waste: A Handbook for Management. Academic Press (1st edition, 2011), 604 pages, ISBN 9780123814753
- Alireza Bahadori: Waste Management in the Chemical and Petroleum Industries, Wiley, 2013. ISBN: 978-1-118-73175-8

Schedule

1st week Registration week	
2nd week: **Lecture:** The current situation and challenges of waste management in the world. Environmental, public, and industrial health considerations. **Practice:** Progress and challenges to the global waste management system.	3rd week: **Lecture:** Legislation and regulation of types. European Union waste management policy, waste strategies. **Practice:** Challenges in legislation, recycling system and technical system of waste electrical and electronic equipment in China.

4th week:

Lecture: Options of waste treatment and disposal. The economics of waste management. Waste management plans.

Practice: Toward the implementation of new regional biowaste management plans: Environmental assessment of different waste management scenarios in Catalonia.

5th week:

Lecture: The logistics of solid waste collection. Waste containers, types of collection systems, equipment, and personal requirements.

Practice: Municipal solid waste collection optimization in Singapore.

6th week:

Lecture: Waste landfill, types of waste landfilled. Landfills for hazardous waste, for non-hazardous waste, and for inert waste.

Practice: Modelling of energy consumption and environmental life cycle assessment for incineration and landfill systems of municipal solid waste management - A case study in Tehran Metropolis of Iran.

7th week:

Lecture: Waste incineration, incineration technologies. Negative effects on the environment caused by the incineration of waste. Operational conditions, technical requirements, and emission limit values for incineration and co-incineration plants.

Practice: Waste to energy – key element for sustainable waste management.

8th week:

Lecture: Life cycling analysis of materials recycling. Recyclable materials, municipal recycling facilities. Turning waste into a resource and build up a circular economy. Green engineering and sustainable design aspects. Integrated waste management strategies.

Practice: A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems.

9th week:

Lecture: Composting, anaerobe digestion. Composting of municipal solid wastes. Treatment methods for biodegradable waste. Processing and utilization of plastic and rubber wastes, degradable plastics and their significance in waste management.

Practice: Comparison of organic waste management systems in the Danish–German border region using life cycle assessment (LCA).

10th week:

Lecture: Other waste treatment technologies: pyrolysis, gasification. Shipment of waste around the world. Waste from the chemical industry, their handling and utilization.

Practice: Comparative assessment of municipal sewage sludge incineration,

gasification and pyrolysis for a sustainable sludge-to-energy management in Greece.

Requirements

A, for a signature:

Attending practices is compulsory. Attendance at lectures is recommended. Students have to attend practice classes and may not miss more than three practice classes during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented. Missed practice classes have to be made up for at a later date previously discussed with the tutor.

B, for a grade:

The course ends with a written end-term test.

The minimum requirement of the end-term test is 60%. The grade is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

If the score of the test is below 60, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Greenfield Management

Code: MK5KOR1S03TX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 2nd year, 2nd semester

Number of teaching hours/week (lecture + practice): 2 + 0

Prerequisite: -

Topics:

The main goal of the course is to introduce the greenfield types and their management as these areas and objects can help to manage the environmental challenges – including climate change induced pressures (e.g. flash floods) and pollution - of urban areas in a sustainable and cost effective way.

Therefore, students get basic knowledge on greenfield systems, their multifunctional values and benefits as well as on anthropogenic impacts on urban green surfaces. By introducing techniques and strategies for improving urban ecological sustainability, along

with good practices and weak solutions, students will be able to understand the importance of integrated greenfield, urban and landscape management.

The greenfield management and ecological planning courses side by side provide an integrated approach and knowledge on sustainable urban management.

Literature:

Required:

- John W. Dover, Green infrastructure, *Incorporating plants and enhancing biodiversity in buildings and urban environments*, Routledge Taylor and Francis Group, London and New York, 2015, ISBN 978-0-415-52123-9
- Kimberly Etingoff, Urban Ecology, *Strategies for Green Infrastructure and Land Use*, Apple Academic Press Taylor and Francis Group, Oakville, Canada, 2016, ISBN: 13: 978-1-77188-281-1

Recommended:

- Green space strategies, *a good practice guide*, Commission for the Architecture and Built Environment, UK, London, 2004 pp. 44
- GreenKeys Manual, A Strategy for urban green space (2008), URL: https://www.ioer.de/greenkeys/Greenkeys_Tools/manual.htm
- Harnik, P., Urban Green, *Innovative Parks for Resurgent Cities*, Island Press, Washington DC, 2010, pp. 208
- Palazzo, D. and Steiner, F. R., Urban Ecological Design, *A Process for Regenerative Spaces*, Island Press, Washington DC, 2011, pp. 328

Schedule

1st week Registration week	
2nd week: **Lecture:** Introduction to greenfield types and functions.	**3rd week:** **Lecture:** Green roofs and green walls.
4th week: **Lecture:** Urban ecosystems and the city as ecosystem.	**5th week:** **Lecture:** Ecosystem services of various greenfield systems.
6th week: **Lecture:** Impacts of green areas on urban climate and air quality.	**7th week:** **Lecture:** Impacts of green areas on the urban hydrological cycle. Green solutions.
8th week: 1st drawing week	Visiting the "passive house" of the university.
9th week: **Lecture:** Impacts of green areas on human health and well-being.	**10th week:** **Lecture:** Anthropogenic pressures and impacts on green fields.

11th week: Lecture: Sustainable management and development strategies for greenfield.	12th week: Lecture: Green Infrastructure Strategy – a new approach.
13th week: Lecture: Best practices and weak solutions around the world.	14th week: Lecture: Visiting Debrecen's different greenfield types.
15th week: 2nd drawing week: TEST	

Requirements

A, for a signature:

Participation at practice is compulsory. Students have to attend practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up a practice with another group. Attendance at practice will be recorded by the practice leader Students write a test at the end of the semester, and present the result of their group work carried out during the course.

Test: maximum: 100 points, minimum: 60 points

B, for grade:

The grade of the test and the presentation defining the mid semester grade.

The grade is given according to the following (score/grade): 0-59 = fail (1); 60-69 = pass (2); 70-79 = satisfactory (3); 80-89 = good (4); 90-100 = excellent (5).

Complex Environmental Engineer Planning I

Code: MK5KKP1K03KX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 2nd year, 1st semester

Number of teaching hours/week (lecture + practice): 0+3

Prerequisite: -

Topics:

Within the framework of this course, students study and practice the resolution of complex environmental problems and environmental engineering tasks.

Literature:

Required:

- Myer Kutz: Handbook of Environmental Engineering, Third Edition, 2018. Wiley Publisher, ISBN 13:9781119304401

Recommended:

- Christie G. Geonkopéis: Transport Processes and Separation Processes Principles (Includes Unit Operations) Forth Edition, 2008. ISBN 0-13-101367-X
- H. Scott Fogler: Elements of Chemical Reacton Engineering. Forth Edition, 2006. Personal Education International. ISBN 0-13-127839-8
- Waren L.McCabe, Julian C Smith, Peter Harriott: Unit Operations of Chemical Engineering. Seventh Edition, McGraw Hill Higher Edition. 2005. ISBN 007-12-4710-6
- H. F. Hemond, E. J. Fechner-Levy: Chemical Fate and Transport in Environment. Second Edition, 2000. AP. ISBN-13: 978-0-12-340275-2.
- Bruce E. Logan: Environmental Transport Processes. JohnWiley and Son Inc. 1999. ISBN: 0-471-18871-9.
- Ekkehard Holzbecher: Environmental Modeling Using MATLAB, Springer, 2007. ISBN978-3-540-72936-5
- Ruth E Weiner, Robin A. Matthews: Environmental Engineering (Fourth Edition), Elsevier, 2003
- Shroder, John F and Sivanpillai, Ramesh: Biological and Environmental Hazards, Risks, and Disasters, Elsevier, 2015

Schedule

1st week Registration week	
2nd week: **Practice:** Environmental Systems Analysis Methods. Measurements in Environmental Engineering.	3rd week: **Practice:** Climate Modeling. Climate Change Impact Analysis for the Environmental Engineer. Adaptation Design to Sea Level Rise.
4th week: **Lecture:** Soil Physical Properties and Processes.	5th week: **Practice:** In Situ Soil and Sediment Remediation: Electrokinetic and Electrochemical Methods.
6th week: **Practice:** Natural or "Conventional" Water Quality Problems.	7th week: **Practice:** Wastewater Engineering. Wastewater Recycling.

8th week: 1st drawing week	
9th week: **Practice:** Design of Porous Pavements for Improved Water Quality and Reduced Runoff.	10th week: **Practice:** Air Pollution Control Engineering.
11th week: **Practice:** Waste Minimization and Reuse Technologies. Waste Reduction in Metals Manufacturing.	12th week: **Practice:** Industrial Waste Auditing.
13th week: **Practice:** Complex tasks.	14th week: **Practice:** Test
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attending practices is compulsory. Students have to attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date being discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Students have to submit one **homework assignment** as scheduled minimum at a sufficient level.

During the semester there is a **test:** the end-term test in the 14th week. Students have to sit for the tests and earn at least 51% of the maximum points.

B, for a grade:

The grade is determined on the basis of the test points. The minimum requirement is 51% of the total points. Based on the score of the tests, the grade for the course is given according to the following (score/grade):

- 0-50 = fail (1);
- 51-62 = pass (2);
- 63-75 = satisfactory (3);
- 76-88 = good (4);
- 89-100 = excellent (5).

If the score of the test is below 50, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Complex Environmental Engineer Planning II

Code: MK5KKP1K03KX17-EN

ECTS Credit Points: 3

Evaluation: mid-semester grade

Year, Semester: 2nd year, 2nd semester

Number of teaching hours/week (lecture + practice): 0+3

Prerequisite: -

Topics:

Within the framework of this course, students study and practice the resolution of complex environmental and environmental engineering tasks.

Literature:

Recommended:

- Ruth E Weiner, Robin A. Matthews: Environmental Engineering (Fourth Edition), Elsevier, 2003
- Shroder, John F and Sivanpillai, Ramesh: Biological and Environmental Hazards, Risks, and Disasters, Elsevier, 2015
- Judit T. Kiss: Introduction to Corporate Financial Decisions for Engineers and Engineering Managers, Debrecen University Press, 2016

Schedule

1st week:

Practice: Fundamentals of financial planning.

2nd week:

	Practice: Static methods for evaluating investment projects, managing the time value of money.
3rd week: **Practice:** Decision rules, calculations, sample tasks.	**4th week:** **Practice:** Dynamic Project Evaluation (Sensitivity Testing).
5th week: **Practice:** Dynamic Project Evaluation (Profit Threshold Analysis).	**6th week:** **Practice:** Dynamic Project Evaluation (Monte-Carlo Simulation, Decision Tree Method).
7th week: **Practice:** Complex tasks.	**8th week:** **Practice:** Complex tasks.
9th week: **Practice:** Complex tasks.	**10th week:** **Practice:** Test.

Requirements

A, for a signature:

Attending practices is compulsory. Students have to attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students cannot make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date being discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct does not meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Students have to submit one **home assignment** as scheduled minimum at a sufficient level.

During the semester, there is a **test**: the end-term test on the 10th week. Students have to sit for the tests and earn at least 51% of the maximum points.

B, for a grade:

The grade is determined based on the test points. The minimum requirement is 51% of the total points. Based on the score of the tests, the grade for the course is given according to the following (score/grade): 0-50 = fail (1); 51-62 = pass (2); 63-75 = satisfactory (3); 76-88 = good (4); 89-100 = excellent (5).

If the score of the test is below 50, students can retake that test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

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DIPLOMA

The diploma shall be issued to the students within thirty days from having successfully passed the final exam at the grandaunt's special request. Otherwise, the diploma shall be awarded to him/her at the graduation ceremony of the Faculty.

The diploma is a public document bearing the coat of arms of the Hungary, certifying that the studies have been successfully completed in the Environmental Engineering master program. The diploma displays the name of the HEI (higher education institution), its institutional identification number, the serial number of diploma, the name and the place and date of birth of its holder, the level of qualification or the degree awarded, the program, the specialization, and its mode of attendance, as well as the place, day, month and year of issue. The diploma shall also contain the signature of the rector (in case of incapacitation the vice-rector), and shall bear the stamp of the University of Debrecen.

At the graduate's special request, a certificate on the completion of studies may be issued. The document does not contain any references to the qualification of the graduate, it merely proves that the he/she has taken a successful final exam. The Faculty shall keep a record of the certificates issued.

The diploma shall be assessed on the basis of the calculation of the grade average as follows:

Outstanding	4,81 – 5,00
Excellent	4,51 – 4,80
Good	3,51 – 4,50
Satisfactory	2,51 – 3,50
Pass	2,00 – 2,50

Diploma with Honours

A degree/diploma with honours shall be issued to a student who receives excellent grade in all the subjects of the final exam, excellent grade for the thesis, the grade average of all their exam and seminar grades is 4. The student did not receive a grade lower than satisfactory (3) during his/her studies.

MODEL CURRICULUM OF ENVIRONMENTAL ENGINEERING MSC

ENVIRONMENTAL TECHNOLOGY, PLANNING, CONSTRUCTIONS SPECIALIZATION

The curriculum of the program is available in excel format on the webpage of the Faculty of Engineering (www.eng.unideb.hu/en)

University of Debrecen Faculty of Engineering — **Full-time training**

Environmental Engineering Master's Program — **Curriculum**

Environmental Technology, Planning, Constructions Specialization

Number	Subject Group	Subject title	Knowledge Group	Code	1st semester				2nd semester				3rd semester				4th semester				Prerequisite
					lecture	practice	evaluation	credit	lecture	practice	evaluation	credit	lecture	practice	evaluation	credit	lecture	practice	evaluation	credit	
1.	Natural Sciences (22 credits)	Mathematical Modeling and Optimization	**00**	MK5MMO1A04KX17-EN					2	2	msg	4									
2.		Applied Statistics	**00**	MK5AST1A04KX17-EN	2	1	msg	4													
3.		Environmental Chemistry and Environmental Toxicity		MK5KKTOK04KX17-EN					2	2	e	4									
4.		Environment Biology and Nature Protection		MK5KBTVK04KX17-EN	2	2	e	4													
5.		Ecology for Engineers		MK5MOKLK03KX17-EN					2	1	msg	3									
6.		Geosciences		MK5FDTIS03KX17-EN	2	0	msg	3													
7.	Economics and Humanities (10 credits)	Environmental Law and Economics		MK5KJGDK04KX17-EN	2	2	msg	4													
8.		Environmental and Quality Management		MK5KMMMM03KX17-EN	2	1	msg	3													
9.		Production Management and Life Cycle Analysis		MK5TMEEM03KX17-EN					2	1	e	3									
10.	Professional Knowledge of Environmental Engineering (24 credits)	Environmental Engineering Measurement Techniques, Monitoring		MK5KMMMK04KX17-EN					2	2	msg	4									
11.		Environmental Health		MK5KEGTK03KX17-EN					2	0	e	3									
12.		Environmental Modelling and Environmental Informatics		MK5KMKIK04KX17-EN	2	2	e	4													
13.		Environmental Operations		MK5KVMVK04KX17-EN	2	2	e	4													
14.		Environmental Resource Management		MK5KEGDK03KX17-EN					2	1	e	3									
15.		Environmental State Assessment, Auditing		MK5KAEAK03KX17-EN					2	1	e	3									
16.		Safety and Environmental Risk		MK5BTKKK03KX17-EN	2	0	msg	3													
17.	Specialization Skills (28 credits)	Environmental Technologies I (Soil Protection)	**56**	MK5KVT1K03K117-EN									2	1	e	3					
18.		Environmental Technologies II (Water Protection)	**56**	MK5KVT2K03K117-EN													2	1	e	3	
19.		Environmental Technologies III (Air and Noise Protection)	**56**	MK5KVT3K03K117-EN									0	3	msg	3					
20.		Environmental Technologies IV (Waste Recycling)	**56**	MK5KVT4K03K117-EN													2	1	msg	3	
21.		Recovery Systems of Renewable Energy Sources I	**62**	MK5MEF1L04KX17-EN									2	1	e	4					
22.		Recovery Systems of Renewable Energy Sources II	**62**	MK5MEF2L03KX17-EN													2	1	e	3	
23.		Near-natural and Cleaner Production Technologies		MK5TKTTK03K117-EN									1	2	msg	3					
24.		Complex Environmental Engineer Planning I	**59**	MK5KKP1K03KX17-EN									0	3	msg	3					
25.		Complex Environmental Engineer Planning II	**59**	MK5KKP2K03KX17-EN													0	3	msg	3	
26.	Optional Subjects (6 credits)	Optional subject I							0	2	msg	3									
27.		Optional subject II															0	2	msg	3	
28.	Criterium Subject	Physical Education			0	2	s	0													
29.	Diplomawork (30 credits)	Diplomawork I		MK5DPT1K15KX17-EN									0	10	msg	15					
30.		Diplomawork II		MK5DPT2K15KX17-EN													0	10	msg	15	
31.		Environmental Summer Professional Practice		MK5NSGYK00KX17-EN					4 weeks												

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	1st semester				2nd semester				3rd semester				4th semester			
Lecture/Practice	16	10			16	10			5	20			6	18		
Exam (e)			3				4				2				2	
Mid-semester grade (msg)			5				4				4				4	
Number of subjects			8				8				6				6	
Number of contact hours (without criteria subject)	26				26				25				24			
Credits				29				30				31				30
Total credit	**120**															

Final Exam topics:

Prerequisites for final exam: Environmental Status Assessment and Modelling; Environmental Protection II

Specialized knowledge: Environmental Technology, Planning, Constructions

MODEL CURRICULUM OF ENVIRONMENTAL ENGINEERING MSC

BUILT ENVIRONMENT SPECIALIZATION

The curriculum of the program is available in excel format on the webpage of the Faculty of Engineering (www.eng.unideb.hu/en)

University of Debrecen Faculty of Engineering — **Full-time training**

Environmental Engineering Master's Program — **Curriculum**

Built Environment Specialization

Number	Subject Group	Subject title	Knowledge Group	Code	1st semester				2nd semester				3rd semester				4th semester				Prerequisite
					lecture	practice	evaluation	credit	lecture	practice	evaluation	credit	lecture	practice	evaluation	credit	lecture	practice	evaluation	credit	
1.	Natural Sciences (22 credits)	Mathematical Modeling and Optimization	00	MK5MMO1A04KX17-EN					2	2	msg	4									
2.		Applied Statistics	00	MK5AST1A04KX17-EN	2	1	msg	4													
3.		Environmental Chemistry and Environmental Toxicity		MK5KKTOK04KX17-EN					2	2	e	4									
4.		Environment Biology and Nature Protection		MK5KBTVK04KX17-EN	2	2	e	4													
5.		Ecology for Engineers		MK5MOKLK03KX17-EN					2	1	msg	3									
6.		Geosciences		MK5FDTIS03KX17-EN	2	0	msg	3													
7.	Economics and Humanities (10 credits)	Environmental Law and Economics		MK5KJGDK04KX17-EN	2	2	msg	4													
8.		Environmental and Quality Management		MK5KMMMM03KX17-EN	2	1	msg	3													
9.		Production Management and Life Cycle Analysis		MK5TMEEM03KX17-EN					2	1	e	3									
10.	Professional Knowledge of Environmental Engineering (24 credits)	Environmental Engineering Measurement Techniques, Monitoring		MK5KMMMK04KX17-EN					2	2	msg	4									
11.		Environmental Health		MK5KEGTK03KX17-EN					2	0	e	3									
12.		Environmental Modelling and Environmental Informatics		MK5KMKIK04KX17-EN	2	2	e	4													
13.		Environmental Operations		MK5KVMVK04KX17-EN	2	2	e	4													
14.		Environmental Resource Management		MK5KEGDK03KX17-EN					2	1	e	3									
15.		Environmental State Assessment, Auditing		MK5KAEAK03KX17-EN					2	1	e	3									
16.		Safety and Environmental Risk		MK5BTKKK03KX17-EN	2	0	msg	3													
17.	Specialization Skills (28 credits)	Urban Climate		MK5VKLTK03K217-EN									2	1	e	3					
18.		Urban Hydrology	56	MK5VHDRK03K217-EN													2	1	e	3	
19.		Air Pollution Control	56	MK5LETVK03K217-EN									2	1	e	3					
20.		Bridges and Structures		MK5TAR1S03TX17-EN									2	0	msg	3					
21.		Noise and Vibration Protection	56	MK5ZRVDK04K217-EN									1	3	msg	4					
22.		Waste Management	56	MK5HUGKK03K217-EN													2	1	e	3	
23.		Greenfield Management		MK5KOR1S03TX17-EN													2	0	msg	3	
24.		Complex Environmental Engineer Planning I	59	MK5KKP1K03KX17-EN									0	3	msg	3					
25.		Complex Environmental Engineer Planning II	59	MK5KKP2K03KX17-EN													0	3	msg	3	
26.	Optional Subjects (6 credits)	Optional Subject I							0	2	msg	3									
27.		Optional subject II															0	2	msg	3	
28.	Criterium subject	Physical Education			0	2	s	0													
29.	Diplomawork (30 credits)	Diplomawork I		MK5DPT1K15KX17-EN									0	10	msg	15					
30.		Diplomawork II		MK5DPT2K15KX17-EN													0	10	msg	15	
31.		Environmental Summer Professional Practice		MK5NSGYK00KX17-EN					4 weeks												

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	1st semester				2nd semester				3rd semester				4th semester			
Lecture/Practice	16	10			16	10			7	18			6	17		
Exam (e)			3				4				2				6	
Mid-semester grade (msg)			5				4				4				4	
Number of subjects			8				8				6				6	
Number of contact hours (without criteria subject)	26				26				25				23			
Credits				29				30				31				30
Total credit	**120**															

Final Exam topics:

Prerequisites for final exam: Environmental Status Assessment and Modelling; Environmental Protection II

Specialized knowledge: Built Environment