University of Debrecen
Faculty of Science and Technology
Institute of Earth Sciences

GEOGRAPHY MSC PROGRAM

2024

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DEAN`S WELCOME

Welcome to the Faculty of Science and Technology!

This is an exciting time for you, and I encourage you to take advantage of all that the Faculty of Science and Technology UD offers you during your bachelor’s or master's studies. I hope that your time here will be both academically productive and personally rewarding

Being a regional centre for research, development and innovation, our Faculty has always regarded training highly qualified professionals as a priority. Since the establishment of the Faculty in 1949, we have traditionally been teaching and working in all aspects of Science and have been preparing students for the challenges of teaching. Our internationally renowned research teams guarantee that all students gain a high quality of expertise and knowledge. Students can also take part in research and development work, guided by professors with vast international experience.

While proud of our traditions, we seek continuous improvement, keeping in tune with the challenges of the modern age. To meet the demand of the job market for professionals, we offer engineering courses with a strong scientific basis, thus expanding our training spectrum in the field of technology. Based on the fruitful collaboration with our industrial partners, recently, we successfully introduced dual-track training programmes in our constantly evolving engineering courses.

We are committed to providing our students with valuable knowledge and professional work experience, so that they can enter the job market with competitive degrees. To ensure this, we maintain a close relationship with the most important national and international companies. The basis for our network of industrial relationships are in our off-site departments at various different companies, through which market participants - future employers - are also included in the development and training of our students.

Prof. dr. Ferenc Kun
Dean

UNIVERSITY OF DEBRECEN

Date of foundation: 1912 Hungarian Royal University of Sciences, 2000 University of Debrecen

Legal predecessors: Debrecen University of Agricultural Sciences; Debrecen Medical University; Wargha István College of Education, Hajdúböszörmény; Kossuth Lajos University of Arts and Sciences

Number of Faculties at the University of Debrecen: 14

Faculty of Agricultural and Food Sciences and Environmental Management

Faculty of Child and Special Needs Education

Faculty of Dentistry

Faculty of Economics and Business

Faculty of Engineering

Faculty of Health

Faculty of Humanities

Faculty of Informatics

Faculty of Law

Faculty of Medicine

Faculty of Music

Faculty of Pharmacy

Faculty of Public Health

Faculty of Science and Technology

Number of students at the University of Debrecen: 30,889

Full time teachers of the University of Debrecen: 1,597

210 full university professors and 1,262 lecturers with a PhD.

FACULTY OF SCIENCE AND TECHNOLOGY

The Faculty of Science and Technology is currently one of the largest faculties of the University of Debrecen with about 3000 students and more than 200 staff members. The Faculty has got 6 institutes: Institute of Biology and Ecology, Institute of Biotechnology, Institute of Chemistry, Institute of Earth Sciences, Institute of Physics and Institute of Mathematics. The Faculty has a very wide scope of education dominated by science and technology (11 Bachelor programs and 13 Master programs), additionally it has a significant variety of teachers' training programs. Our teaching activities are based on a strong academic and industrial background, where highly qualified teachers with a scientific degree involve student in research and development projects as part of their curriculum. We are proud of our scientific excellence and of the application-oriented teaching programs with a strong industrial support. The number of international students of our faculty is continuously growing (currently ~ 760 students). The attractiveness of our education is indicated by the popularity of the Faculty in terms of incoming Erasmus students, as well.

THE ORGANIZATIONAL STRUCTURE OF THE FACULTY

Dean: Prof. Dr. Ferenc Kun, Full Professor
E-mail: ttkdekan@science.unideb.hu

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Consultant on Talent Management Programme: Prof. dr. Tibor Magura, Full Professor
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Dean's Office
Head of Dean's Office: Mrs. Katalin Kozma-Tóth
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DEPARTMENTS OF INSTITUTE OF EARTH SCIENCES

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Mr. Dr. Tamás Tóth, PhD	Assistant Professor	toth.tamas@science.unideb.hu	127
Mr. Dr. Ferenc Wantuch, PhD	Assistant Professor	wantuch.ferenc@nkh.gov.hu	127

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***** - Chemistry Building

ACADEMIC CALENDAR

General structure of the academic semester (2 semesters/year):

Study period	1st week	Registration*	1 week
	2nd – 15th week	Teaching period	14 weeks
Exam period	directly after the study period	Exams	7 weeks

*Usually, registration is scheduled for the first week of September in the fall semester, and for the first week of February in the spring semester.

For further information please check the following link:

https://www.edu.unideb.hu/tartalom/downloads/University_Calendars_2024_25/University_calendar_2024-2025-Faculty_of_Science_and_Technology.pdf

THE GEOGRAPHY MASTER PROGRAM

Information about the Program

Name of MSc Program:	Geography MSc Program
Specialization available:	Geoinformatics Landscape and environmental research Renewable energy
Field, branch:	Science
Qualification:	Geographer
Mode of attendance:	Full-time
Faculty, Institute:	Faculty of Science and Technology Institute of Earth Sciences
Program coordinator:	Prof. Dr. György Szabó, University Professor
Duration:	4 semesters
ECTS Credits:	120

Objectives of the MSc program:

Geographer MSc course provides specialized geography knowledge in the fields of environmental science, renewable energy and geoinformatics. Students will learn the most up-to-date software and hardware for spatial data collection, analysis and visualization including both the statistical and cartography side; how to exploit the renewable energy (solar, geothermic and wind); knowledge of the devices of measurements, calculation methods of energy; processes of the landscapes; environmental evaluation techniques; nature protection and policy; environmental quality assurance/control.

Professional competences to be acquired

A Geographer:

a) Knowledge:

- He/she knows the actual theories and models of geography based on a scientific background, furthermore, is aware of his/her specific field's possible directions of development.
- He/she knows the general and specific features, principles, limits, and relations to other disciplines of geography.
- He/she knows the possibilities of studying the processes, systems, scientific issues of geography and has a wide knowledge of literature.
- He/she knows the deeper connections and the related therories between physical and social geography.
- He/she knows the specific research methods and abstraction techniques of geography in terms of learning and problem solving capabilities; furthermore, the capability of elaborating practical features of theoretical questions.

- He/she knows the research planning and evaluation methods.
- He/she knows the graphical, projection and mapping methods of geography.

Geoinformatics specialization:
- He/she knows the process of geoinformation based data collection.
- He/she knows the methods of processing and modelling of remotely sensed data.
- He/she knows the database management and models.
- He/she knows the frequently used geoinformation software of data collection, analysis and visualization.

Landscape and environmental research specialization:
- He/she is familiar with the methods for predicting the effects of landscape and environmental transformation and the determination of indicators predicting the expected consequences.
- He/she is familiar with the long-term monitoring methods of the landscape and the environment and the modern tools and methods of GIS.
- He/she knows and understands the natural and social aspects of landscape and environmental protection.
- He/she is familiar with the higher level methods of field and laboratory data collection, data capture and processing, and data interpretation related to landscape and environmental research.
- He/she knows the rehabilitation procedures of the landscape and environmental development.
- He/she knows the methods of integrated management of settlement environmental protection in relation to landscape protection.

Renewable energy specialization:
- He/she knows the renewable energy capacity, environmental characteristics and effects of different regions.
- He/she knows the environmental effects of utilization of renewable energies.
- He/she knows the techniques of what enables the utilization of renewable energies.
- He/she knows the geographic fundamentals of the utilization of renewable energy sources, their optimal geological, climatological, geographical and social conditions.

b) Abilities:
- He/she is able to analyze various ideas in the knowledge system of geography, to synthetize and assess the comprehensive and special relationships, and to criticize the theories and principles of geography.
- He/she is able to define special professional problems by using a versatile, interdisciplinary approach, to reveal and formulate the theoretical and practical background needed to solve them.
- He/she is able to apply the special research methods of geography and its abstraction techniques in practice to develop alternative solutions within any narrower field of geography.
- He/she is able to write scientific summaries and analysises on certain topics of geography.
- He/she is able to apply field, laboratory, and practical methods and special tools to a high standard.
- He/she is able to plan, organize, and manage geographical researches in any workplaces e.g. research-development institutes and administration.

Geoinformatics specialization:
- He/she is able to plan and lead autonomously the process of data collection.
- He/she is able to process and model remotely sensed data.
- He/she is able to arrange the collected or purchased data into a geodatabase, to perform operations and to elaborate models.

- He/she is able to use the best known geoinformation software for data collection, evaluation and visualization.

Landscape and environmental research specialization:
- He/she is capable of autonomously designing and implementing long-term landscape and environmental monitoring, forecasting the effects of landscape and environmental conversion, and by identifying the indicators can predict the expected consequences.
- He/she is able to the integrate usage of knowledge of the disciplines needed for landscape and environmental research.
- He/she is capable of field and laboratory autonomous data collection, data capture and processing, and data interpretation for landscape and environmental research.
- He/she is capable of managing the rehabilitation interventions for the landscape and environmental development.
- He/she is able to design and implement the integrated management of environmental protection of settlements in landscape frameworks.

Renewable energy specialization:
- He/she is able to survey the renewable energy capacity, environmental characteristics and effects of different regions, and on that base of the knowledge is able to make proposals for their most effective utilization.
- He/she is able to survey the environmental effects of the utilization of renewable energy sources.
- He/she is able to prepare project plans for utilization of renewable energy sources according to current tenders.
- He/she is able to analyze the geographic fundamentals of the utilization of renewable energy sources, and their optimal geological, geographical and social conditions.

c) Attitude:
- He/she undertakes those comprehensive and distinct conditions and professional identity which constitute the specific character, personal and community role of his area of expertise.
- He/she endeavours to improve and synthesise knowledge of the processes taking place in the geographical spheres.
- He/she aims to resolve tasks related to geographical matters in co-operation with the employees, taking into consideration their professional views.
- He/she effectively and credibly conveys the comprehensive and detailed issues of this occupation, and is committed to sustainable development which leads and forms his/her actions.
- He/she takes a proactive role in work and uses the results of professional activities for the service of the community.
- He/she has developed a professional identity and vocation.
- He/she endeavours to further develop their knowledge in the field of geography.

d) Autonomy and responsibility:
- He/she deals with the creation and modelling of theoretical and practical systems requiring general and special geographical skills with a high level of autonomy and responsibility.
- He/she fills in leading researcher positions in research and development institutions and administration related to geography after appropriate practice.
- He/she states her/his personal case in geographical issues in known decision making situations and takes responsibility for their social and environmental consequences.
- He/she leads teams of professionals
- He/she applies a wide variety of techniques and methods independently in practice in contexts at different levels of complexity and computability.

Completion of the MSc Program

The 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 programs and student achievement. ECTS in no way regulates the content, structure and/or equivalence of study programs.
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, subject-related subjects and differentiated field-specific subjects.

For the Geography Master Program the following professional fields define the training:

- theoretical aspects of geography (e.g. modelling, simulation, geomathematics): 8-12 credits
- professional studies (e.g. physical geography, environmental geography, regional policy): 22-32 credits
- specialization: 35-55 credits

Credit points assigned to optional subjects: 6
Credit points assigned to thesis: 30
Credits total: 120
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 subjects which takes into account the prerequisite(s) of each subject. You can find the recommended list of subjects/semesters in chapter “Model Curriculum of Geography MSc Program”.

	semesters				ECTS credit points	evaluation
	1.	2.	3.	4.		
	contact hours, types of teaching (l – lecture, p – practice), credit points					
Basic courses						
Applied geography subject group						
TTGMG5001_EN Applied geomathematics, modelling and simulation *Sándor Szegedi*	14 l/ 1cr. 28 p/ 2cr.				1+2	mid-semester grade
TTGME7001_EN New research methods of geography *Szilárd Szabó*	28 l/ 3cr.				3	exam
TTGME7002_EN Environmental application of GIS *József Lóki*	14 l/ 1cr. 28 p/ 2cr.				1+2	exam mid-semester grade
TTGME7005_EN Natural and anthropogenic hazards *Gábor Négyesi*	28 l/ 3cr.				3	exam
Environmental geography subject group						
TTGME6002_EN Landscape analysis *Róbert Vass*	28 l/ 3cr.				3	exam
TTGMG6003_EN Landscape analysis *Róbert Vass*	28 p/ 2cr.				2	mid-semester grade
TTGME7004_EN Anthropogenic geomorphology *Gábor Négyesi*		28 l/ 3cr.			3	exam
TTGME6001_EN Environmental systems – Environmental Geography *György Szabó*	28 l/ 3cr. 14 p/ 1cr.				3+1	exam mid-semester grade
Regional planning, project management subject group						
TTGME6501_EN Project management and R+D politics *Gábor Kozma*	14 l/ 1cr.				1+0	exam
TTGMG6502_EN Project management and R+D politics *Gábor Kozma*	28 p/ 2cr.				0+2	mid-semester grade
TTGME6505_EN Regional and spatial development *János Pénzes*	28 l/ 3cr.				3+0	exam
TTGMG6506_EN Regional and spatial development *János Pénzes*	28 p/ 2cr.				0+2	mid-semester grade
Society and political geography subject group						

TTGME6507_EN Space and society *Károly Teperics*		14 l/ 1cr. 28 p/ 2cr.			1+2	exam mid-semester grade
TTGME6503_EN Political geography and globalisation *István Pásztor*	28 l/ 3cr. 28 p/ 2cr.				3+2	exam mid-semester grade

Geoinformatics specialization						
Data management and programming subject group						
TTGME7007_EN Sampling and data collection *Gábor Négyesi*		28 l/ 3cr.			3	exam
TTGME7008_EN Database management *Boglárka Balázs*		14 l/ 1cr.			1	exam
TTGML7009_EN Database management *Boglárka Balázs*		28 p/ 2cr.			2	mid-semester grade
TTGME7010_EN GIS specific programming *Gergely Szabó*		42 l/ 4cr.			4	exam
TTGML7011_EN GIS specific programming *Gergely Szabó*		28 p/ 2cr.			2	mid-semester grade
Technical informatics, data publicationsubject group						
TTGME7012_EN Technical informatics *Gábor Négyesi*		28 l/ 3cr.			3	exam
TTGML7013_EN Technical informatics *Gábor Négyesi*		28 p/ 2cr.			2	mid-semester grade
TTGME7014_EN Web maps *Gábor Négyesi*			28 l/ 3cr. 14 p/ 1cr.		3+1	exam
TTGML7022_EN GIS softwares *Zoltán Túri*				14 l/ 1cr. 28 p/ 2cr.	1+2	mid-semester grade
Photogrammetry, analysis and modelling subject group						
TTGML7015_EN GIS analyses I. *Zoltán Túri*			28 p/ 2cr.		2	mid-semester grade
TTGML7016_EN GIS analyses II. *Zoltán Túri*				28 p/ 2cr.	2	mid-semester grade
TTGME7017_EN Models in GIS *Boglárka Balázs*		28 l/ 3cr.			3+1	exam
TTGML7018_EN Models in GIS *Boglárka Balázs*		14 p/ 1cr.			1	mid-semester grade
TTGME7019_EN Photogrammetry *Gergely Szabó*			28 l/ 3cr.		3	exam

TTGML7020_EN Photogrammetry *Gergely Szabó*			14 p/ 1cr.		1	mid-semester grade
CAD-systems and practical issues subject group						
TTGML7021_EN CAD-systems *Gergely Szabó*		14 l/ 1cr. 14 p/ 1cr.			1+1	mid-semester grade
TTGMG7025_EN Project work in GIS *Gergely Szabó*			X		2	mid-semester grade
TTGMG7024_EN Fieldwork in GIS *Boglárka Balázs*			X		2	mid-semester grade

Landscape and environmental research specialization						
National and settlement level environment protection subject group						
TTGME6008_EN Environment protection in Hungary *Beáta Babka*		28 l/ 3cr.			3	exam
TTGMG6009_EN Environment protection in Hungary *Beáta Babka*		14 p/ 1cr.			1	mid-semester grade
TTGME6016_EN Urban ecology *István Fazekas*				28 l/ 3cr.	3	exam
TTGMG6017_EN Urban ecology *István Fazekas*				14 p/ 1cr.	1	mid-semester grade
Nature and landscape protection subject group						
TTGME6004_EN Cultural landscapes *Beáta Babka*		28 l/ 3cr.			3	exam
TTGME6011_EN Geoconservation *Borbála Benkhard*			28 l/ 3cr.		3	exam
TTGMG6012_EN Geoconservation *Róbert Vass*			28 p/ 2cr.		2	mid-semester grade
TTGME6018_EN Landscape Protection in Europe *Péter Csorba*				28 l/ 3cr.	3	exam
Environmental management and politics subject group						
TTGME6006_EN Environmental management and quality assurance *István Fazekas*		28 l/ 3cr.			3	exam
TTGMG6007_EN Environmental management and quality assurance *István Fazekas*		28 p/ 2cr.			2	mid-semester grade
TTGME6010_EN Environmental policy *Emőke Kiss*			28 l/ 3cr.		3	exam

TTGME6015_EN Environmental economics *Emőke Kiss*			28 l/ 3cr.		3	exam
Planning and practical issues subject group						
TTGML7006_EN Applied environmental geoinformatics *Szilárd Szabó*		28 p/ 2cr.			2	mid-semester grade
TTGME6005_EN Environmental impact assessment *István Fazekas*		14 l/ 1cr.			1	exam
TTGMG6019_EN Landscape and environmental planning *Róbert Vass*				14 l/ 1cr. 14 p/ 1cr.	1+1	mid-semester grade
TTGME6013_EN The environmental relations of sectoral planning *György Szabó*			14 l/ 1cr.		1	exam
TTGMG6014_EN The environmental relations of sectoral planning *György Szabó*			28 p/ 2cr.		2	mid-semester grade
TTGMG6021_EN Environmental field trip *István Fazekas*			X		2	mid-semester grade
TTGMG6022 Project work in environmental geography *Róbert Vass*			X		2	mid-semester grade

Renewable energy specialization						
Climatology, society subject group						
TTGMG5502_EN Meteorological-climatological basics of the utilization of renewable energy sources *Sándor Szegedi*		14 l/ 1cr. 28 p/ 2cr.			1+2	mid-semester grade
TTGME6023_EN Environmental law *István Fazekas*			28 l/ 3cr.		3	exam
TTGMG6024_EN Project management in energetics *Mária Vasvári*				28 p/ 2cr.	2	mid-semester grade
TTGME6516_EN Society and Energy *Zsolt Radics*			28 l/ 3cr.		3	exam
Wind and solar energy subject group						
TTGME5503_EN Wind energy *István Lázár*		28 l/ 3cr.			3	exam

TTGMG5504_EN Wind energy *István Lázár*		28 p/ 2cr.			2	mid-semester grade
TTGME5509_EN Solar energy *Sándor Szegedi*			28 l/ 3cr.		3	exam
TTGMG5510_EN Solar energy *István Lázár*			28 p/ 2cr.		2	mid-semester grade
Bio and geothermic energy subject group						
TTGME5505_EN Bioenergy *Ferenc Wantuch*		28 l/ 3cr.			3	exam
TTGMG5506_EN Bioenergy *Ferenc Wantuch*		28 p/ 2cr.			2	mid-semester grade
TTGME5501_EN Geothermal energy *Tamás Buday*		28 l/ 3cr.			3	exam
TTGMG5502_EN Geothermal energy *Tamás Buday*		28 p/ 2cr.			2	mid-semester grade
Water and practical issues subject group						
TTGME5507_EN Hydropower *Ferenc Wantuch*		28 l/ 3cr.			3	exam
TTGMG5508_EN Hydropower *Ferenc Wantuch*		28 p/ 2cr.			2	mid-semester grade
TTGML7026_EN GIS in energetics *Boglárka Balázs*				28 p/ 2cr.	2	mid-semester grade
TTGMG5512_EN Renewable energies field trip *István Lázár*			X		2	mid-semester grade
TTGMG5513_EN Renewable energy project work *Sándor Szegedi*			X		2	mid-semester grade

Thesis I *Péter Csorba*			X		10	mid-semester grade
Thesis II. *Szilárd Szabó*				X	20	mid-semester grade

optional course						
					6	
internship						
					6 weeks 2	

Work and Fire Safety Course

According to the Rules and Regulations of University of Debrecen a student has to complete the online course for work and fire safety. Registration for the course and completion are necessary for graduation. For MSc students the course is only necessary only if BSc diploma has been awarded outside of the University of Debrecen.
Registration in the Neptun system by the subject: MUNKAVEDELEM
Students have to read an online material until the end to get the signature on Neptun for the completion of the course. The link of the online course is available on webpage of the Faculty.

Internship

Students majoring in the Geography MSc have to carry out a 6 weeks internship involved in the model curriculum. The internship course must be signed up for previously via the NEPTUN study registration system in the spring semester (2^{th} semester). Its execution is the criteria requirement of getting the pre-degree certificate (absolutorium).

Objective of the internship, competences
Students get acquainted with professional work in conformity with their major at the company or institution and join in the daily working process. They have to resolve tasks independently assigned by their supervisor and gain experiences may be utilized later in the labour market. During the internship common and professional competences may be acquired. Common competences: precise working on schedule either individually or in team, talk shop applying correct technical terms. Professional competences: applying the professional skill gained during the training and acquiring new knowledge.

Places suitable for internship
All the organizations, institutions and companies in Hungary or abroad, provide students with the opportunity to acquire proficiency in accordance with their specialization in the field of operation, repairing technology, installation, management and development of different machines and vehicles, may be a suitable place.

Physical Education

According to the Rules and Regulations of University of Debrecen a student has to complete Physical Education courses at least in one semester during his/her Master's training. Our University offers a wide range of facilities to complete them.

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 the 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 preparing thesis – 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 in written form. By solving the task, the student relies on his/her studies using national and international literature under the guidance of an internal supervisor (referee). By a completed dissertation and its successful defence geography student certifies that he/she is capable to apply the acquired knowledge in practice and to summarize the completed work and its results in a professional way, to solve the tasks related to his/her topic creatively and to complete individual professional work. By preparing and defending a thesis a student who completes the Geography Master Program proves that he/she is capable of the practical applications of the acquired skills, summarizing the work done and its results in a professional way, creatively solving the tasks related to the topic and doing individual professional work.

The student can choose any topic for a thesis suggested by the institute or in occasional cases individual topics acknowledged by the head of the department. The requirements of the thesis content, the general aspects of evaluation and the number of credits assigned to the thesis are determined by the requirements of the program.

The formal requirements of the thesis are detailed in the "manual for writing thesis" which is available on the official home page of institute.

A thesis can be submitted only if it is supported both by the internal supervisor. If a thesis is evaluated with a fail mark by the referee and the department the student is not allowed to take the final exam and is supposed to prepare a new or modified thesis. The student has to be informed about it. Conditions on resubmitting the thesis are defined by the program coordinator of the particular specialization.

Final Exam

Students had obtained the pre-degree certificate will finish their studies by taking the final exam of Geography Master Program. A final exam is the evaluation and control of the knowledge and skills acquired. The candidate has to certify that he/she is able to apply the obtained

knowledge in practice. A final exam can be taken in the forthcoming exam period after obtaining the pre-degree certificate. A final exam has to be taken in front of the Final Exam Board. If a candidate does not pass his/her final exam by the termination of his/her student status, he/she can take his/her final exam after the termination of the student status on any of the final exam days of the relevant academic year according to existing requirements on the rules of the final exam.
The Final Exam consists of 2 parts:
- presentation of the thesis and its defence
- oral exam
  - a core material question
  - a question regarding applied geography specialization

Final Exam Board
Board chair and its members are selected from the acknowledged internal and external experts of the professional field. Traditionally, it is the chair and in case of his/her absence or indisposition the vice-chair who will be called upon, as well. The board consists of – besides the chair – at least two members (one of them is an external expert), and questioners as required. The mandate of a Final Exam Board lasts for one year.

Repeating a failed Final Exam
If any part of the final exam is failed it can be repeated according to the rules and regulations. A final exam can be retaken in the forthcoming final exam period. If the Board qualified the Thesis unsatisfactory a student cannot take the final exam and he has to make a new thesis. A repeated final exam can be taken twice on each subject.

Diploma

The diploma is an official document decorated with the coat of arms of Hungary which verifies the successful completion of studies in the Geography Master Program. It contains the following data: name of HEI (higher education institution); institutional identification number; serial number of diploma; name of diploma holder; date and place of his/her birth; level of qualification; training program; specialization; mode of attendance; place, day, month and year issued. Furthermore, it has to contain the rector's (or vice-rector's) original signature and the seal of HEI. The University keeps a record of the diplomas issued.

In Geography Master Program the diploma grade is calculated as the average grade of the results of the followings:

- Weighted average of the overall studies at the program (A)
- Average of grades of the thesis and its defense given by the Final Exam Board (B)
- Average of the grades received at the Final Exam for the two subjects (C)

Diploma grade = (A + B + C)/3

Classification of the award on the bases of the calculated average:

Excellent	4.81 – 5.00
Very good	4.51 – 4.80
Good	3.51 – 4.50
Satisfactory	2.51 – 3.50
Pass	2.00 – 2.50

Course Descriptions of Geography MSc Program

Title of course: Applied geomathematics modelling and simulation **Code: TTGMG5501_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 1 hours/week - practice: - - laboratory: 2 hours/week	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: 14 hours - practice: 28 hours - laboratory: - home assignment: 48 hours - preparation for the exam: - Total: 90 hours	
Year, semester: 1st year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course
The aim of the course is to introduce students into the geomathematical analyses and evaluation methods used in geography. In the frame of the course students gain knowledge on the management of online databases, database building and management, statistical methods of database analyses (functions, correlation and regression etc.) graphical interpretation of the results (diagrams, histograms), modelling methods.
Literature
Compulsory literature: H von Storch, F. W. Zwiers: Statistical Analysis in Climate Research. Cambridge University Press (2002) ISBN-10: 0521012309 Additional literature: D. E. Wilkes: Statistical Methods in the Atmospheric Sciences, Volume 100, Third Edition (International Geophysics) Academic press (2011) ISBN-10: 0123850223
Schedule: *1st week* Introduction. Management of online hydrological and climatological databases. *2nd week* Interpretation and homogenization of data sets downloaded from online data bases. *3rd week* Screening of errors in datasets. *4th week* Application of functions in MS Excel environment 1. *5th week* Application of functions in MS Excel environment 2. *6th week* Application of functions in MS Excel environment 3.

7th week
Methods of graphical data presentation, criteria for selection of optimal diagram type and opportunities of application.
8th week
Methods for preparation of histograms and their application.
9th week
Homogeneity and independence examinations using the χ^2 test.
10th week
Opportunities of application of star diagrams in geography>
11th week
Correlation ad regression analyses.
12th week
Modelling the intensity of solar radiance 1.
13th week
Modelling the intensity of solar radiance 2.
14th week
End test.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be discussed with the tutor. If a student's behavior or conduct doesn't 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.
- for a grade
The course ends in a **practice grade**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD

Title of course: New research methods of geography **Code: TTGME7001_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 32 hours

Total: 60 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Drones (UAVs) in ordinary usgae and in scientific work. Terrestrial and aerial laser scanning surveys. C-14 and K-Ar age determination. Geoecological mapping. WRB soil classification. Environmental risk assessment, remediation. Urban climate. Climate modelling in different scales. Geochemistry of rocks. Geophysics. Applied vulcanology.

Literature

Compulsory:
- Casagrande, G., Sik, A., Szabó, G. eds. 2018. Small Flying Drones. Springer, 161 p.
- McManamon, P. 2015. Field Guide to Lidar. SPIE Press Book, 168 p.
- Jerram, D. Introducing volcanology. A guide to hot rocks. Dunedin Academic Press, 128 p.

Recommended:
- D. O. Connor et al (2006): Driving rural development: Policy and Practice in Seven EU Countries. ISBN: 90 232 3989 X.

Schedule:
1st week
Drones in practice
2nd week
Aging techniques
3rd week
Aerial and ground laser scanning
4th week
WRB soil classification
5th week
Geomorphological mapping
6th week
Geochemistry
7th week
Geophysics
8th week

Applied vulcanology
9th week
New directions in economic geography
10th week
Features of modern cities
11th week
Urban climate
12th week
Climate change modelling
13th week
Grade offering exam
14th week
Presentation of project works.

Requirements:
- for a signature
Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester.
The students must choose one of the topics offered by the teacher to plan a project, write an essay and prepare a presentation.
The students must take a written exam at the end of the semester.
- for a grade
The course ends in an **examination**.:
Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-49	fail (1)
50-64	pass (2)
65-74	satisfactory (3)
75-85	good (4)
86-100	excellent (5)

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

Person responsible for course: Prof. Dr. Szilárd Szabó, university professor, DSc

Lecturer:
Prof. Dr. Szilárd Szabó, university professor, DSc
Dr. Gergely Szabó, associate professor, PhD
Dr. Péter Rózsa, associate professor, PhD
Prof. Dr. Gábor Kozma, university professor, DSc

Title of course: Environmental application of GIS **Code: TTGME7002_EN**	**ECTS Credit points: 1**
Type of teaching, contact hours - lecture: 1 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 14 hours - practice: - - laboratory: - - home assignment: - - preparation for the exam: 16 hours Total: 30 hours	
Year, semester: 1st year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Over the course, the students discover the conceptual endeavors to further develop their knowledge in the field of geography, the background of environmental application of GIS, the database of the natural and socio-economic environment. They also gain information about the structure of environmental information systems and required geoinformation applications.

Literature

- Brimicombe, A. 2009. GIS, Environmental Modeling and Engineering. CRC Press, 378 p.
- Zhu, X. 2016. GIS for Environmental Applications: A Practical Approach. Routledge, 490 p.

Schedule:

1st week Introduction to the course. Definitions. Theoretical background of the environmental application of GIS.

2nd week Databases of natural environment (geology, morphology).

3rd week Databases of natural environment (hidrography, hidrology).

4th week Databases of natural environment (soil, vegetation).

5th week Databases of natural environment (climatic elements).

6th week Databases of natural hazards and environmental protection.

7th week Databases of social environment (settlements, population).

8th week Databases of social environment (agriculture, industry).

9th week Databases of social environment (mining, energy).

10th week Databases of social environment (trade, service).

11th week Databases of social environment (tourism, sport).

12th week Structure of environmental information systems.

13th week Introduction to applied geoinformation systems.

14th week Environmental application of GIS in regional planning and landscape evaluation.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
The course ends in a writing examination.
The minimum requirement for the test respectively is 50%. Based on the score of the test, the grade for the test is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-86	good (4)
87-100	excellent (5)

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

Person responsible for course: Prof. Dr. József Lóki, professor emeritus, DSc

Lecturer: Prof. Dr. József Lóki, professor emeritus, DSc

Title of course: Natural and anthropogenic hazards **Code: TTGME7005_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The study shows the different kind of hazards (natural, anthropogenic, semi-anthropogenic) which threaten the society. First of all we analyse the basic conceptions (dangers, hazards, risk, vulnerability) and their connections. It provides detailed pictures about the genetic types of natural hazards - according to Earth's spheres – and dissect the protecting methods. According the protection methods it takes attention to the environmental effects of different methods and their role in the forming out of secondary hazards. It deals with changes of hazards in space and time and their dependence from society.

Literature

Compulsory:

- Tobin, G. A.- Montz, B. E.: 1997: Natural Hazards. The Guilford Press, New York/London, p. 388.
- Bryant, E. 1993: Natural hazards. Cambridge University Press, p. 293.

Recommended:

- Edward A. Keller – Duane E. DeVecchio 2015. Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes 4th Edition. Routledge, p. 354

Schedule:

1st week

Clarifying the basic concepts and definitions in natural hazards: hazard, catastrophe, risk, catastrophe situation, prevention, protection plan.

2nd week

Characterization of natural phenomena: size, periodicity, speed, duration, spatial extent. Vulnerability of society.

3rd week

The types and features of natural hazards. .The system of natural hazards.

4th week

Geographical aspects of natural hazards and catastrophes.

5th week
Natural catastrophes in the lithosphere: earthquakes. Causes, formation and geographical distribution of earthquakes. Damages caused by earthquakes and the protection possibilities against it.

6th week
Natural catastrophes in the lithosphere: volcanism and tsunamis. Hazards from volcanism, regional distribution of volcanism. Protecting possibilities against volcanic eruptions and tsunamis.

7th week
Natural catastrophes in the lithosphere: catastrophes caused by external forces: mass movements. Protection possibilities against it.

8th week
Hazards in the atmosphere: catastrophes by direct effects of atmosphere: fires, tornadoes, tropical cyclones, dust devils. Protection possibilities against it.

9th week
Hazards in the atmosphere: catastrophes by direct effects of atmosphere: desertification, droughts. Causes and social consequences of desertification.

10th week
Hazards in the atmosphere: catastrophes by indirect effects of atmosphere: floods. Features and formations of floods and the protection possibilities against it.

11th week
Natural hazards in Hungary – hazards and values

12th week
The protection possibilities against catastrophes: active and passive protecting possibilities.

13th week
Risk analyses in natural hazards.

14th week
Summary of the semester.

Requirements:
- for a grade
Attendance at **lectures** is recommended, but not compulsory.
The course ends in an **examination**.
The minimum requirement for the examination respectively is 60%. Based on the score of the test, the grade for the examination is given according to the following table:

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, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Gábor Négyesi, assistant professor, PhD
Lecturer: Dr. Gábor Négyesi, assistant professor, PhD

Title of course: Landscape analysis **Code: TTGME6002_EN**	**ECTS Credit points:3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divides into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 1st semester

Topics of course

The concept, purpose, main subject areas of the field analysis. Use of the landscape analysis in environmental impact assessment work and in municipal environmental programs at local, micro regional and regional level. Adaptation of the curriculum to existing national or regional concepts, existing scientific materials, European Union expectations. Expected directions for home improvement in the country, the likely impact of climate change. Historical and historical landscapes, extraterrestrial views, the legacy of land art. Consequences of the signing of the European Landscape Convention.

Literature

G. Johnson, Patil G. (2006): Landscape Pattern Analysis Springer V.
Pettit Ch., Catwright W., Bishop I., Pullar D., Lowell, K., Duncan J. (2008): Landscape Analysis and visualisation. Springer V.
M. Turner, R. Gardner (1991): Quantitative Methods in Landscape Ecology. Ecological Studies

Schedule

1st week:
The definition of the landscape analysis, differences in various definitions. The devepoment and perspectives of the landscape evaluation.

2nd week:
The place of the landscape analysis during the EIA and in the various environmental programmes

3rd week:
Contatcts of the landscape analysis to the Great Plain Programme, National Forest Programme, Agro-Environmental Programmes and The National Programme of the Climate Change

4th week
The future of the Hungarian landscapes, in the mirror of the climate change and the changeing expectations of the society.

5th week
National Plan of the Country Planning, national ecological network and the environmentally sensitive areas.

6th week:
The basis of the diversity of the hungarian landscapes, its historical and land use background.

7th week:
The survey of the unique landscape features, objects.

8th week:
The composory steps of the outline of landuse programmes, the contatct between the actual status and the aims.

9th week:
Landscape character, the esthetics of the landscapes. The objectivity of the visual valuation of the landscapes.

10th week:
The SENSOR program of the EU, usefulness to the local application

11th week:
The landscape analysis in the work of the authorities, rules, conpulsory contents.

12th week:
The content and output of the statements of the authorities.

13th week:
The provision (clause) of the statement made by the authorities.

14th week:
The survey of the semester: starting and closing points.

Requirements
Attendance at **lectures** is recommended, but not compulsory.
The course ends in an written **examination**.

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Participation at **practice classes** is compulsory. A student must 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. 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. Students have to submit an essay as scheduled minimum on a sufficient level for a practice grade.

Person responsible for course: Dr. Róbert Vass, assintant professor, PhD

Lecturer: Dr. Róbert Vass, assintant professor, PhD

Title of course: Landscape analysis **Code: TTGMG6003_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated) divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 14 hours
- preparation for the exam: 32 hours

Total: 60 hours

Year, semester: 1st year, 1st semester

Topics of course

To know the practical aspects of the themes covered in the theoretical lesson, the possibilities and limitations of the methods used. Be aware of the alternatives to meeting practical requirements, in particular the difficulties encountered with bioindication and the problems of quantifying the nature geographic qualifications.

Literature

S. R. Swaffield, V. Nellemann (2017): *Landscape Analysis: Investigating the potentials of space and place* Routledge
M. Luc, U. Somorowska, J.B. Szmańda, (Eds.) (2015): *Landscape analysis and planning* **:** *geographical perspectives***.** Springer V.
S. Rippon: (2004): Historic Landscape Analysis. Practical Handbook 16.

Schedule

1st week:
Introduction, tematics of the semester

2nd week:
The landscape analysis in the EIS

3rd week:
The position of the landscape analysis in the local and regional environmental programmes

4th week:
The impact of the European Landscape Convention on the landscape analysi

5th week:
The measuring of the Unique Landscape Values

6th week:
Examples to the objective survey of the surface and geological forms

7th week:
Possibilities for the measurement of the hydrologial and pedological endowments

8th week:

The survey of the vegetaion, as the most sensitive componenets of the nature.

9th week:
The possibilities and limits of the use of bioindication

10th week:
The landscape sesitivity, the landscape loadibility int he mirror of the landscape analysis

11th week:
The antropogen impact ont he landscape; the hemeroby

12th week:
The possibilities and limits of the ecological evaluation of the landscapes

13th week:
Other aspects of the ecological landscape analysis; development politics

14th week:
Summary, main outputs

Requirements
Participation at **practice classes** is compulsory. A student must 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. 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. Students have to submit an essay as scheduled minimum on a sufficient level for a practice grade.

Person responsible for course: Dr. Róbert Vass, assintant professor, PhD

Lecturer: Dr. Róbert Vass, assintant professor, PhD

Title of course: **Anthropogenic geomorphology** **Code: TTGME7004_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: examination	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: 12 hours - preparation for the exam: 50 hours Total: 90 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

The subject and the system of anthropogenic geomorphology and its disciplinary relations. Anthropogenic geomorphology of agriculture. The surface shaping effect of mining. Geomorphological aspects of water management. Anthropogenic geomorphological features of settlements. An overview of transport and industry geomorphological problems. The anthropogenic geomorphological memory of the military and defense. Other anthropogenic geomorphological problems: the effects of sport and tourism. An overview of the geomorphological effects of anthropogenic processes in extreme natural environments. Anthropogenic geomorphologic synthesis.

Literature

Goudie, A. (1995): The Human Impact on the Natural Environment. Blackwell, Oxford.
Sherlock, R. L. (1982): Man as a geological agent. Witherby, London.
Szabó, J., Dávid, L. and Lóczy, D. (eds.) (2010): Anthropogenic geomorphology. A Guide to Man-Made Landforms. Springer Science+Business Media B. V. ISBN 978-90-481-3057-3

Schedule:

1st week Introduction to the course.

2nd week The subject and the system of anthropogenic geomorphology and its disciplinary relations.

3rd week The surface shaping effect of mining.

4th week An overview of industry geomorphological problems.

5th week Anthropogenic geomorphological features of transport.

6th week Anthropogenic geomorphological features of settlements.

7th week Anthropogenic geomorphology of agriculture.

8th week Geomorphological aspects of water management.

9th week The anthropogenic geomorphological memory of the military and defense.

10th week Other anthropogenic geomorphological problems: the effects of sport and tourism.

11th week An overview of the geomorphological effects of anthropogenic processes in extreme natural environments.

12th week Anthropogenic geomorphologic synthesis.

13th week Anthropogenic geomorphological landscapes of Hungary - case studies.

14th week Test, Questions.

Requirements:
Attendance at lectures is recommended, but not compulsory.

- *for a grade*

The course ends in an examination. The minimum requirement for the examination is 50%. The grade for the examination is given according to the following table:

Score	Grade
0-49%	fail (1)
50-59%	pass (2)
60-72%	satisfactory (3)
73-84%	good (4)
85-100%	excellent (5)

Students can take a retake test in conformity with the education and examination rules and regulations.

- *an offered grade:*

It may be offered for students if the test written in the 14th week is at least satisfactory (3).

Person responsible for course: Dr. Gábor Négyesi associate professor, PhD

Lecturer: Dr. Gábor Négyesi, associate professor, PhD

Title of course: Environmental systems - Environmental Geography **Code: TTGME6001_EN**	**ECTS Credit points: 4**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: 1 hours/week
- laboratory: -

Evaluation: exam, mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: 14 hours
- laboratory: -
- home assignment: 28 hours
- preparation for the exam: 50 hours

Total: 120 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Lecture: Environmental sciences and environmental geography as the sciences of environmental systems. Overview of the main characteristic of environmental systems, the types and operation of systems. Feedback mechanisms. Chaos theory, the basics of the science of networks. Qualitative and quantitative changes in the global Earth System. Material flows within the Earth and their surface effects on society. Material flows in geospheres connected with the movements of air and water: water cycle, carbon cycle, oxygen cycle, nitrogen cycle, and ozone depletion. The operation of the climate system, natural and anthropogenic climate change. The possibilities and limitations of society in the Earth System.

Practice: The concept of the system, its main features. Types of system models. The basic rules of construction of system models. System model to be created individually by the students. Presentation of the prepared system models. Group work on the selected environmental topic. Groups write an essay and prepare presentations.

Literature

Compulsory literature:
H. Imura (2013) Environmental Systems Studies. A Macroscope for Understanding and Operating Spaceship Earth. Springer. Japan

Recommended literature:
G. Venkatesh (2016) Environmental Life-Cycle Analysis: A primer. Bookboon, The eBook company
A. Davis, G. Nagle (2015) Environmental Systems and Societies Student Book. Pearson International Baccalaureate

Schedule:
1st week
Lecture: Introduction to the course
*Practice***:** The concept of the system, its main features.

2nd week
Lecture: Environmental sciences and environmental geography as the sciences of environmental systems.
*Practice***:** Types of system models. The basic rules of construction of system models. Select the themes of the system model to be created individually by the students.

3rd week
Lecture: Overview of the main characteristic of environmental systems, the types and operation of systems.
*Practice***:** Presentation of the prepared system models, evaluation of student presentations I.

4th week
Lecture: Feedback mechanisms.
*Practice***:** Presentation of the prepared system models, evaluation of student presentations II.

5th week
Lecture: Chaos theory, the basics of the science of networks.
*Practice***:** Preparing for group work. There will be four groups. Discussing the topic to be elaborated by the groups. Students have to write a 10-12 page essay as part of a group work and have to prepare a presentation about the selected topic.

6th week
Lecture: Qualitative and quantitative changes in the global Earth System.
*Practice***:** Consultation I. on the sources of literature related to selected themes.

7th week:
Lecture: Material flows within the Earth and their surface effects on society.
*Practice***:** Consultation II. on the sources of literature related to selected themes.

8th week
Lecture: Material flows in geospheres connected with the movements of air and water: water cycle and oxygen cycle.
*Practice***:** Consultations III. on writing essay (10-12 pages) and discussion of the tasks related to the preparation of powerpoint presentation.

9th week
Lecture: Material flows in geospheres connected with the movements of air and water: nitrogen cycle, and ozone depletion.
*Practice***:** Consultations IV. Prepare the final version of the essay and discussion on the first draft of the powerpoint presentation.

10th week
Lecture: The effect of the carbon cycle on the climatic system.
*Practice***:** Consultations V. Prepare the final version of the Powerpoint presentation.

11th week
Lecture: The operation of the climate system.
*Practice***:** Presentation and evaluation of presentations of Groups 1 and 2.

12th week
Lecture: Natural and anthropogenic climate change.
*Practice***:** Presentation and evaluation of presentations of Groups 3 and 4.

13th week
Lecture: The possibilities and limitations of society in the Earth System.
*Practice***:** End-term test

14th week
Lecture: Evaluation of the course, instructions for the exam.
*Practice***:** Evaluate of the practical part of the course, offer a practical grade.

Requirements:

Attendance at **lectures** is recommended, but not compulsory.
Participation at **practice classes** is compulsory. A student must 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. 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.
During the semester there is one test: the end-term test in the 13th week. Students write an essay on the freely choosen subject and elaborate a presentation which will be presented for the students of the course. They will get a rating for the essay and the presentation. The average of the three grades will be a practical grade.
The final grade will be the average of the practical grade and the examination grade.
The minimum requirement for the end-term test and the examination respectively is 51%. Based on the score of the tests separately, the grade for the end-term tests and the examination is given according to the following table:

Score	Grade
0-50%	fail (1)
51-60%	pass (2)
61-70%	satisfactory (3)
71-85%	good (4)
86-100%	excellent (5)

If the score of any test is below 51%, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Prof**.** Dr. György Szabó, university professor, PhD

Lecturer: Prof**.** Dr. György Szabó, university professor, PhD

Title of course: Project management and R+D policy **Code: TTGME6501_EN**	**ECTS Credit points: 1**
Type of teaching, contact hours - lecture: 1 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 14 hours - practice: - - laboratory: - - home assignment: - - preparation for the exam: 16 hours Total: 30 hours	
Year, semester: 1st year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Definition of innovations. History of innovation diffusion research. Innovation models. Types of innovations. Attributes of innovations and their rate of adoption. The innovation-decision process and characteristics of different stages. Innovativeness and adopter categories. Consequences of innovations. Innovation in organisations. Definition of R+D activity and its types. Spatial diffusion of innovation. R+D policy of European Union.

Literature

Compulsory:
- Polenske, K. R. (ed) (2007) The economic geography of innovation. Cambridge
- Rogers, E. M. (2003) Diffusion of innovation. Free Press Publisher

Recommended:
- Keely L. et al. (2013) Ten types of innovation. Wiley

Schedule:

1st week
Definition of innovation: Schumpeter, Frascati Manual, Oslo Manual

2nd week
History of innovation diffusion research: theory of long waves (Kondratieff, Schumpeter, Mensch)

3rd week
Innovation models: technology push, demand pull, coupling model, integrated model, paralles and integrated model

4th week
Types of innovations: company approach (product innovation, process innovation, marketing innovation, organizational innovation), innovation matrix approach (breakthrough innovation, sustaining innovation, basic research, disruptive innovation)

5th week
Attributes of innovations and their rate of adoption: relative advantage, compatibility, complexity, trialability, observability

6th week
The innovation-decision process and characteristics of different stages I: a model of the innovation-decision process, the knowledge stage, the persuasion stage

7th week
The innovation-decision process and characteristics of different stages II: the decision stage, the implementation stage, the confirmation stage, communication channels by stages in the innovation-decision process
8th week
Innovativeness and adopter categories: adopter categories as ideal types (innovators, early adopters, early majority, late majority, laggards), characteristics of adopter categories
9th week
Consequences of innovations: classifications of consequences, achieving dynamic equilibrium, equality in the consequences of innovations
10th week
Diffusion networks: models of communication flow, characteristics of opinion leaders, the critical mass in the diffusion of interactive innovations
11th week
Innovation in organisations: types of innovation-decision, organizational innovativeness, stages in the innovation process
12th week
Spatial diffusion of innovation: history of research on spatial diffusion of innovation, types of spatial diffusion of innovation, barriers of spatial diffusion
13th week
Definition of R+D activity and its types: Frascati and Oslo Manual, basic research, applied research, development research
14th week
R+D policy of European Union: history of R+D policy of European Union, structure of R+D policy, most important characteristics of Horizon 2020 policy

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
During the semester students have to write an essay dealing with a selected subject of course.
The course ends in a written **examination**. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:

Person responsible for course: Prof. Dr. Gábor Kozma, university professor, DSc

Lecturer: Dr. Erika Nagy, assistant professor, PhD

Title of course: Project management and R+D policy **Code: TTGMG6502_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: practical grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 22
- preparation for the exam: 10

Total: 60 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Characteristics of project. Approaches to projects management: lean project management, process-based management, project production management, benefits realisation management. Most important tasks of project manager. Project management types. Project management success criteria. Risk management. Stages of project management: initiating, planning, executing, monitoring and controlling. Methods to evaluate projects. Importance of risk management. Types of project documents.

Literature

Compulsory:

- Carayannis, E. G. (ed.) (2005) The story of managing projects. Greenwood Publishing Group
- Cattani, G. – Ferriani, S. – Frederiksen, L. Florian, T. (2011) Project-based organizing and strategic management. Emerald Publishing

Recommended:

- Nokes, S (2010) The definitive guide to project management. Financial Time/Prentice Hall

Schedule:

1st week
Characteristics of projects.
2nd week
Approaches to projects management I: lean project management, process-based management
3rd week
Approaches to projects management II: project production management, benefits realisation management
4th week
Most important tasks of project manager
5th week
Project management types.
6th week
Project management success criteria. Risk management
7th week
Mid-term exam

8th week
Stages of project management I: initiating, planning,
9th week
Stages of project management II: executing, monitoring and controlling
10th week
Methods to evaluate projects
11th week
Importance of risk management
12th week
Types of project documents
13th week
Mid-term examination
14th week
Presentation of projects

Requirements:

- for a signature

Participation at practice classes is compulsory. Students must attend practice classes 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 practice classes will be recorded by the instructor. Being late is equivalent with an absence. In case of further absences, a medical certification needs to be presented.

Besides everybody has to select a project from their country and has to make a presentation about it.

- for a grade

Everybody has to take two mid-term examinations during the semester at the end of the modules. The minimum requirement for the mid-term examinations is 50%.

Based on the result of mid-term examination and the quality of presentation, the final grade is calculated as an average of them:

- the quality of the presentation (35%)
- the result of the examinations (70%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

Person responsible for course: Prof. dr. Gábor Kozma, university professor, DSc

Lecturer: Dr. Erika Nagy, assistant professor, PhD

Title of course: Regional and spatial development **Code: TTGME6505_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: 12 hours - preparation for the exam: 50 hours Total: 90 hours	
Year, semester: 1st year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

The internal system of regional development – Presentation of subsystems. The process of regional development activities. Possibilities interpretation of the region and the region types. Interpretation of the conservative, liberal and social-democratic character of spatial development. Strategic goals and tools of traditional, innovation-oriented and partnership-based regional policy. The regional management models and specific task types. The rationale and necessity of the European Union's spatial development policy and the stages of its history. The regional processes and spatial structure of Hungary. The actors, institutions and their network of regional development based on European models and the central-European reality. Content requirements and developmental directions for spatial development documents. Effects and significance of tourism in regional development.

Literature

Compulsory:

- Gyula Horváth: Spaces and places in Central and Eastern Europe : historical trends and perspectives of regional development / Abingdon ; New York : Routledge, 2015, 250 p.
Robert, Jacques : Territoire européen (angol) The European territory : from historical roots to global challenges ., New York : Routledge, Taylor & Francis Group, 2014 272 p

Recommended:

- The Routledge handbook to regional development in Central and Eastern Europe / edited by Gábor Lux and Gyula Horváth, Abingdon, Oxon ; New York : Routledge, 2018. 323 p.

Schedule:

week 1
The subsystems of spatial development, the models of the spatial development activity, their levels.
week 2
Interpretation of the conservative, liberal and social-democratic character of territorial development, the social philosophical background of attempts to develop a territorial system.
week 3
Changes in the strategic frameworks, tools and goals of regional policy over the last hundred years, comparing the stages of development.
week 4

Models of territorial management and specific types of tasks in different socially oriented and controlled areas.
week 5
The rationale and necessity of the European Union's spatial development policy - Europe's major territorial processes over the last 60 years.
week 6
The regional processes and spatial structure of Central-Europe I. - from the Second World War to the end of the 1990s
week 7
Regional processes and spatial structure of Central-Europe II. - from the change of regime to the present
week 8
The development of EU regional policy - From the beginning to the present day
week 9
The actors and institutions of regional development and their relationship systems based on European models. The motivations of governmental, municipal decision-making bodies in spatial development, the motivations of government agencies and deconcentrated bodies and development agencies in spatial development, the motivation of the private sector and the voluntary community sector in spatial development.
week 10
The development of the institutional system of spatial development in Hungary, background, causes, characteristics, consequences, results.
week 11
The content requirements of spatial development documents and their appearance in the actual spatial development decisions.
week 12
An overview of the current regional development documents of our country and our local environment.
week 13
Effects and significance of tourism in spatial development
week 14
The speciality of the development of rural and urban areas, the emergence of partnership-based spatial development activities.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
During the semester students have to write an essay dealing with a selected subject of course.
The course ends in a written **examination**. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:

Person responsible for course: Dr. János Pénzes, associate professor, PhD
Lecturer: Dr. Zsolt Radics, assistant professor, PhD

Title of course: Regional and spatial development **Code: TTGMG6506_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: practical grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The course **offers** a deep, but specific set of knowledge on economic geography which is suitable for the theoretical foundation of regional development activities. In the framework of the practical course focusing on East Central Europe the students deal with development issues of the global semi-periphery based on different theories explaining the global socio-economical inequalities. They get acquainted with these theoretical concepts and experience their usefulness through case studies.

Content of the course: definition of semi-periphery, evidences for the semi-periphery character of East Central Europe. Concepts of global commodity chains / global value chains / global production networks, theories of new regionalism (industrial districts, clusters, regional innovation systems) and approaches of evolutionary economic geography (path-dependence, related / unrelated variety, regional resilience) as well as their application in the research of the East Central European economy.

Literature

Horváth, Gy. (2015): Spaces and places in Central and Eastern Europe. Historical trends and perspectives of regional development. Routledge, London, New York. ISBN: 978 0 41572 774 7

De Marchi, V. - Di Maria, E. - Gereffi, G. eds. (2018): Local clusters in global value chains linking actors and territories through manufacturing and innovation. Routledge, London, New York. ISBN: 978 1 13874 286 4

Boschma, R. - Martin, R. eds. (2010): The Handbook of Evolutionary Economic Geography. Edward Elgar, Cheltenham, Northampton. ISBN: 978 1 84720 491 2

Schedule:

1st week

Concept of semi-periphery, general information about the course, distribution of the tasks.

2nd week

Socio-economic features of East Central Europe 1. Economy.

3rd week

Socio-economic features of East Central Europe 2. Society.

4th week

Socio-economic features of East Central Europe 3. Settlement system, spatial structures.
5th week
Explanations 1. The concept of global commodity chains / global value chains.
6th week
Explanations 2. East Central Europe and global production networks.
7th week
Explanations 3. The concept of industrial districts.
8th week
Explanations 4. East Central Europe and clusters.
9th week
Explanations 5. The notion of regional innovation systems.
10th week
Explanations 6. The evolutionary concept of path-dependence.
11th week
Explanations 7. The evolutionary concept (un) related diversification.
12th week
Explanations 8. The idea of regional resilience.
13th week
Summary: East Central Europe – a semi-peripheral region in mirror of different theories. Discussion.
14th week
Summary: East Central Europe – a semi-peripheral region in mirror of different theories. Evaluation.

Requirements:
- for a signature and grade
Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. Attendance at practice classes will be recorded by the practice leader. Students are required to elaborate a chosen article, to present it to the others as well as to write an essay till the end of the semester answering the question(s) asked at the first lesson. **Final grade** is based on the evaluation of active participation and presentation as well as of the written essay:

- active participation and presentation (50%)
- the quality of the essay (50%)

The grade for the course is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. János Pénzes, associate professor, PhD

Lecturer: Dr. Ernő Molnár, assistant professor, PhD

Title of course: Space and society **Code: TTGME6507_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 1 hours/week
- practice: 2 hours/week
- laboratory: -

Evaluation: by two written tests covering the practical lessons (60%), by one written test covering the theoretical lessons (30%) and by the short essay and homework

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- practice: 28 hours
- laboratory: -
- home assignment: 18
- preparation for the exam: 30 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

The objectives of the course is to provide comprehensive overview about the – primarily quantitative – research approach and techniques of the society's spatial organization. The theoretical background and analytical methods of spatial inequalities are especially emphasized. Multivariate statistical methods and spatial parametric calculations are also included

Literature

Coulter, Philip B. 1989: Measuring inequality. A methodological handbook. – Westview Press, London. 204 p. (ISBN 9780813377261)

Fotheringham, Stewart – Brunsdon, Chris – Charlton, Martin 2000: Quantitative Geography: Perspectives on Spatial Data Analysis. – SAGE Publications Ltd., 288 p. (ISBN 978-0761959472)

Gyuris, Ferenc 2013: The Political Discourse of Spatial Disparities: Geographical Inequalities Between Science and Propaganda. Springer, Cham–Heidelberg–New York. 381 p. (ISBN 978-3-319-01507-1)

Haggett, Peter 2001: Geography: A Global Synthesis. – Prentice Hall. 864 p. (ISBN 978-0582320307)

Schedule:

1st week Ratio and average values in the social, economic analyses

2nd week Analysis of spatial social inequalities I.

3rd week Analysis of spatial social inequalities II.

4th week Analysis of spatial social inequalities III.

5th week Indicators of spatial segregation

6th week Correlation and regression analyses in the social, economic analyses

7th week Mid-term test

8th week Composite indicators

9th week Multivariate statistical methods in the social, economic analyses

10th week Spatial analyses, spatial relations

11th week Spatial parameters in the spatial interaction models I.

12th week Spatial parameters in the spatial interaction models II.

13th week Network analysis in the social, economic studies

14th week End-term test

Requirements:

Participation at classes is compulsory. A student must attend the courses 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.
Home tasks are required in order to practice which is included in the evaluation of the final grade. During the semester there are two tests for the practice (the mid-term test in the 7th week and the end-term test in the 14th week) and one end-term test in the 14th week for the theory.
The subject matters are basing on the lectures and the additional supplements provided.

Score	Grade
0-49	fail (1)
50-62	pass (2)
63-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

The minimum requirement for the mid-term and end-term tests respectively is 50%. The final grade is the weighted average of them (each test 30%; evaluation of home tasks 10%).

Person responsible for course: Dr. Károly Teperics, associate professor, PhD

Lecturer: Dr. János Pénzes, associate professor, PhD

Title of course: Political geography and globalisation **Code: TTGME6503_EN**	**ECTS Credit points: 5**
Type of teaching, contact hours - lecture: 2 hours/week - practice: 2 hours/week - laboratory: -	
Evaluation: exam, mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: 28 hours - laboratory: - - home assignment: 44 hours - preparation for the exam: 50 hours Total: 150 hours	
Year, semester: 1st year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

The aim of the course is to help the student understand and learn the globalisation as an economic and social process and the recent geographical political problems. The student get practice in the course how to use methods in the political geographical research and how to use sources interpreting the global world.

Literature

Compulsory:

- Huntington, S. P. (2016): The Clash of Civilizations and the Remaking of World Order. ISBN: 9780140267310.
- Maurice Mullard (2006): The Politics of Globalisation and polarisation. ISBN: 978-1845427795

Recommended:

- Francis Fukuyama (1992): The End of History and the Last Man. ISBN: 978-0743284554.
- Henry Kissinger (1994): Diplomacy. ISBN: 978-0671510992.

Schedule:

1st week
The division of the political geography, its internal system.
2nd week
Globalization – its main geographic features and interpretations.
3rd week
The themes of globalization I. - The family and the nation in globalization. Globalization and liberalism: individual human rights.
4th week
The themes of globalization II. - Environmental issues. The relationship between globalization and the USA. Giants of globalisation. Conspiracy theories and globalization.
5th week
Demographic trends and their political geographical consequences I. Demographic explosion in the world after 1960. Population growth of South Asia between 1960 and 2015.
6th week
Demographic trends and their political geographical consequences II. - The population growth of Africa and Europe between 1960 and 2015. Prospects for population growth by 2050.

7th week
Security policy challenges in the global world I. – Political geographical changes in South Asia and Africa between 1960-2001.
8th week
Security policy challenges in the global world II - Islamic growth in South Asia and Africa. After September 11, 2001 in South Asia. After 11 September 2001 in Africa.
9th week
Security policy challenges in the global world III.- The USA as the exporter of democracy, the "Arab Spring". Today's terrorism - Islamic State and Boko Haram. Terrorism in Europe.
10th week
Political Geographical interpretation of poverty, hunger, and ecological crisis I. - The evolution of GDP per capita between 1960 and 2015. The geography of poverty, economic refugees and refugees from the economic situation. Refugee camps in the world.
11th week
Political geographical interpretation of poverty, hunger, ecological crisis II. - Ecological problems such as geographical causes of political conflicts (hunger, healthy drinking water, diseases (Ebola, epidemics, etc.).
12th week
Geographical background of migration: Migrations in world history, the spread of humanity, its political implications (the spread of religions - crusades, assimilation and civilization, XX-XXI. century attraction centres (America, Southeast Asia and Australia, Europe).
13th week
The South Asians and Africans image about Europe, views of European countries and Europeans, and the change of Europeans' world view.
14th week
Refugees, migrants (economic refugees or economic migrants) The EU's foreign policy: Schengen and borders, migrants, Dublin Conventions, migrants in the Mediterranean Sea and in the Balkans, migrant routes.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
Writing an **essay** in a topic chosen by the student.
The course ends in an oral **examination**.

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. István Zoltán Pásztor, assistant professor, PhD

Lecturer: Dr. István Zoltán Pásztor, assistant professor, PhD

Title of course: Sampling and data collection **Code: TTGME7007_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Techniques of active and passive remote sensing. Technical backround of data capture. Physical background of optical remote sensing. Atmospheric correction. Spectral profiles. Significance of swath, binning and geometric resolution. Main techniques of hyperspectral data processing. Physical background of LiDAR (Light Detection and Ranging). Processing techniques and feature extraction. Radar data and theoretical details of data capturing. Radar data processing.

Literature

- *Marcus Borengasser, William S. Hungate, Russell Watkins 2007: Hyperspectral Remote Sensing: Principles and Applications, CRC Press,*
- *Prasad S. Thenkabail, John G. Lyon 2011: Hyperspectral Remote Sensing of Vegetation, CRC Press, p. 782*
- *Weitkamp, Claus 2005: Lidar. Range-Resolved Optical Remote Sensing of the Atmosphere, Springer*
- *Takashi Fujii, Tetsuo Fukuchi 2005: Laser Remote Sensing, CRC Press, p. 912*

Schedule:

1st week
Physical aspects of remote sensing
2nd week
Light scattering and atmospheric correction
3rd week
Hyperspectral remote sensing (data collection)
4th week
Techniques of hyperspectral data processing (train and test dataset)
5th week
Techniques of hyperspectral data processing II. (band selection)
6th week
Techniques of hyperspectral data processing III. (machine learning)
7th week
Midterm written exam
8th week

The LiDAR data: types, physical basics, elements of a LiDAR system
9th week
Aerial LiDAR
10th week
Terrestrial LiDAR
11th week
Software environments for LiDAR data
12th week
Feature extraction from LiDAR data
13th week
Digital terrain modelling from LiDAR data, ground point filtering
14th week
Grade offering exam

Requirements:
- *for a signature*
Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester.
The students must choose one of the topics offered by the teacher to plan a project, write an essay and prepare a presentation.
The students must take a written exam at the end of the semester.
- *for a grade*
The course ends in an **examination**:
Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-49	fail (1)
50-64	pass (2)
65-74	satisfactory (3)
75-85	good (4)
86-100	excellent (5)

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

Person responsible for course: Prof. Dr. Szilárd Szabó, university professor, DSc

Lecturer: Prof. Dr. Szilárd Szabó, university professor, DSc

Title of course: Database Management **Code: TTGME7008_EN**	**ECTS Credit points: 1**

Type of teaching, contact hours
- lecture: 1 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 16 hours

Total: 30 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The main concept of database management approach. Basic nomenclature of data modelling. Structure of Database Management Systems. Database administrator and workgroups in DBMS. The Relational Model: relational scheme and relation. Constraints in Relational Models. Functional dependence and its properties. The fundamentals of database system design: directives and normal forms. Relational algebra. The Entity-Relation (ER) model. The implementation of ER model into relational model. The structure of EER model and its implementation of EER model. The main nomenclature of Object oriented DBMS. The main concept of ODMG. The ODL language. The implementation ODL schemes into relational model. Transaction handling and permission management. Introduction of Oracle Spatial.

Literature

- Bowman, J.S. (2006): The practical SQL handbook: using SQL variants. 4th edition, Addision-Wesley.
- Connolly, T., Begg, C. (2014): Database Systems: A Practical Approach to Design, Implementation, and Management. 6th edition. Pearson.
- Gillenson, M.L. (2011): Fundamentals of Database Management Systems. 2nd edition. Wiley.
- Harper, S. (2009): Oracle SQL developer 2.1 : database design and development using this feature-rich, powerful, user-extensible interface. Packt Publ.

Schedule:

1st week Introduction to the course. Database administrator and workgroups in DBMS.
2nd week Basic nomenclature of data modelling. Structure of Database Management Systems.
3rd week The Relational Model: relational scheme and relation.
4th week Constraints in Relational Models, examples.
5th week Functional dependence and its properties.
6th week The fundamentals of database system design: directives and normal forms. (1NF, 2NF, 3NF, BCNF).
7th week Relational algebra.
8th week The Entity-Relation (ER) model. The implementation of ER model into relational model.
9th week The structure of EER model and its implementation of EER model.
10th week The main nomenclature of Object oriented DBMS.

11th week The main concept of ODMG. The ODL language.
12th week The implementation ODL schemes into relational model. Transaction handling and permission management.
13th week Introduction of Oracle Spatial.
14th week Types of Oracle Spatial.

Requirements:

Participation at classes is strongly suggested.
In the end of the semester there is one test.
The minimum requirement for the test and the examination respectively is 50%. Based on the score of the test, the grade for the test and the examination is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-72	satisfactory (3)
73-84	good (4)
85-100	excellent (5)

Person responsible for course: Dr. Boglárka Balázs, assistant professor, PhD

Lecturer: Dr. Boglárka Balázs, assistant professor, PhD
Dr. László Bertalan, assistant professor, PhD

Title of course: Database Management **Code: TTGML7009_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: 2 hours/week	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: - - laboratory: 28 hours - home assignment: 32 hours - preparation for the exam: - Total: 60 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Summary of theoretical background related to Database Management. Main functions of SQL structured query language. Main settings of SQL Developer environment. DML statements. Creation of data tables. Adding constraints. Modification of data table columns, rename and delete. Insertion of columns and values, batch insertion method. Simple and one-table queries. Function implementation. Grouped data handling. Joining tables. Embedded function implementation. DCL statements. Permission management.

Literature

- Bowman, J.S. (2006): The practical SQL handbook: using SQL variants. 4th edition, Addision-Wesley.
- Gillenson, M.L. (2011): Fundamentals of Database Management Systems. 2nd edition. Wiley.
- Harper, S. (2009): Oracle SQL developer 2.1: database design and development using this feature-rich, powerful, user-extensible interface. Packt Publ.
- Nield, T. (2016): Getting Started with SQL: A Hands-On Approach for Beginners. 1st edition. O'Reilly Media.

Schedule:

1st week Introduction to the course. Requirements. Summary of theoretical background related to Database Management. Main functions of SQL structured query language. Main settings of SQL Developer environment.
2nd week DDL statements. Creation of data tables. Adding constraints. Modification of data table columns, rename and delete.
3rd week DML statements. Insertion of columns and values, batch insertion method.
4th week DQL statements. Simple and one-table queries.
5th week DQL statements. Function implementation.
6th week DQL statements. Grouped data handling.
7th week DQL statements. Joining tables.
8th week Summary, practice.
9th week DQL statements. Embedded function implementation.
10th week DQL statements. Logical operations.
11th week DCL statements. Permission management

12th week Summarizing, practicing.
13th week Test. Offered grading.
14th week Obligatory test, semester closing.

Requirements:
Participation at classes is compulsory. A student must attend the courses 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.
During the semester there is one practical test. It can be completed in the 13th or 14th week.
The minimum score is 50%. Based on the score of the test, the grade for the test is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-72	satisfactory (3)
73-84	good (4)
85-100	excellent (5)

-an offered grade:
it may be offered for students if the test written in the 13th week is at least satisfactory (3).
- in case an offered grade cannot be given, or it is not convenient for the student there is a possibility to repeat in the last week

Person responsible for course: Dr. Boglárka Balász, assistant professor, PhD

Lecturer: Dr. Boglárka Balázs, assistant professor, PhD
Dr. László Bertalan, assistant professor, PhD

Title of course: GIS specific programming **Code: TTGME7010_EN**	**ECTS Credit points: 4**
Type of teaching, contact hours - lecture: 3 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 42 hours - practice: - - laboratory: - - home assignment: - - preparation for the exam: 78 hours Total: 120 hours	
Year, semester: 1st year, 2st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Fundamentals of programming (algorithm, methods of algorithm description, programming paradigms, interpreter, compiler). Fundamentals of Python (variable, data types, basic programming structures, objects, user defined functions, exception handling, user input). Applying codes in ArcGIS. Reading, modifying and deleting data from GIS file types with the help of ArcPy package. Creating new files, updating attribute tables. Working with rasters.

Literature

- Eric Pimpler, Programming ArcGIS 10.1 with Python Cookbook, Packt Publishing, 2013.
- Rance D. Necaise, Data Structures and Algorithms Using Python, Wiley, 2011.
- Kent D. Lee, Steve Hubbard, Data Structures and Algorithms with Python, Springer, 2015.
- Paul A. Zandbergen, Python Scripting for ArcGIS, ESRI Press, 2013

Schedule:

1st week Fundamentals of programming. Basic steps of program design, the concept and expression types of algorithms, structured programming, control statements. Introduction to Python.

2nd week Operator types (e.g. relation, logical, etc.). Rules of expression evaluation. Syntax and usage of different types of selection and loop. Concept and application of modules. Steps of script writing. Numeric and string datatypes.

3rd week Basic principles of object oriented programing (object, attribute, method, object variables, syntax rules). Types of "for" loop.

4th week Concept and usage of exceptions.

5th week Basics of ArcPy site package.

6th week Coding in ArcGIS. Working with the Mapping module of ArcPy. Analysis of scripts downloaded from internet.

7th week: Concept, properties, structure, and storing options of feature classes (shape files, geodatabase). Types and applications of cursor objects.

8th week Adding new attribute data to a feature class (with checking). How to calculate and populate values for an attribute.

9th week Working with text files (basic steps, functions, checking).

10th week Storing geometry of a feature class, object types and their methods to access geometry data.

11th week Building new geometry and its assignment to a feature. Principle of multigeometry. Creating new shape file or geodatabase for a feature class.

12th week Accessing raster data and their properties from scripts. Working with Spatial Analyst module of Arcpy.

13th week Case studies.

14th week Points to remember, discussing the structure of the exam.

Requirements:

Participation at classes is compulsory. A student must attend the courses 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.

Grade is given based on the scores gained at the exam according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

-an offered grade:
it may be offered for students if his/her performance at the lab tests exceeds the satisfactory level and he/she takes part at the classes actively.
- in case an offered grade cannot be given, or student declines it, there is a possibility to have an exam in the exam session.

Person responsible for course: Dr. Gergely Szabó, associate professor, PhD

Lecturer: Dr. Marianna Zichar, associate professor, PhD

Title of course: GIS specific programming **Code: TTGML7011_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: 2 hours/week	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: - - laboratory: 28 hours - home assignment: 32 hours Total: 60 hours	
Year, semester: 1st year, 2st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Fundamentals of programming (algorithm, methods of algorithm description, programming paradigms, interpreter, compiler). Fundamentals of Python (variable, data types, basic programming structures, objects, user defined functions, exception handling, user input). Applying codes in ArcGIS. Reading, modifying and deleting data from GIS file types with the help of ArcPy package. Creating new files, updating attribute tables. Working with rasters.

Literature

- Eric Pimpler, Programming ArcGIS 10.1 with Python Cookbook, Packt Publishing, 2013.
- Rance D. Necaise, Data Structures and Algorithms Using Python, Wiley, 2011.
- Kent D. Lee, Steve Hubbard, Data Structures and Algorithms with Python, Springer, 2015.
- Paul A. Zandbergen, Python Scripting for ArcGIS, ESRI Press, 2013

Schedule:

1st week Fundamentals of programming. Basic steps of program design, the concept and expression types of algorithms, structured programming, control statements. Introduction to Python.

2nd week Operator types (e.g. relation, logical, etc.). Rules of expression evaluation. Syntax and usage of different types of selection and loop. Concept and application of modules. Steps of script writing. Numeric and string datatypes.

3rd week Basic principles of object oriented programing (object, attribute, method, object variables, syntax rules). Types of "for" loop.

4th week Concept and usage of exceptions.

5th week Basics of ArcPy site package.

6th week Coding in ArcGIS. Working with the Mapping module of ArcPy. Analysis of scripts downloaded from internet.

7th week: Concept, properties, structure, and storing options of feature classes (shape files, geodatabase). Types and applications of cursor objects.

8th week Adding new attribute data to a feature class (with checking). How to calculate and populate values for an attribute.

9th week Working with text files (basic steps, functions, checking).

10th week Storing geometry of a feature class, object types and their methods to access geometry data.

11th week Building new geometry and its assignment to a feature. Principle of multigeometry. Creating new shape file or geodatabase for a feature class.

12th week Accessing raster data and their properties from scripts. Working with Spatial Analyst module of Arcpy.

13th week Case studies.

14th week Points to remember, discussing the structure of the exam.

Requirements:

Participation at classes is compulsory. A student must attend the courses 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.

Grade is given based on the scores gained at the exam according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

-an offered grade:
it may be offered for students if his/her performance at the lab tests exceeds the satisfactory level and he/she takes part at the classes actively.
- in case an offered grade cannot be given, or student declines it, there is a possibility to have an exam in the exam session.

Person responsible for course: Dr. Gergely Szabó, associate professor, PhD

Lecturer: Dr. Marianna Zichar, associate professor, PhD

Title of course: Technical Informatics **Code: TTGME7012_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: 22 hours - preparation for the exam: 40 hours Total: 90 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Terminology of computer networking. The history of Internet, its development and recent tendencies. The tasks of data communication. Development of data communication networks and architectures. Terminology of data forwarding. Methods for transfer and connection. Network addressing and services. Layered network systems and references models. Protocol stack. The structure of DNS namespace and the operation of name resolution types. Iterative and recursive name resolution. Electronic mail systems. UDP and TCP protocols. Connection management and Reliable Data Transfer. Addressing and Multiplexing. Network traffic control. IP-based network communication. IP addressing mechanisms, classes and subnetworks. Network routing. ARP address resolution protocol and data fragmentation. The technical implementation of data transfer. Cable types, physical basics of technical implementation. Metal and fiber optic-based wired and wireless transmission. Network devices and network design, construction. Methods of signal encoding.

Literature

- Nastase, R. (2017): Computer Networking: Beginner's guide for Mastering Computer Networking and the OSI Model (Computer Networking Series Book 1). Amazon.
- Olifer, N., Olifer, V. (2005): Computer Networks: Principles, Technologies and Protocols for Network Design. Wiley.
- Schlager, R. (2013): The OSI Model: simply explained. CreateSpace Independent Publishing Platform
- Severance, C.R. (2015): Introduction to Networking: How the Internet Works. CreateSpace Independent Publishing Platform; 1 edition

Schedule:

1st week Introduction to the course. Terminology of computer networking. The history of Internet, its development and recent tendencies.

2nd week The tasks of data communication. Development of data communication networks and architectures. Terminology of data forwarding.

3rd week Methods for transfer and connection. Network addressing and services. Layered network systems and references models. Protocol stack.

4th week The structure of DNS namespace and the operation of name resolution types. Iterative and recursive name resolution.

5th week File transfer (FTP). Electronic mail systems (SMTP, POP, IMAP, MIME). Webmail.

6th week The Internet (WWW, HTTP, HTML, WWW addressing system, URL and URI structure).

7th week UDP and TCP protocols. Connection management and Reliable Data Transfer.

8th week Addressing and Multiplexing. Network traffic control.

9th week IP-based network communication (IP, ICMP).

10th week IP addressing mechanisms, classes and subnetworks.

11th week Network routing.

12th week ARP address resolution protocol and data fragmentation.

13th week The technical implementation of data transfer.

14th week Cable types, physical basics of technical implementation. Metal and fiber optic-based wired and wireless transmission. Network devices and network design, construction. Methods of signal encoding.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
In the end of the semester there is one final test.
- for a grade
The course ends in an **examination**. The exam grade is the result of the examination.
The minimum requirement for the examination is 50%. Based on the score of the test the grade for the examination is given according to the following table:

Score	Grade
0-49%	fail (1)
50-59%	pass (2)
60-72%	satisfactory (3)
73-84%	good (4)
85-100%	excellent (5)

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

Person responsible for course: Dr. Gábor Négyesi, assistant professor, PhD

Lecturer: Dr. Gábor Négyesi, assistant professor, PhD

Title of course: Technical Informatics **Code: TTGML7013_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: 2 hours/week	
Evaluation: test, presentation	
Workload (estimated), divided into contact hours: - lecture: 0 hours - practice: 0 hours - laboratory: 28 hours - home assignment: 16 hours - preparation for the exam: 16 hours Total: 60 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

The following topics will be covered by the student presentations and practice: BigData & GIS, Cloud technology (Cloud & Fog Computing), Web2.0 & GIS; Smart City & GIS; IoT – Internet of Things; Parallel computing technologies – Supercomputers & GIS; Machine Learning; Automation and GIS in the precision agriculture; CISCO, Barcodes and QR codes; Mobile telecommunications technologies; Virtual Reality models in GIS.
Virtual Computers, Installing operation systems (Windows Server, Linux distributions). Establishing FTP connections and Servers.

Literature

- Nastase, R. (2017): Computer Networking: Beginner's guide for Mastering Computer Networking and the OSI Model (Computer Networking Series Book 1). Amazon.
- Olifer, N., Olifer, V. (2005): Computer Networks: Principles, Technologies and Protocols for Network Design. Wiley.
- Schlager, R. (2013): The OSI Model: simply explained. CreateSpace Independent Publishing Platform
- Severance, C.R. (2015): Introduction to Networking: How the Internet Works. CreateSpace Independent Publishing Platform; 1 edition

Schedule:
1st week Introduction to the course. Schedule for the semester. Terminology of computer networking and operation systems.

2nd week Student presentations (each 20') about innovations and newest hardware and software technologies.

3rd week Student presentations (each 20') about innovations and newest hardware and software technologies.

4th week Student presentations (each 20') about innovations and newest hardware and software technologies.

5th week Student presentations (each 20') about innovations and newest hardware and software technologies.

6th week Virtual Computers, Installing operation systems (Windows Server).

7th week Virtual Computers, Installing operation systems (Linux distributions).

8th week Virtual Computers, Establishing FTP connections and Servers.

9th week Mobile – overview.

10th week Mobile programming (Android).

11th week Mobile programming (Android).

12th week Practice, questions, summary.

13th week Test. Offered grading.
14th week Obligatory test, semester closing.

Requirements:

Attendance at **classes** is compulsory. A student must attend the courses 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.
During the semester the students have to complete a project and present it, and in the end of the semester there is one final test.
The exam grade is calculated from the result of the test (70%) and the grade of presentation (30%). The minimum requirement for the examination is 50%. Based on the score of the test the grade is given according to the following table:

Score	Grade
0-49%	fail (1)
50-59%	pass (2)
60-72%	satisfactory (3)
73-84%	good (4)
85-100%	excellent (5)

If the result of any task is below 50%, students have to compose a short document about the topics of presentation and retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:
it may be offered for students if the test written in the 13th week is at least satisfactory (3).
- in case an offered grade cannot be given, or it is not convenient for the student there is a possibility to repeat in the last week.

Person responsible for course: Dr. Gábor Négyesi, assistant professor, PhD

Lecturer: Dr. Gábor Négyesi, assistant professor, PhD

Title of course: **Web maps** **Code: TTGME7014_EN**	**ECTS Credit points: 4**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: 1 hours/week
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: 14 hours
- laboratory: -
- home assignment: 28 hours
- preparation for the exam: 50 hours

Total: 120 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Types and characteristics of web maps. Effective usage of KML language elements. Characteristics of geoportals, discussion of related case studies. Creation of HTML pages containing maps with customized information with the help of JavaScript and Google Maps API. 3D models on the maps.

Literature

- Pinde Fu, Jiulin Sun, Web GIS, Principles and applications, ESRI Press, 2011.
- Josie Wernecke: The KML Handbook, Addison-Wesley, 2009
- Alper Dincer, Balkan Uraz, Google Maps JavaScript API Cookbook, Packt Publishing, 2013.

Schedule:

1st week
Lecture: Data mining on we data sources and GIS applications
*Practice***:** Identify the data sources on their functionality; classify data sources,

2nd week
Lecture: Steps and background of Google Map creation
*Practice***:** Creation and publication of a simple Google Map

3rd week
Lecture: Different types of placemark geometry
*Practice***:** Create and manage placemarks

4th week
Lecture: HTML formatting in the attribute data in placemarks' connected data
*Practice***:** Character formatting, links, tables, pictures

5th week
Lecture: Application of uniqe styles, style elements
*Practice***:** Elaboration of unique styles

6th week
Lecture: Shared formatting and stylemaps. Placemarks with multigeometry.
*Practice***:** Practice on style sharing and multigeometry.

7th week:
Lecture: Possibilities of ground overlay, screen overlay, photo overlay.
*Practice***:** Definition of overlying pictures and their characteristics.

8th week
Lecture: Midterm summary.
*Practice***:** Midterm written exam.

9th week
Lecture: Network links and their applications. Animation with timestamp and time range
*Practice***:** Practice on animation

10th week
Lecture: The Google Maps API
*Practice***:** Practice on Google Maps API.

11th week
Lecture: Efficient management of bulk data of placemarks; data storage options and regions
*Practice***:** Practice on regions and visibility of placemarks

12th week
Lecture: KML and event management
*Practice***:** Creation of KML file

13th week
End-term test

14th week
Lecture: Evaluation of the course, instructions for the exam.
*Practice***:** Evaluate of the practical part of the course, offer a practical grade.

Requirements:

Attendance at **lectures** is recommended, but not compulsory.
Participation at **practice classes** is compulsory. A student must 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. 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.
The final grade will be the average of the practical grade and the examination grade.
The minimum requirement for the end-term test and the examination respectively is 51%. Based on the score of the tests separately, the grade for the end-term tests and the examination is given according to the following table:

Score	Grade
0-50%	fail (1)
51-60%	pass (2)
61-70%	satisfactory (3)
71-85%	good (4)
86-100%	excellent (5)

If the score of any test is below 51%, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
Person responsible for course: Dr.. Gábor Négyesi, asssisstant professor, PhD
Lecturer: Dr. Gábor Négyesi, assistant professor, PhD Dr. Marianna Zichar, associate professor, PhD

Title of course: GIS software **Code: TTGML7022_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 1 hours/week - practice: 0 hours/week - laboratory: 2 hours/week	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: 14 hours - practice: - - laboratory: 28 hours - home assignment: 48 hours - preparation for the exam: - Total: 90 hours	
Year, semester: 2nd year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Over the course, the students discover different modules of the TopoLynx a kind of GIS software about how to use it in spatial data analyses, data management, and map editing through practical problems. They also gain information about the theoretical background of object-based image analysis, fields of application, workflows of eCognition software. The course allows students to get to know about segmentation procedures, image classification methods and how to use eCognition in analyzing of remote sensing data and creating of thematic maps.

Literature

- Blaschke, T., Lang, S., Hay, G. 2008. Object-Based Image Analysis: Spatial Concepts for Knowledge-Driven Remote Sensing Applications. Springer, 817 p.
- eCognition Reference Book. Trimble
- eCognition User Guide. Trimble
- www.ecognition.com
- http://topolynx.hu/#hardware

Schedule:

1st week Lecture&laboratory: Introduction to the course. Conceptual background.

2nd week Lecture: Database-organization, data segment creation, data access modification.
Laboratory: The TopoLynx software family and software environment, production support, graphical surface.

3rd week Lecture: Digital image processing.
Laboratory: Map visualization, thematical mapping, map views ant layer handling, visualization of vector layers.

4th week Lecture: Raster analyse, image filthering methods.
Laboratory: Operations with maps (measures, information query, selection), Editing and drawing maps, Export-import functions in TopoLynx.

5th week Lecture: Surface modelling, volume calculations.

Laboratory: Raster functions, image processing, raster analyses, export of surface models, transformations of maps, spatial visualization.

6th week Lecture: Transformation methods.
Laboratory: Handling of data, creating data structures, data filtering, data export and import.

7th week Lecture: Georeferencing and orthorectifying.
Laboratory: Layout view, printing the maps.

8th week Lecture: Introduction to conceptual background of object-based image analysis. Object-oriented methods vs. pixel-based techniques.
Laboratory: About eCognition software. System requirements. Graphical unit interface.

9th week Lecture: Pixel co-ordinate system and user co-ordinate system. Image layer related features. Image object related features.
Laboratory: Supported data types, tools, panels. Creating eCognition projects.
10th week Lecture: Image object hierarchy. Segmentation algorithms I.
Laboratory: Segmentation techniques.

11th week Lecture: Segmentation algorithms II.
Laboratory: Image classification.

12th week Lecture: Accuracy assessment.
Laboratory: Accuracy assessment. Raster-vector conversion.

13th week Practical grading – offered grade.

14th week Practical grading.

Requirements:
- for a signature
Attendance at **practice classes** is compulsory. A student must 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. 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, to be discussed with the tutor. Students are required to bring the drawing tasks, drawing instruments and calculator of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behavior or conduct doesn't 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.
- for a grade
The course ends in a practical grading.
The final grade is calculated as the weighted average of practical examination grade (75%) and the presentation quality (25%).
The minimum requirement for the practical grading respectively is 50%. Based on the score of the test, the grade for the test is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-86	good (4)
87-100	excellent (5)

If the practical grading is not successful, students can repeat the referring in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS. *-an offered grade:* it may be offered for students in the 13th week if the grade is at least satisfactory (3).
Person responsible for course: Dr. Zoltán Túri, assistant professor, PhD
Lecturer: Dr. Gábor Négyesi, assistant professor, PhD Dr. Zoltán Túri, assistant professor, PhD

Title of course: GIS analyses I. **Code: TTGML7015_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: 2 hours/week	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: - - laboratory: 28 hours - home assignment: 32 hours - preparation for the exam: - Total: 60 hours	
Year, semester: 2nd year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Over the course, the students discover different modules of ENVI and how to use this software in analyzing of different spectral, geometric and radiometric resolution remotely sensed data. They also gain information about the theoretical background of pixel-based image analysis. The course allows students to get to know about image classification methods and creating of thematic maps.

Literature

- Robert A. Schowengerdt (2007). Remote Sensing: Models and Methods for Image Processing. 3rd Edition, Academic Press, 558 p.
- ENVI Tutorials. http://www.harrisgeospatial.com/docs/tutorials.htm
- ENVI Documents. http://www.harrisgeospatial.com/docs/using_envi_Home.html

Schedule:

1st week Introduction to the course. Definitions. Theoretical background of image processing. Image classification techniques.

2nd week About ENVI software. System requirements. Supported data types. Graphical unit interface.

3rd week Browse, open and display data. Display tools. Enhancement tools, stretch, status bar.

4th week Data management. Image window views. Base projection. Manage raster layers. Change a color table.

5th week View and standard portal. View metadata, ENVI header files. ROIs, vector toolbox tools, annotations.

6th week Scatter plot. Image preprocessing. Creating mask, selecting mask rasters. Atmospheric, radiometric and other correction tools.

7th week Image transformations. Principal components analysis, independent components analysis, minimum noise fraction transform, tasseled cap.

8th week Band math, spectral indices. Mosaic georeferenced images.

9th week Georectify imagery. Orthorectification workflow. Orthorectification using reference images.

10th week Image classification. ISODATA classification, Mahalanobis distance classification, maximum likelihood classification, minimum distance classification, spectral angle mapper.

11th week Landsat time series image analysis.

12th week Feature extraction with example-based classification.

13th week Practical grading – offered grade.

14th week Practical grading.

Requirements:
- for a signature
Attendance at **practice classes** is compulsory. A student must 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. 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, to be discussed with the tutor. Students are required to bring the drawing tasks, drawing instruments and calculator of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behavior or conduct doesn't 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.
- for a grade
The course ends in a practical grading.
The minimum requirement for the practical test respectively is 50%. Based on the score of the test, the grade for the test is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-86	good (4)
87-100	excellent (5)

If the practical grading is not successful, students can repeat the referring in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:
it may be offered for students in the 13th week if the grade is at least satisfactory (3).

Person responsible for course: Dr. Zoltán Túri, assistant professor, PhD

Lecturer: Dr. Zoltán Túri, assistant professor, PhD

Title of course: GIS based analysis II. **Code: TTGML7016_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: 2 hours/week	
Evaluation: mid-semester grade	
Workload (estimated), divides into contact hours: - lecture: - - practice: - - laboratory: 28 hours - home assignment: 32 - preparation for the exam: - Total: 60 hours	
Year, semester: 2nd year, 2nd semester	

Topics of course

The concept of the course is to introduce the most important analysis techniques for the students in the field of social and economic geography.

Literature

- Robert A. Schowengerdt (2007). Remote Sensing: Models and Methods for Image Processing. 3rd Edition, Academic Press, 558 p.
- ENVI Tutorials. http://www.harrisgeospatial.com/docs/tutorials.htm
- ENVI Documents. http://www.harrisgeospatial.com/docs/using_envi_Home.html

Schedule

1st week: Short summary on vector type data models along practical points

2nd week: Practice with applied data on buffer generation

3rd week: Geoprocessing with points and lines

4th week: Geoprocessing with poligons

5th week: Editing Open Street Map layers

6th week: Publication of spatial on the web

7th week: WMS, WFS and TMS layers

8th week: midterm exam

9th week: Project work: creating working groups and data definition

10th week: Project work: data collection

11th week: Project work: data management and analysis

12th week: Presentation of the projects

13th week: Presentation of the projects

14th week: End-term exam

Requirements

Participation at **practice classes** is compulsory. A student must 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. 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.

The final grade will be the average of the practical grade and the examination grade.

The minimum requirement for the end-term test and the examination respectively is 51%. Based on the score of the tests separately, the grade for the end-term tests and the examination is given according to the following table:

Score	Grade
0-50%	fail (1)
51-60%	pass (2)
61-70%	satisfactory (3)
71-85%	good (4)
86-100%	excellent (5)

If the score of any test is below 51%, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS

Person responsible for course: Dr. Zoltán Túri, assisstant professor, PhD

Lecturer: Dr. Zoltán Túri, assisstant professor, PhD
Dr. János Pénzes, associate professor, PhD

Title of course: Models in GIS **Code: TTGME7017_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: written exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: 24 hours - preparation for the exam: 38 hours Total: 90 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Definition, types of models. Characteristics of models. Processing of model building. Calibration, verification. Network analysis and modelling. Watershed modelling. Models of erosion. RUSLE, WEPP. 3D geological models. Surface- and groundwater modelling. Model Builder. BIM.

Literature

- Aber, T.J., Yang, X. and Steward, D.R., 2007. Modelling groundwater flow using PMWIN and ArcGis. Water resources Research Lab. Kansas State University, p.61.
- Fotheringham, S. and Wegener, M., 1999. Spatial models and GIS: New and potential models (Vol. 7). CRC press.
- Jørgensen, S.E., 2016. Ecological Model Types (Vol. 28). Elsevier.
- Refsgaard, J.C., Kovar, K., Haarder, E. and Nygaard, E., 2008. Calibration and reliability in groundwater modelling: credibility of modelling. IAHS Press.
- Abbott, M.B., Refsgaard, J.C., 2012: Distributed Hydrological Modelling. Springer Science & Business Media. 336 p.

Schedule:

1st week Introduction to the course. Nomenclature of modelling, type of models, advantages, disadvantages.

2nd week Classification of models. Advantages and disadvantages. (Statistical models)

3rd week R^2. Regression models.

4th week Network analysis. Minimal cost route planning on vector dataset.

5th week Model Builder I.

6th week Model Builder II. (Iterations, submodels, conversion to python)

7th week Examples for modelling in Model Builder. Solutions and possibilities.

8th week Modelling of soil erosion.

9th week WEPP, RUSLE – background, parameters and application.

10th week Watershed analysis.

11th week 3D geological modelling.

12th week Hydrodynamic and transport modelling – background, parameters and application.

13th week Questions, summary.

14th week Test – offered grade.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
During the semester there are two tests: the mid-term test in the 8th week and the end-term test in the 15th week. Students have to sit for the tests
- for a grade
The course ends in an **examination**.
The minimum requirement for the the examination is 50%. The grade for the examination is given according to the following table:

Score	Grade
0-49%	fail (1)
50-59%	pass (2)
60-72%	satisfactory (3)
73-84%	good (4)
85-100%	excellent (5)

Students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:
it may be offered for students if the test written in the 14th week is at least satisfactory (3).

Person responsible for course: Dr. Boglárka Balázs, assistant professor, PhD

Lecturer: Dr. Boglárka Balázs, assistant professor, PhD

Title of course: Models in GIS **Code: TTGML7018_EN**	**ECTS Credit points: 1**
Type of teaching, contact hours - lecture: - - practice: 1 hours/week - laboratory: -	
Evaluation: presentation, mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: - - laboratory: 14 hours - home assignment: 6 hours - preparation for the exam: 10 hours Total: 30 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Definition, types of models. Characteristics of models. Processing of model building. Implementation, calibration, verification. Network analysis and modelling. Student presentations (Watershed modelling. Models of erosion. RUSLE, WEPP. 3D geological models. Surface- and groundwater modelling. Model Builder. BIM.)

Literature

- Aber, T.J., Yang, X. and Steward, D.R., 2007. Modelling groundwater flow using PMWIN and ArcGis. Water resources Research Lab. Kansas State University, p.61.
- Fotheringham, S. and Wegener, M., 1999. Spatial models and GIS: New and potential models (Vol. 7). CRC press.
- Jørgensen, S.E., 2016. Ecological Model Types (Vol. 28). Elsevier.
- Refsgaard, J.C., Kovar, K., Haarder, E. and Nygaard, E., 2008. Calibration and reliability in groundwater modelling: credibility of modelling. IAHS Press.
- Abbott, M.B., Refsgaard, J.C., 2012: Distributed Hydrological Modelling. Springer Science & Business Media. 336 p.

Schedule:

1st week Introduction to the course. Nomenclature of modelling, type of models, advantages, disadvantages, examples.

2nd week Examples for Statistical models.

3rd week R^2. Regression models. Examples.

4th week Student presentations.

5th week Model Builder I.

6th week Model Builder II.

7th week Examples for modelling in Model Builder. Practice.

8th week Student presentations.

9th week Student presentations.

10th week Student presentations.

11th week Student presentation.

12th week Student presentations.

13th week Offered grading (test and practical examination).

14th week Final test and practical examination.

Requirements:
- for a signature
Attendance at classes is compulsory.
- for a grade
The final grade is calculated as the weighted average of practical examination grade (75%) and the presentation quality (25%).
The minimum requirement for the the examination is 50%
Students can take a retake theexamination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:
it may be offered for students if the results in the 13th week is at least satisfactory (3).

Person responsible for course: Dr. Boglárka Balázs, assistant professor, PhD

Lecturer: Dr. Boglárka Balázs, assistant professor, PhD

Title of course: Photogrammetry **Code: TTGME7019_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The aim of the course is to acquire basic theoretical knowledge of photogrammetry. Topics: the history of aerial photography, the basics of photogrammetry, theory and practice of aerial photography, classical photogrammetry and instruments, qualitative and quantitative information of aerial images, single photogrammetry, orthorectification, stereo photogrammetry, aerial triangulation, orthoimage types and their characteristics, photogrammetric based surface models, and the legal issues of airborne data collection.

Literature

- Casagrande, G., Sik, A., Szabó, G. 2018. Small Flying Drones - Applications for Geographic Observation. ISBN 978-3-319-66577-1.
- Krauss, K., 2007. Photogrammetry. Geometry from Images and Laser Scans. ISBN 978 – 3 – 11 – 019007 – 6.
- Linder, W. Photogrammetry, a Practical Course. 2009. ISBN 978 – 3 – 540 – 92725 – 9.

Schedule:

1st week Introduction to the course

2nd week History of the Photogrammetry

3rd week Principles of aerial Imaging

4th week Classic (analogue) photogrammetry

5th week Qualitative information of aerial images

6th week Quantitative information of aerial images

7th week: Ortorectification

8th week Stereo photogrammetry

9th week Types and features of orthoimages

10th week Principles of photogrammetry-based surface models

11th week Applications of surface models

12th week Small-format aerial imaging systems

13th week Legal questions of aerial imaging

14th week End-term examination.

Requirements:

Participation at classes is compulsory. A student must attend the courses 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.
During the semester there is end-term examination.

The minimum requirement for the end-term examination is 60%. Based on the score of the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Gergely Szabó, associate professor, PhD

Lecturer: Dr. Gergely Szabó, associate professor, PhD

Title of course: Photogrammetry **Code: TTGML7020_EN**	**ECTS Credit points: 1**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: 1 hours/week	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: - - practice: - - laboratory: 14 hours - home assignment: 16 hours Total: 30 hours	
Year, semester: 2nd year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

The aim of the course is to acquire basic theoretical knowledge of photogrammetry. Topics: the history of aerial photography, the basics of photogrammetry, theory and practice of aerial photography, classical photogrammetry and instruments, qualitative and quantitative information of aerial images, single photogrammetry, orthorectification, stereo photogrammetry, aerial triangulation, orthoimage types and their characteristics, photogrammetric based surface models, and the legal issues of airborne data collection.

Literature

- Casagrande, G., Sik, A., Szabó, G. 2018. Small Flying Drones - Applications for Geographic Observation. ISBN 978-3-319-66577-1.
- Krauss, K., 2007. Photogrammetry. Geometry from Images and Laser Scans. ISBN 978 – 3 – 11 – 019007 – 6.
- Linder, W. Photogrammetry, a Practical Course. 2009. ISBN 978 – 3 – 540 – 92725 – 9.

Schedule:

1st week Introduction to the course

2nd week History of the Photogrammetry

3rd week Principles of aerial Imaging

4th week Classic (analogue) photogrammetry

5th week Qualitative information of aerial images

6th week Quantitative information of aerial images

7th week: Ortorectification

8th week Stereo photogrammetry

9th week Types and features of orthoimages

10th week Principles of photogrammetry-based surface models

11th week Applications of surface models

12th week Small-format aerial imaging systems

13th week Legal questions of aerial imaging

14th week End-term examination.

Requirements:

Participation at classes is compulsory. A student must attend the courses 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.
During the semester there is end-term examination.

The minimum requirement for the end-term examination is 60%. Based on the score of the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Gergely Szabó, associate professor, PhD

Lecturer: Dr. Gergely Szabó, associate professor, PhD

Title of course: **CAD-systems** **Code**: **TTGML7021_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: 1 hours/week - practice: - - laboratory: 1 hours/week	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: 14 hours - practice: - - laboratory: 14 hours - home assignment: 20 hours - preparation for the exam: 12 hours Total: 60 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Theoretical background of CAD-based systems; the philosophy of CAD systems; creating objects; modify various types of objects; operations with objects (mirroring, moving, cutting, copying, multiplying, etc.); layer management, layer properties; hatch, topological object building; projections, raster-based layers; map representation, layout properties

Literature

- Burrough, P., McDonell, R.A., Lloyd, C.D., 2015. Principles of Geographical Information Systems. ISBN 9780198742845
- Kang-tsung Chang. 2001. Introduction to Geographic Information Systems. ISBN 9781259613449

Schedule:

1st week Introduction to the course

2nd week Theory of vector-based systems

3rd week The philosophy of CAD-systems

4th week Short history of CAD-systems

5th week Geometric features in CAD

6th week Object-making in CAD

7th week: Modification of objects

8th week Mid-term test

9th week Object-based processes

10th week Layers in CAD

11th week Topology-based object building

12th week Projections in CAD

13th week Layouts

14th week End-term examination and referring.

Requirements:

Participation at classes is compulsory. A student must attend the courses 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.
During the semester there are middle-term and end-term examinations. The end-tem referring involves the knowledge of the software skills.

The minimum requirement for the middle-term and end-term examinations is 60%. Based on the score of the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Gergely Szabó, associate professor, PhD

Lecturer: Dr. Gergely Szabó, associate professor, PhD

Title of course: **Project work in GIS** **Code: TTGMG7025_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: - Cannot be determined – see the section "Topics of course".	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: - - laboratory: - - home assignment: 60 hours - preparation for the exam: - Total: 60 hours	
Year, semester: 2nd year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course
The students work in their own time schedule. They choose a project leader who coordinates, controls the implementation of the project, which should be presented in the end of the semester. The project manager has to give a brief description of each team member and evaluate their work. The assignment is defined by the lecturers at the beginning of the semester.
Literature

Schedule:
Requirements: -
Person responsible for course: Dr. Gergely Szabó, associate professor, PhD
Lecturer:

Title of course: Fieldwork in GIS **Code: TTGMG7024_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: -	
Evaluation: exam, practical grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: 60 hours - laboratory: - - home assignment: - - preparation for the exam: - Total: 60 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course
In fieldwork the students visit the organizations and companies operating in the public and private sector. These organizations provide information on their organizational structure, their activity in relation to the geoinformation, and describe the work-related requirements.
Literature

Schedule: During 1 week the students visit the organizations and companies operating in the public and private sector. These organizations provide information on their organizational structure, their activity in relation to the geoinformation, and describe the work-related requirements.
Requirements: Attendance at fieldwork is compulsory. During the practical trip the students have to write notes and submit in the end of the week.
Person responsible for course: Dr. Boglárka Balázs, assistant professor, PhD
Lecturer: Dr. Gergely Szabó, associate professor, PhD Dr. Zoltán Túri, assistant professor, PhD

Title of course: Environmental Protection of Hungary **Code: TTGME6008_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Lecture: Evaluating the natural condition of Hungary from an environmental point of view. The landscape sensitivity of the Hungarian macroregions. Changes in the air pollution of Hungary from the beginning of the 20th century to the present day. Overview of the main sources of air pollutants and major type of air pollutants. The major sources of noise pollution in Hungary. Opportunities for controlling noise. The state of the main rivers, lakes and groundwater in Hungary, and the factors influencing the water quality. The state of the soils of Hungary and the main soil degradation processes. Environmental impacts of mining. The presence of environmental aspects in the industry. The possibilities of environmentally friendly energy production in Hungary. Possibilities of using renewable energy sources in Hungary. Environmental aspects of agriculture. Waste management in Hungary.

Literature

Compulsory literature:
Environmental report, 2013 (2014) Hungarian Central Statistical Office, 129 p.

Recommended literature:
Indicators of sustainable development for Hungary (2015) Hungarian Central Statistical Office, 228 p.
National Framework Strategy on Sustainable Development of Hungary. Resolution 18/2013. (28th March) of the Parliament, 108 p.

Schedule:
1st week
Introduction to the course.

2nd week
Evaluating the natural condition of Hungary from an environmental point of view.

3rd week
The landscape sensitivity of the Hungarian macroregions.

4th week
Changes in the air pollution of Hungary from the beginning of the 20th century to the present day.

5th week
Overview of the main sources of air pollutants and major type of air pollutants.

6th week
The major sources of noise pollution in Hungary. Opportunities for controlling noise.

7th week:
The state of the main rivers, lakes and groundwater in Hungary, and the factors influencing the water quality.

8th week
The state of the soils of Hungary and the main soil degradation processes.

9th week
Environmental impacts of mining.

10th week
The presence of environmental aspects in the industry.

11th week
The possibilities of environmentally friendly energy production in Hungary.

12th week
*L*Possibilities of using renewable energy sources in Hungary.

13th week
Environmental aspects of agriculture. Waste management in Hungary.

14th week
Evaluation of the course, instructions for the exam.

Requirements:

Attendance at **lectures** is recommended, but not compulsory.
The minimum requirement for the examination is 51%. Based on the score of the tests separately, the grade for the examination is given according to the following table:

Score	Grade
0-50%	fail (1)
51-60%	pass (2)
61-70%	satisfactory (3)
71-85%	good (4)
86-100%	excellent (5)

If the score of any test is below 51%, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Beáta Babka, assistant professor, PhD

Lecturer: Dr. Beáta Babka, assistant professor, PhD

Title of course: Environmental Protection of Hungary **Code: TTGMG6009_EN**	**ECTS Credit points: 1**

Type of teaching, contact hours
- lecture: -
- practice: 1 hours/week
- laboratory: -

Evaluation: practical grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 14 hours
- laboratory: -
- home assignment: 16 hours
- preparation for the exam: -

Total: 30 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Practice: Methodology for determining the landscape sensitivity. Important environmental information systems, publication databases. Visit to Debrecen Thermal Power Plant. Visit to the Debrecen Renewable Energy Park. Visit to the Government Office of Hajdú-Bihar County (Department of Environmental Protection and Nature Conservation). Self-elaboration of a freely chosen Hungarian environmental problem. Consultations and student presentations on the topics chosen and developed by the students.

Literature

Compulsory literature:
Environmental report, 2013 (2014) Hungarian Central Statistical Office, 129 p.

Recommended literature:
Indicators of sustainable development for Hungary (2015) Hungarian Central Statistical Office, 228 p.
National Framework Strategy on Sustainable Development of Hungary. Resolution 18/2013. (28th March) of the Parliament, 108 p.

Schedule:
1st week
Introduction to the practical part of the course.

2nd week
Methodology for determining the landscape sensitivity.

3rd week
Important environmental information systems, publication databases.

4th week
Visit to Debrecen Thermal Power Plant.

5th week
Visit to the Renewable Energy Park in Debrecen.

6th week
Visit to the Government Office of Hajdú-Bihar County (Department of Environmental Protection and Nature Conservation).

7th week:
Students own work on a freely chosen Hungarian environmental problem. Students should choose a topic. In the frame of own work student have to write an essay and prepare a presentation.

8th week
Consultations I. on the sources of scientific literature related to selected topic.

9th week
Consultations II. on writing essay (8-10 pages) and discussion of the tasks related to the preparation of powerpoint presentation.

10th week
Consultations III. Prepare the final version of the essay and discussion on the first draft of the powerpoint presentation.

11th week
Consultations IV. Prepare the final version of the Powerpoint presentation.

12th week
Presentation and evaluation of student's presentations.

13th week
End-term test

14th week
Evaluate of the practical part of the course, offer a practical grade.

Requirements:

Participation at **practice classes** is compulsory. A student must 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. 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.
During the semester there is one test: the end-term test in the 13th week. Students write an essay on the freely choosen subject and elaborate a presentation which will be presented for the students of the course. They will get a rating for the essay and the presentation. The average of the three grades will be a practical grade.
The minimum requirement for the end-term test is 51%. Based on the score of the grade for the end-term tests is given according to the following table:

Score	Grade
0-50%	fail (1)
51-60%	pass (2)
61-70%	satisfactory (3)
71-85%	good (4)
86-100%	excellent (5)

If the score of any test is below 51%, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
Person responsible for course: Dr. Beáta Babka, assistant professor, PhD
Lecturer: Dr. Beáta Babka, assistant professor, PhD

Title of course: Urban ecology **Code: TTGME6016_EN**	**ETCS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 2nd year, 2nd semester

Topics of course

The historical stages, the current level and the tendencies of urban integration. Characteristic features of a liveable, ideal and tolerable urban environment. The impact of urban integration on the original geological, relief, climatic, hydrological, soil and biogeographical conditions. Noise and light pollution. The role of urban structure in the territorial organization of local urban ecological impacts.

Literature

R.T.T. Forman (2014): Urban Ecology: Science of Cities. Cambridge Univ. Press
I. Douglas, P. James (2014):Urban ecology: an introduction. Routledge
Marzluff, J., Shulenberger, E., Endlicher, W., Alberti, m., Bradley, G., Ryan, C., ZumBrunnen, C., Simon, U. (Eds.) (2008): *Urban Ecology*. An *International Perspective on the Interaction Between Humans and Nature. Springer*
Landscape and Urban Planning journal

Schedule:

1st week:
Urban ecology, as a special field of the landscape ecology. The urbanisation of the World.

2nd week:
Urban and rural ecosystems. The „liveable" cities. Megapolices and megacities

3rd week:
The ecological components of the quality of the life. The mankind as an „ecoparasite"

4th week:
The deformed ecological system of the cities.

5th week:
Change of the relief in the territory of cities. Urban archeology

6th week:
The urban climate, the heatisland

7th week:
Urban soils, hortisol, necrosol, anthosol ect. Cultur-stratification, soil pollution.

8th week:
Biogeography of the cities. Bioclimate and vegetation. Biostresses in the cities. The Geeen Capital of Europe campaign.

9th week:
Animals in the cities. Domestication, hygienic problems, Invasive species.

10th week:
Light and noise pollution of the cities.

11th week:
The mosaic patteren of the building up in the towns. Models of the city structure. Green- and air-corridors in the cities. From historical downtowns to satellite-quarters. Visions for the future.

12th week:
The ”rurbanization”. The criteries of the sustainability of the cities; healthy, secure and aesthetical.

Requirements
Attendance at **lectures** is recommended, but not compulsory.
The course ends in an written **examination**.

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Participation at **practice classes** is compulsory. A student must 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. 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. Students have to submit an essay as scheduled minimum on a sufficient level for a practical grade.

Person responsible for course: Dr. István Fazekas, Assintant Professor, PhD

Lecturer: Dr. István Fazekas, Assintant Professor, PhD

Title of course: Urban ecology **Code: TTGMG6017_EN**	**ECTS Credit points: 1**

Type of teaching, contact hours
- lecture: -
- practice: 1 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours
- lecture: -
- practice: -
- laboratory: -
- home assignment: 10 hours
- preparation for the exam: 6 hours

Total: 30 hours

Year, semester: 2nd year, 2nd semester

Topics of course

Detailed analysis of the city ecological position of Debrecen, comparison with Szeged. The characteristic change and current state of the relief, climate, hydrography (groundwater), soil and vegetation in Debrecen - as part of the seminar processing. Urban ecological walk in downtown Debrecen

Literature

K. Gaston (2010): Urban Ecology. Ecological Rewiews, Cambridge Univ. Press
Journal of Urban Ecology

Schedule:
1st week:
Urban ecological examples in Hungary; Debrecen and Szeged

2nd week:
Historical development of Debrecen city, the change of the natural endowments.

3rd week:
Change of the relief and soils in the territory Debrecen

4th week:
Urban climate of Debrecen city

5th week:
A city with constant watershortage.

6th week:
Vegetation of the built up areas.

7th week:
Light-pollution and noise measurements in Debrecen.

8th week:
Study walk in the city of Debrecen

9th week:

Study walk in the city of Debrecen

10th week:
Study walk in the city of Debrecen

11th week:
Study walk around the University Campus

12th week:
Urban ecological study tour programme.

Requirements
Participation at **practice classes** is compulsory. A student must 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. 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. Students have to submit an essay as scheduled minimum on a sufficient level for a practical grade.

Person responsible for course: Dr. István Fazekas, Assintant Professor, PhD

Lecturer: Dr. István Fazekas, assistant professor, PhD

Title of course: Cultural landscapes **Code: TTGME6004_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: 24 hours - preparation for the exam: 38 hours Total: 90 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Clarification of the concept of the cultural landscape from the geographic and landscape architectural point of view. Understand the interpretation of the cultural landscape and its functional characteristics and types. The conflicts that arise during the management of cultural landscapes, the possibilities of solving them, and the acquisition of sustainable, long-term landscaping methods. Changes in cultural landscapes during last Millennia. Types and history of cultural landscapes.

Literature

Longstreth, R. (ed) 2008 Cultural Landscapes. Balancing Nature and Heritage in Preservation Practice, University of Minnesota Press, ISBN 978-0-8166-5099-6, pp. 232.
Dieterich, Martin, van der Straaten, Jan (Eds.) 2004. Cultural Landscapes and Land Use, The Nature Conservation — Society Interface, Springer Netherlands, ISBN 978-1-4020-2105-3, pp. 222.

Schedule:

1. week: The concept, definition and formation of the cultural landscape.
2. week: Methods for study of landscape change and cultural landscape, documents of the development of the traditional cultural landscape.
3. week: Archaeological landscape research methods.
4. week: The effect of climate change during Holocene on natural vegetation and land use changes
5. week: Prehistoric influences of humans on landscapes in Central Europe
6. week: Human transformation of landscape during bronze and iron age.
7. week: Landscape developement during the Roman Empire
8. week: Changes of the landscape in time of Migration Period and Early Midle Age
9. week:Formation and traditional land use of the rural landscapes
10. week: Landscape developement of vineyards, gardens and orchards
11. week: Early montain industry areas and their heritage in cultural landscape
12. week: Influence of water regulations on cultural landscapes
13. week: Architectural heritage of settlements and their relevance in rural and urban landscapes

14. week: Protection of cultural landscapes, the position of landscape protection within nature conservation, evaluation of the landscape as a heritage

Requirements:

- *for a signature*

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

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

- *for a grade*

The course ends in an **examination**.

The minimum requirement for the examination is 50%. The grade for the examination is given according to the following table:

Score	Grade
0-49%	fail (1)
50-59%	pass (2)
60-72%	satisfactory (3)
73-84%	good (4)
85-100%	excellent (5)

Students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

it may be offered for students if the test written in the 14th week is at least satisfactory (3).

Person responsible for course: Dr. Beáta Babka, assistant professor, PhD

Lecturer: Dr. Beáta Babka, assistant professor, PhD

Title of course: Geoconservation **Code: TTGME6011_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 24 hours
- preparation for the exam: 38 hours

Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The purpose of the course is to present the history, conceptual use and practice of nature conservation, to know the legal and institutional framework of nature conservation concerning to abiotic values, to familiarize the protected geological objects; look into the methods of defining priorities and the opportunities for adequate maintenance and management practices. We deal with the possibilities of protecting geomorphologic, geological and hydrological values and the problems of their maintenance. Understanding geographic, geomorphological and geological aspects of nature conservation. An overview of the geological and geomorphological values, types of geomorphosites. The role of national and international nature conservation. Legislative regulation of geo-conservation. Geological explorations, fossils and their deposits, minerals and rocks, and governing the protection of geomorphological values. Finally, a number of Hungarian and foreign examples will be presented of the geological features, geomorphological values and the methodological features of the demonstration sites.

Literature

Murray Gray 2013. Geodiversity: Valuing and Conserving Abiotic Nature, 2nd Edition, Wiley-Blackwell ISBN: 978-0-470-74215-0, pp. 508.
Reynard, E., Coratza, P., Regolini-Bissig, G. (eds.) 2009. Geomorphosites. Friedrich Pfeil Verlag, München, ISBN 978-3899370942, pp. 240.

Schedule:
1. week: The formation, antecedents, concept and definition of nature conservation. Basic concepts in nature conservation.
2. week: History of Geoconservation in Europe and Hungary.
3. week: Types of protected areas and values: legislative frameworks defined legislation.
4. week: Geosites protected by international conventions, with international relevance
5. week: Types of objects for geoconservation: geomorphologic features, mineralogical values, fossil remains, protection of aquatic values.
6. week: The relevance of mining activities in forming of geological values.
7. week: Protection of caves and their related karstic areas.
8. week: Nature conservation and maintenance practices of geosites.
9. week: The role of non-governmental organizations in geoconservation.

10. week: Educational paths, visitor centers, showrooms.
11. week: The economy of geoconservation. How much natural values are worth? conservation economics: economic aspects of maintenance and management.
12. week: Geoparks and their organisations
13. week: Touristic aspects of geoconservation, Geotourism.
14. week: Geological hazards, risks of geoconservation.

Requirements:

- for a signature

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

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

- for a grade

The course ends in an **examination**.

The minimum requirement for the examination is 50%. The grade for the examination is given according to the following table:

Score	Grade
0-49%	fail (1)
50-59%	pass (2)
60-72%	satisfactory (3)
73-84%	good (4)
85-100%	excellent (5)

Students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

it may be offered for students if the test written in the 14th week is at least satisfactory (3).

Person responsible for course: Dr. Borbála Benkhard, assistant professor, PhD

Lecturer: Dr. Borbála Benkhard, assistant professor, PhD

Title of course: Geoconservation **Code: TTGMG6012_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The purpose is to involve students into the practical management and education practice in geoconservation in form of maintaining work, environmental education or design and realize new sites for geo-education in field conditions.

Literature

W. A. P. Wimbledon & S. Smith-Meyer (Eds). 2012. *Geoheritage in Europe and Its Conservation*. ProGEO, , 405 pp., ISBN 978-82-426-2476-5. pp. 405.

Schedule:
1. *week: Protection of geosites: legislation*
2. *week: Administrative tools of protection*
3. *week: Procedure of declaration protected geosites in practice*
4. *week: Geosites in conservation practice*
5. *week: Management of caves and other karstic features*
6. *week: Management of protected geological profiles*
7. *week: Management of burial mounds*
8. *week: Management of springs*
9. *week: Management of salt lakes*
10. *week: Management of peatbogs*
11. *week: Management of protected mines and quarries*
12. *week: Geosites in Geography education*
13. *week: Design and construction of geological study paths*
14. *week: Civil organizations in geoconservation*

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.

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

- *for a grade*

The course ends in an oral **presentation about experiences**.

The minimum requirement for the presentation is 50%. The grade for the examination is given according to the following table:

Score	Grade
0-49%	fail (1)
50-59%	pass (2)
60-72%	satisfactory (3)
73-84%	good (4)
85-100%	excellent (5)

Students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-*an offered grade:*

it may be offered for students if the test written in the 14th week is at least satisfactory (3).

Person responsible for course: Dr. Róbert Vass assistant professor, PhD

Lecturer: Dr. Róbert Vass assistant professor, PhD

Title of course: Landscape protection in Europe **Code: TTGME6018_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: examination

Workload (estimated), divided into contect hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 2nd year, 2nd semester

Topics of course

During the first hours of the course, we will address the general features of European landscape protection, with current trends in the management of cultural landscapes. It speaks in detail about the continental appreciation of landscape protection, the opportunities offered by the European Landscape Convention. In the case of Norwegian, British, French, Italian, German and Austrian case studies we present exemplary landscape management and landscape development programs.

Literature

European Landscape Convention
Frislid, R. Cultural landscapes of Norway. Lansbruksforlaget 2001
Muir, R. The new reading the landscape 2006
Aalen F et al. Atlas of the Irish Rural Landscapes 2005

Schedule

1st week:
The different approach to the landscape protection in Europe. General tendencies.

2nd week:
The impact of the European Landscape Convention.

3rd week:
Case study from Norway.

4th week:
Case study from Ireland.

5th week:
Case study from England.

6th week:
Case study from Germany, Rhine-valley.

7th week:
Case study from Catalonia/Spain.

8th week:
Case study from France (Loire-valley).

9th week:
Case study from the swiss Alps.

10th week:
Case study from the austrian Alps

11th week:
Case study from Tuscany Italy

12th week:
Summary and main tendencies in the European landscape protection.

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

Person responsible for course: Dr. Róbert Vass, assistant professor, PhD

Lecturer: Dr. Róbert Vass, assistant professor, PhD

Title of course: Environmental management and quality assurance **Code: TTGME6006_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 31 hours
- preparation for the exam: 31 hours

Total: 90 hours

Year, semester: 1nd year, 2nd semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

Students will learn the tools of environmental management, environmental planning, environmental development, and environmentally friendly technologies. We deal with the purpose of waste management (sustainable natural resource management), its main principles and priorities. Students will learn about the technological processes and technical possibilities of communal solid waste management from recycling and energy utilization to disposal. We deal with communal waste management tasks and their costs. Students will learn about the environmental impacts of production processes, low-waste (clean) technologies, the most important operations for managing gas (steam), liquid and solid industrial waste. We also deal with the technical possibilities of environmental energetics.

Literature

George Tchobanoglous – Frank Kreith: Handbook of solid waste management (2002)
L.F.M. Rebellon: Waste management – an integrated vision (2012) ISBN 978-953-51-0795-8

Schedule:

1st week
Waste management I. Formation, composition and collection of solid waste.
2nd week
Waste management II. Planning municipal waste management. The operation of complex regional waste management areas. Equipment, operation and monitoring of landfills.
3rd week
Waste management III. Technological processes and technical possibilities of pretreatment of municipal solid waste.
4th week
Waste management IV. Collection and aerobic treatment of biodegradable waste. Composting of municipal bio-waste.
5th week
Waste management V. Collection and anaerobic treatment of biodegradable wastes. The biochemical process of fermentation.
6th week

Waste management VI. Environmental impact assessment of landfills. Final disposal and after-care of landfills. Recultivation technical solutions and costs.
7th week
Waste management VII. Disposal of hazardous waste. Temporary storage, depositing and thermal disposal.
8th week
Water management I. The balance of the water circulation. Components of the entire water balance. The way of rain water in the river basin. Hydrographic data collection, surface and ground water measurements.
9th week
Water management II. The basis, technical possibilities and systems of the water supply of settlements. Methods for extracting and cleaning drinking water.
10th week
Water management III. Framework guidelines for water resources protection at EU, national and regional level. The process and results of water base protection.
11th week
Water management IV. Water pollution and sewage treatment.
12th week
Energy management I. Energy consumption and the development of energy sources. The renewable energy sources.
13th week
Energy management II. The potential of renewable energy sources. The energetic utilization of biomass.
14th week
Energy management III. Energy efficiency opportunities.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
During the semester students have to write an essay dealing with a selected subject of course focussing attention on their home country.
The course ends in a written **examination**. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:

Person responsible for course: Dr. István Fazekas, assistant professor, PhD

Lecturer: Dr. István Fazekas, assistant professor, PhD

Title of course: Environmental management and quality assurance **Code: TTGMG6007_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 16 hours
- preparation for the exam: 16 hours

Total: 60 hours

Year, semester: 1nd year, 2nd semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

Students will learn the tools of environmental management, environmental planning, environmental development, and environmentally friendly technologies. We deal with the purpose of waste management (sustainable natural resource management), its main principles and priorities. Students will learn about the technological processes and technical possibilities of communal solid waste management from recycling and energy utilization to disposal. We deal with communal waste management tasks and their costs. Students will learn about the environmental impacts of production processes, low-waste (clean) technologies, the most important operations for managing gas (steam), liquid and solid industrial waste. We also deal with the technical possibilities of environmental energetics.

Literature

George Tchobanoglous – Frank Kreith: Handbook of solid waste management (2002)
L.F.M. Rebellon: Waste management – an integrated vision (2012) ISBN 978-953-51-0795-8

Schedule:
1st week
Waste management in practice I. Mixed and selective waste collection, mobile collecting, methods of selective collection. The equipment and operation of the selective waste collection points.
2nd week
Waste management in practice II. Equipment and operation of landfills in practice
3rd week
Waste management in practice III. Waste disposal, sorting and pretreatment facilities.
4th week
Waste management in practice IV. The operation of composting facilities in practice.
5th week
Waste management in practice V. Fermentation technologies. Biogas production and recovery in landfill, waste water and in power plants.
6th week

Waste management in practice VI. Environmental documentation of a landfill site, preparation of a recultivation plan, recultivation technologies in practice.
7th week
Waste management in practice VII. Incineration in practice. Contaminant gas (vapor), liquid and solid set waste and their treatment.
8th week
Water management in practice I. Surface water extraction and drinking water purification technology.
9th week
Water management in practice II. Groundwater extraxtion and drinking water purification technology.
10th week
Water management in practice III. Technological possibilities for reducing water pollution.
11th week
Water management in practice IV. Wastewater treatment technologies.
12th week
Energy management in practice I. Technological possibilities for solar, wind and geothermal energy utilization.
13th week
Energy management in practice II. Energy utilization of biomass; Solid and biomass used as gaseous energy sources.
14th week
Energy management in practice III. Energy utilization of biomass; Biomass used as a liquid energy source. Technical options for bioethanol and biodiesel production.

Requirements:
- for a signature
Participation at **practice classes** is compulsory. A student must 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.
-for a grade
During the semester there is a task to be submitted and an end-term test in the 15th week.
The term mark is calculated as an average of them:
- the result of task to be submitted
- the result of the end-term test

The minimum requirement for the end-term test respectively is 60%. Based on the score of the test separately, the grade for the test and the task to be submitted is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. István Fazekas, assistant professor, PhD

Lecturer: Dr. István Fazekas, assistant professor, PhD

Title of course: Environmental policy **Code: TTGME6010_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 31 hours
- preparation for the exam: 31 hours

Total: 90 hours

Year, semester: 2nd year, 1nd semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

Students will learn about the social background of institutional environmental policy, green movements and green parties. We deal with the key actors in international environmental policy, environmental world conferences, major conventions and protocols. Students will learn about environmental decision-making and regulatory mechanisms. We deal with the most important environmental policy objectives of the European Union, their achievements so far, and development plans.

Literature

Jane Roberts: Environmental policy (2003) Routledge 256 p.
Marian R. Chertow – Daniel C. Esty: Thinking Ecologically the next generation of environmental policy (1997) Yale University Press 271 p. ISBN 0-300-07303-8

Schedule:

1st week
The birth of the global and European environmental policies.
2nd week
Green movement - green parties.
3rd week
Objects and tools of environmental policy.
4th week
Global environmental policy I. World environment summits and conferences.
5th week
Global environmental policy II. The role of UN organizations in environmental protection. UNEP, FAO, WHO, UNESCO.
6th week
Global environmental policy III. The major conventions and protocols.
7th week
Global environmental policy IV. Global climate policy.
8th week
Environmental policy in the OECD member states.
9th week

The most important environmental policy objectives of the European Union.
10th week
Decision-making, legislation and control in EU institutions.
11th week
The possibilities of environmental regulation.
12th week
Environmental policy objectives and results for environmental elements (air, water, soil and biodiversity) in the European Union.
13th week
Environmental policy objectives and results in the European Union on adverse environmental impacts (noise, waste, chemicals, GMOs, industrial risks, nuclear hazards).
14th week
Current priority areas for EU environmental policy.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
During the semester students have to write an essay dealing with a selected subject of course focussing attention on their home country.
The course ends in a written **examination**. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:

Person responsible for course: Dr. Emőke Kiss, assistant professor, PhD

Lecturer: Dr. Emőke Kiss, assistant professor, PhD

Title of course: Environmental economics **Code: TTGME6015_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 31 hours
- preparation for the exam: 31 hours

Total: 90 hours

Year, semester: 2nd year, 1nd semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

The aim of the course is to analyze the socio-economic causes of environmental problems, the environmental impact of economic growth, review the government's potential and tools for sustainable development, the micro- and macro indicators of sustainability, and then assess the domestic situation of sustainable development, elements. Students will get acquainted with the environmental costs and damages, environmental management tools and practices, and corporate environmental management methods.

Literature

Broemly, D. W. (edited): The Handbook of Environmental Economics, Blackwell Oxford UK and Cambridge USA 1995.
Brown, Lester R.: "Building a Sustainable Society, W. W. Norton & Co, New York – London, 1994.
Costanza, Robert: Ecological Economics, Columbia University Press, New York, 1991.
Daly, Herman E. – Cobb, John B.: For the Common Good, Beacon Press, Boston 1989.
Meadows, D. H. – Meadows Dennis L. – Randers, Jorgen: Beyond the Limits, Chelsea Green Publishing Co, Post Millis, Vermont, 1992

Schedule:
1st week
Socio-economic causes of environmental problems.
2nd week
Economic growth or development and environmental problems.
3rd week
Evaluating the state's potential and tools for sustainable development.
4th week
Micro- and macro-indicators of sustainable development.
5th week
Environmental protection costs and damages.
6th week
Environmental regulators I. Legislation and fiscal regulation.
7th week

Environmental regulators II. Market methods for environmental protection. Financial support, greening tax system, environmentally friendly product labeling.
8th week
Environmental regulators III. Emission trading system.
9th week
Environmental regulators IV. Other market methods, corporate environment management
10th week
Environmental regulators V. Examples of environmental control devices used in different countries.
11th week
Environmental protection in corporate practice.
12th week
Standardized environmental management systems.: BS7750, EMAS, ISO 14001
13th week
The most important elements of environmental management systems. SWOT analysis at companies. Making environmental reports, plans. Environmental auditing.
14th week
Analysis and management of corporate environmental risks. Environmental conflicts. Conflict management methods and strategies in corporate practice.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
During the semester students have to write an essay dealing with a selected subject of course focussing attention on their home country.
The course ends in a written **examination**. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:

Person responsible for course: Dr. Emőke Kiss, assistant professor, PhD

Lecturer: Dr. Emőke Kiss, assistant professor, PhD

Title of course: Applied environmental geoinformatics **Code: TTGML7006_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: -
- laboratory: 2 hours/week

Evaluation: practical grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: -
- laboratory: 28 hours
- home assignment: 14 hours
- preparation for the exam: 18 hours

Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Students will get introduced with the applied part if geoinformatics: how to apply the GIS-based knowledge in solving environmental issues concerning a site selection, risk assessment or to prepare environmental impact assessments. They learn the theory of the essential specific methods of the data processing: analytical hierarchy process, multicriteria evaluation, and the basics of image processing (visual interpretation, unsupervised classification).

During the practical part of the course unit the students work in small groups and solve different environmental issues. They have to cooperate and to learn how to split the tasks into smaller pieces. All the important elements of the theoretical part will be applied on the practice. Students presents their solved tasks and learn the basic presentation techniques.

Literature

Zhu, X. (2016): GIS for Environmental Applications: A Practical Approach. Routledge, 490 p.
Wade, T. - Sommer, S. (2006): A to Z GIS: An Illustrated Dictionary of Geographic Information Systems, ESRI Press, 268 p.
Bajjali, W. (2017): ArcGIS for Environmental and Water Issues. Springer, 353 p.

Schedule:
1st week Genereal introduction to QGIS software
2nd week Basement of raster geoinformatical models: resolutions, aerial photos, satellite images
3rd week Spectral features of surface objects
4th week Reclassification of raster layers
5th week. Boolean layaer, Boolean algebra
6th week Map algebra.
7th week Midterm summary, practice.
8th week Midterm written exam
9th week Contrast enhancement.
10th week Non-supervised classification
11th week Supervised classification I.
12th week Supervised classification II.
13th week Accuracy assessment

14th week Grade-offering exam.

Requirements:

Practice:

Participation at classes is compulsory. A student must attend the courses 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.

During the semester there is one practical test. It can be completed in the 14th week.

The minimum score is 50%. Based on the score of the test, the grade for the test is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-72	satisfactory (3)
73-84	good (4)
85-100	excellent (5)

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

Person responsible for course: Prof. Dr. Szilárd Szabó, university professor, DSc

Lecturer: Prof. Dr. Szilárd Szabó, university professor, DSc

Title of course: Environmental impact assessment **Code: TTGME6005_EN**	**ECTS Credit points: 1**

Type of teaching, contact hours
- lecture: 1 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- practice: -
- laboratory: -
- home assignment: 10 hours
- preparation for the exam: 6 hours

Total: 30 hours

Year, semester: 1nd year, 2nd semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

The aim of the course is to provide students with an overview of the environmental impacts of various anthropogenic activities, in particular the investments related to land use, forestry, landfill and urban development (construction, industrial park, infrastructure, touristic development). They learn about disturbation of different habitat types, their resistance and stability, and conservation methods. Based on field ecological data, they evaluate the habitats, nature conservation values of each habitat and make proposals for their protection, optimum utilization and the possible ways of conservation.

Literature

Peter Wathern (edited): Environmental impact assessment: theory and practice; Routledge London UK and New York USA 1990.
Richard K. Morgan: Environmental impact assessment: A methodological perspective; Kluwer Academic Publishers Dordrecht-Boston-London 1998.

Schedule:
1st week
Legislative requirements for environmental impact assessment I. Content and form requirements for environmental impact assessment and review.
2nd week
Legislative requirements for environmental impact assessment II. Accredited sampling, field and laboratory tests, emission and immission limits.
3rd week
Legislative requirements for environmental impact assessment III. Best available techniques.
4th week
Anthropogenic environmental impacts I. The environmental impacts of agricultural land use (arable, forest, meadow, vineyard). Optional site criteria and environmental aspects for land use planning for agriculture.
5th week
Anthropogenic environmental impacts II. Environmental impacts of water-related activities, environmental and landscape protection recommendations.
6th week

Anthropogenic environmental impacts III. Environmental impacts of mining, environmental and landscape protection recommendations. Industrial activities and Best Available Techniques.

7th week

Anthropogenic environmental impacts IV. Environmental review of abandoned landfills. Environmental impact of non-insulated waste and sewage dump sites. Environmental impact of recultivated landfills.

8th week

Anthropogenic environmental impacts V. Renaturalization, recultivation technologies, remediation of contaminated sites.

9th week

Anthropogenic environmental impacts VI. Environmental impacts of linear infrastructure developments, environmental and landscape protection recommendations.

10th week

Anthropogenic environmental impacts VII. Environmental impacts of tourism developments. Environmental impacts of installation, environmental protection and landscape protection recommendations.

11th week

Environmental impacts in nature conservation area I. Conservation and preservation. Nature-close treatment modes. Grazing, mowing, incineration, chemistry and water management in natural and nature conservation areas.

12th week

Environmental impacts in nature conservation area II. Sustainable and destructive disturbances affecting different habitat types, types of degradation, resistance and stability, fragmentation and isolation. Ecological corridors.

13th week

Self-solving problem I. The students evaluate the condition and nature conservation value of a habitat, and make recommendations for their conservation, optimum utilization, possible ways of conservation, and determine the conditions for certain development investments.

14th week

Self-solving problem II. Students conduct a strategic environmental assessment of a settlement development plan while planning the optimum location for the development investments required by the settlement and the optimal use of each land use unit.

Requirements:

- for a signature

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

- for a grade

During the semester students have to write an essay dealing with a selected subject of course focussing attention on their home country.

The course ends in a written **examination**. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

Person responsible for course: Dr. István Fazekas, assistant professor, PhD
Lecturer: Dr. István Fazekas, assistant professor, PhD

Title of course: Landscape and environmental planning **Code: TTGMG6019_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: 1 hours/week
- practice: 1 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contect hours:
- lecture: 14 hours
- practice: 14 hours
- laboratory: 0 hours
- home assignment: 12 hours
- preparation for the exam: 20 hours

Total: 60 hours

Year, semester: 2nd year, 2nd semester

Topics of course

Lectures: To familiarize themselves with the objectives, working methods and legal obligations of landscape and environmental planning. The course covers the historical development of landscape planning, its development in Hungary and the role of geography in landscape planning. The lectures cover the most important landscape planning principles, the articulation of landscapes, the transformation of the settlement image. An important topic is the enforcement of landscape protection principles related to the recultivation of surface mining areas and the definition of line engineering facilities - in particular the roads. Most of the Hungarian landscapes are characterized mainly by the utilization of agricultural and forestry, which also has a landscape planning aspect.
Practice: The content of the tasks of the EIA and of the territorial environmental programs that wish to map out the program. Variable perception of landscape values. Objectivity of the landscape assessment of the landscape, the possibilities of analyzing the landscape factors. Bioindication opportunities. The methodology used in the individual landscape evaluation methodology. Foreign samples of ecological landscape assessment. The question of landscape load and sensitivity. The correlation between landscape fragmentation and landscape structure by judging the ecological productivity of the landscape.

Literature

AB. Leitão, J. Miller, J. Ahern, K. McGarigal (2012): Measuring landscapes: A planner's handbook. Island press
J. Ahern, E. Leduc, ML. York (2007) Biodiversity planning and design: sustainable practices. Island Press
S. Pauleit, L. Liu, J. Ahern, A. Kazmierczak (2011): Multifunctional green infrastructure planning to promote ecological services in the city.Oxford University Press
Landscape and Urban Planning journal

Schedule

1st week:
The place of the planning between the other landscape studies.
The definition of the landscape planning, develpoment, rehabilitation and recultivation.

2nd week:
The contact of the landscape planning and the geograhy.

3rd week:
The impact of the Europen Landscape Convention ont he hungarian landscape planning and character research.

4th week:
The judicial background of the landscape planning, the main steps of the planning process.

5th week:
The law about the Built Environment about the Cultural Heritage and about the Regional Planning.

6th week:
The Concept of the National Regional Development (OtRT) and National Resettlement Plan (OTÉK).

7th week:
The landscape loadibility, sensitivity and stability.

8th week:
Forests, woodlets in the landscape planning.

9th week:
Implementation of the telecommunication objects and wind power plant to the landscape.

10th week:
Destructed surfaces by the mining and the landscape rehabilitation.

11th week:
Positive example to the thinking in landscpe; the Balatonfelvidék region.

12th week:
A new line of the landscape research; the landscape character analysis.

Requirements
Attendance at **lectures** is recommended, but not compulsory.
Participation at **practice classes** is compulsory, 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. Attendance at practice classes will be recorded by the practice leader. In case of further absences, a medical certificate needs to be presented. The evaluation for the practical grade based on the student activity on the lessons.

Person responsible for course: Dr. Róbert Vass, assistant professor, PhD

Lecturer: Dr. Róbert Vass, assistant professor, PhD

Title of course: The environmental relations of sectoral planning **Code: TTGME6013_EN**	**ECTS Credit points: 1**

Type of teaching, contact hours
- lecture: 1 hours/week
- practice: 0 hours/week
- laboratory: 0 hours/week

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- practice: 0 hours
- laboratory: 0 hours
- home assignment: 0 hours
- preparation for the exam: 16 hours

Total: 30 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The concept of sectoral planning, the relationship between sector planning and spatial planning. Financial resources for implementing sectoral plans. The structure of the National Development Plans, their role in the process of sector planning. The main objectives of National Environmental Programs, their role in sectoral planning. Strengthen environmentally conscious thinking in public education, higher education and vocational training. The possibilities of environmentally conscious production and sustainable consumption. Possibilities of access to environmental information. The presence of environmental aspects in industrial and agricultural planning and in forestry, food and water management, transport, tourism, energy and waste management.

Literature

Compulsory literature:
C. E. Miller (2001) Planning and Environmental Protection. Bloomsbury Publishing, 288 p.

Recommended literature:
Environmental Handbook - Documentation on monitoring and evaluating environmental impacts-
Volume I: Introduction, Cross-sectoral Planning, Infrastructure,
Volume II: Agriculture, Mining/Energy, Trade/Industry,
Volume III: Compendium of Environmental Standards,
German Federal Ministry for Economic Cooperation and Development (BMZ)
http://wgbis.ces.iisc.ernet.in/energy/HC270799/HDL/ENV/enven/begin.htm#Environmental Handbook

Schedule:
1st week Introduction to the course

2nd week The concept of sectoral planning, the relationship between sectoral planning and spatial planning.

3rd week Financial resources for implementing sectoral plans.

4th week The structure of the National Development Plans, their role in the process of sectoral planning.

5th week The main objectives of National Environmental Programs, their role in sectoral planning.

6th week Strengthen environmentally conscious thinking in public education, higher education and vocational training.

7th week The possibilities of environmentally conscious production.

8th week The possibilities of environmentally conscious and sustainable consumption.

9th week Possibilities of access to environmental information.

10th week The presence of environmental aspects in industrial and agricultural planning.

11th week The presence of environmental aspects in forestry, food and water management.

12th week The presence of environmental aspects in transport and tourism.

13th week The presence of environmental aspects in energy and waste management.

14th week Evaluation of the course, instructions for the exam.

Requirements:

Attendance at **lectures** is recommended, but not compulsory.
The minimum requirement for the examination is 51%. Based on the score of the test, the grade is given according to the following table:

Score	Grade
0-50%	fail (1)
51-60%	pass (2)
61-70%	satisfactory (3)
71-85%	good (4)
86-100%	excellent (5)

If the score of any test is below 51%, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Prof**.** Dr. György Szabó, university professor, PhD

Lecturer: Prof**.** Dr. György Szabó, university professor, PhD

Title of course: The environmental relations of sectoral planning practice **Code: TTGMG6014_EN**	**ECTS Credit points:** 2

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 12 hours
- preparation for the exam: 20 hours

Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Students familiarize themselves with the environmental aspects of sectoral planning. Students will get acquainted and apply the government decrees in the sectoral planning. They are familiar with global and European environmental information systems (eg CORINE, COPERNICUS, SEiS) and gain expertise in their practical application. They collect, manage, analyze data from different databases. Students are familiar with basic geovisualization methods based on the environmental information systems. They can display and map the geographical results. During the semester students preparing case studies using environmental information systems. Case studies will be presented as oral presentation.

Literature

Compulsory:

- Voigt, K. (1998). Environmental information databases. The Encyclopedia of Computational Chemistry, John Wiley & Sons, Chichester, 941-52.
- Haklay, M. (1999). From environmental information systems to environmental informatics-evolution and meaning.

Recommended:

- Verburg, P. H., Neumann, K., & Nol, L. (2011). Challenges in using land use and land cover data for global change studies. Global Change Biology, 17(2), 974-989.

Schedule:

1st week

Description of the semester work. Government decrees in the sectoral planning.

2nd week

Environmental aspects of sectoral planning. The theoretical basis of environmental information systems.

3rd week

The theoretical basis of global and European environmental information systems.

4th week

Description and practical application of Shared Environmental Information System (SEIS). Collecting and visualization geographic data; data analysis and interpretation.

5th week
The theoretical basis and practical application of the COPERNICUS Program.
6th week
Practical application and data collection from the different databases of COPERNICUS. Visualization geographic data; data analysis and interpretation.
7th week
European Environment Information and Observation Network (EIONET). Collecting and visualization geographic data; data analysis and interpretation.
8th week
Description and practical application of EUROSTAT. Collecting and visualization geographic data; data analysis and interpretation.
9th week
Description and practical application of CORINE Land Cover. Collecting and visualization geographic data; data analysis and interpretation.
10th week
Students oral presentation of the case studies. Discussion of results.
11th week
Students oral presentation of the case studies. Discussion of results.
12th week
Students oral presentation of the case studies. Discussion of results.
13th week
Written examination.
14th week
The evaluation of the semester work, description and justification of the practice notes.

Requirements:
- for a signature
Participation at **practice classes** is compulsory. A student must 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. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct doesn't 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 **make a PowerPoint presentation from the prepared case study** as scheduled minimum on a sufficient level.
- for a grade
Students have to make and present a case study using environmental information systems. The course ends in an **examination**. Based on the average of the grades of the PowerPoint presentation and the examination, the grade is calculated as an average of them:

- PowerPoint presentation
- the result of the examination

The grade for the tests and the presentation is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Prof**.** Dr. György Szabó, university professor, PhD

Lecturer: Dr. Tamás Mester, assistant lecturer**,** PhD

Title of course: Environmental field trip **Code: TTGMG6021_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: -	
Evaluation: practical grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: - - laboratory: - - home assignment: 60 hours - preparation for the exam: - Total: 60 hours	
Year, semester: 2nd year, 1nd semester	
Its prerequisite(s):	
Further courses built on it: -	

Topics of course
The aim of the course is to acquaint students with the environmental impacts of various anthropogenic activities whereby environmental users use environmentally friendly technology. Students will learn how to remediate damaged, contaminated landscape elements and how to preserve nature-friendly landscapes. Students will learn the tools of environmental management, environmental planning, environmental development, and environmentally friendly technologies.
Literature
At least 5 literary sources must be used to develop a study and presentation of each subject, which is selected individually.

Schedule:
Requirements: *- for a signature* Participation at environmental field trip is compulsory. If the student does not attend the study, the subject will not be signed and the student must repeat the course. *-for a grade* After the field trip students have to write an essay dealing with a selected subject of course focussing attention on their home country. Based on the quality of the essay student will get a term mark.
Person responsible for course: Dr. István Fazekas, assistant professor, PhD
Lecturer: Dr. István Fazekas, assistant professor, PhD

Title of course: Project work **Code**: **TTGMG6022_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: -
- laboratory: -

Evaluation: signature

Workload (estimated), divided into contact hours:
- lecture: -
- practice: -
- laboratory: -
- home assignment: 60 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Contents of the course: Students are working according their own time. All of them should choose a project leader who controls, allocates the implementation of the assignment issued by the lecturers at the beginning of the year and organizes the presentation of the results at the end of the semester. Also, at the end of the semester, he/she gives a brief description of each member of the team in the light of their work.

Literature

Schedule:
The students work on design, and realization individually on a project, related to environmental problems communication, education, research or management according their own time schedule. After the designing period they refer to each other in form of oral presentation, and works out the ways of realization. In a short written report they refer about their experiences with realization.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
During the semester there are two tests: the mid-term test in the 8th week and the end-term test in the 15th week. Students have to sit for the tests
- for a grade
The course ends in an **examination**.
The minimum requirement for the the examination is 50%. The grade for the examination is given according to the following table:

Score	Grade
0-49%	fail (1)
50-59%	pass (2)
60-72%	satisfactory (3)
73-84%	good (4)
85-100%	excellent (5)

Students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS. *-an offered grade:* it may be offered for students if the test written in the 14th week is at least satisfactory (3).
Person responsible for course: Dr. Róbert Vass, assistant professor, PhD
Lecturer: Dr. Róbert Vass, assistant professor, PhD

Title of course: Meteorological-climatological basics of the utilization of renewable energy sources **Code: TTGMG5502_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 1 hours/week
- practice: 2 hours/week
- laboratory: -

Evaluation: practice grade

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- practice: 28 hours
- laboratory: -
- home assignment: 48 hours
- preparation for the exam: -

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The aim of the course is to provide knowledge on the meteorological-climatological background of the utilization of the renewable energy sources. The course consists of six coherent chapters of meteorology and climatology. The first part deals with the terminology used in meteorology and climatology; the structure of the atmosphere and the physical properties of solar radiation. The second part discusses the development of horizontal air movements, the wind. The Third part traces what happens during the vertical movements of the air: development of clouds and precipitation is examined. Climate forming and modifying factors are discussed in part four. Spatial patterns of Climate parameters on the earth are revealed in part five. Characteristics of the climate of Hungary relevant from the aspect of the utilization of the renewable energies are presented in part six. Practical meteorological topics such as meteorological measurement instruments and methods are discussed in the frame of the practice.

Literature

Compulsory literature:

C. D. Ahrens: Meteorology Today: An Introduction to Weather, Climate, and the Environment, Cengage Learning; 9th edition (2008) ISBN-10: 0495555738

additional literature:

J. M. Wallace: Atmospheric Science, Second Edition: An Introductory Survey (International Geophysics) 2nd Edition. Academic Press; 2 edition (2006) ISBN-10: 012732951X

R. V. Rohli: Climatology Academic Press; 2 edition (2006) ISBN-10: 128411998X

Schedule:

1st week

Introduction: structure of the atmosphere. Characteristics of the planetary boundary layer.

2nd week

Horizontal movements of air, the wind direction and wind speed in the free atmosphere and in the planetary boundary layer.

3rd week

Vertical movements of air, processes of cloud and precipitation development 1.

4th week
Vertical movements of air, processes of cloud and precipitation development 2.
5th week
Climate forming and modifying factors 1.
6th week
Climate forming and modifying factors 2.
7th week
Spatial pattern of climate elements on the Earth 1.
8th week
Spatial pattern of climate elements on the Earth 2.
9th week
Temporal patterns of climate elements on the Earth 1.
10th week
Temporal patterns of climate elements on the Earth 2.
11th week
Spatial and temporal dynamics of climate elements in Hungary 1.
12th week
Spatial and temporal dynamics of climate elements in Hungary 2.
13th week
End test.
14th week
Correction opportunity

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be discussed with the tutor. If a student's behavior or conduct doesn't 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.
- for a grade
The course ends in a **practice grade**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD

Title of course: Environmental law **Code: TTGME6023_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: 31 hours - preparation for the exam: 31 hours Total: 90 hours	
Year, semester: 2nd year, 1nd semester	
Its prerequisite(s):	
Further courses built on it: -	

Topics of course

The aim of the course is to provide knowledge on the most important international treaties and reports connected to different environmental elements and problems, environmental legislative process in the EU, environmental laws of the EU and Hungarian engagements and derogation demands derived from them. Most important Hungarian environmental regulations, authorities with their tasks and the structure of the Hungarian environmental protection organizations are presented in the frame of the course as well.

Literature

Compulsory literature:
E. Fisher: Environmental law. Oxford University Press; 1 edition (2018)
Additional literature: ISBN-10: 0198794185
J. Salzman and B. Thompson Jr.: Environmental Law and Policy (Concepts and Insights) 4th Edition Foundation Press; 4 edition (2013) ISBN-10: 1609303059

Schedule:
1st week
The basic concepts of environmental regulation, the system of environmental law.
2nd week
The legal source system for environmental protection.
3rd week
Methodology of environmental regulation. The integrative and the sectoral method, the administrative method, the method of economic regulation, the method of self-regulation
4th week
The basic principles of environmental law, the constitutional background of environmental protection, the right to the environment
5th week
International conventions and protocols on environment and sustainable development.
6th week
Environmental protection and sustainable development legislation and strategies in the EU
7th week

Legal framework for environmental management and evaluation. Standardized environmental management systems.: BS7750, EMAS, ISO 14001
8th week
The specialties of the environmental authority process, the licensing of the use of the environment
9th week
Integrated Pollution Prevention and Control, and the Best Available Techniques.
10th week
The framework law of the environment, and the Hungarian administrative and official institutions.
11th week
Air, noise, climate protection, water protection legislation
12th week
Nature and landscape protection, forest protection, land protection, food safety, GMO, catastrophe protection legislation
13th week
Legal and market regulation of waste management.
14th week
Environmental tasks at state and local level. Tasks and powers of the municipal environmental protection authority.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
During the semester students have to write an essay dealing with a selected subject of course focussing attention on their home country.
The course ends in a written **examination**. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:

Person responsible for course: Dr. István Fazekas, assistant professor, PhD

Lecturer: Dr. István Fazekas, assistant professor, PhD

Title of course: Project management in the energy sector **Code: TTGMG6024_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: 2 hours/week - laboratory: -	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: 28 hours - laboratory: - - home assignment: 32 hours - preparation for the exam: Total: 60 hours	
Year, semester: 2nd year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Fundamentals of project management. Project cycle theory. Project planning methods. Development and management of energy programs. Energy investments. Phases of the development of energy investments. Energy projects. European Union subsidy system. Applications for the 2014-2020 programming period in the energy sector. Tendering services. Practical experience of case studies.

Literature

Compulsory:
- The presentations of practices

Recommended:
- Huba-Varga Nikolett – Dobay Kata: Az Európai Uniós támogatások, pályázatkészítés és projektmenedzsment, Pécs, 2007
Mészáros Géza: Energetikai hatékonysági programok kidolgozása és menedzsmentje, EDUTUS Főiskola, 2012

Schedule:
Week 1 Basics of project management
Week 2 The Project Cycle Theory
Week 3 Project Planning Methods
Week 4 Development and management of energy programs
Week 5 Energy investments
Week 6: Phases of the development of energy investments
Week 7 Energy projects
Week 8 European Union subsidy system
Week 9 Applications for the 2014-2020 Programming Period in Energy
Week 10 Tendering services
Week 11 Case Studies I.
Week 12 Case Studies II.

Requirements:
- *for a signature*
Attendance at **practice** is compulsory.
- *for a grade*
During the semester students have to write **two tests**.
Based on the result of tests and the quality of on-practice-work, the final grade is calculated as an average of them:

- the quality of the on-practice-work (20%)
- the result of the tests (80%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

-an offered grade:

Person responsible for course: Dr. Mária Vasvári, assistant lecturer, PhD

Lecturer: Dr. Mária Vasvári, assistant lecturer, PhD

Title of course: Society and energy **Code: TTGME6516_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 12 hours
- preparation for the exam: 50 hours

Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The role of energy and energy sources for the history of civilizations. The spread of the use of energy sources, their geographic and historical reasons. Cultural conditions for the use of energy sources. Geographical causes and consequences of attitudes related to the environment, including energy use. Geographical characterization of the current energy use of the world, energy sources and regions. Energy Problems in the World - Abundance and Poverty. Conventional and alternative energy solutions to address problems of social level.

Literature

Compulsory:
- Mészáros Rezső: A globális gazdaság földrajzi dimenziói, Akadémiai Kiadó, Budapest, 2010.
- Vajda György: Energiapolitika. MTA, Budapest, 2001. p

Recommended:
-

Schedule:
Week 1 Understanding energy in the context of historical civilizations - "Did Prometheus take us good?"
Week 2 Understanding Energy in Social Philosophy - "Tightening and Invisible Drivers".
Week 3 Geographical shapes and trends of the use of energy sources I. - fossil energy sources
Week 4 Geographical shapes and trends of the use of energy sources II. - Renewable energy forms
Week 5 Cultural conditions for the use of energy sources I. - Energy management of the Christian culture
Week 6 Cultural conditions for the use of energy sources II. - The energy management of Islamic culture
Week 7 Cultural conditions for the use of energy sources III. - The energy management of East Asian cultures
Week 8 Cultural conditions for the use of energy sources IV. - Traditional, natural cultures and postmodern theories.
Week 9 Geographical Causes and Consequences of Attitudes to the Environment and the Energy Consumption.

Week 10 The emergence of problems arising from the uneven distribution and consumption of energy sources on the Earth.
Week 11 Geographical causes and consequences of energy supply and energy shortage
Week 12 Traditional and alternative solutions to addressing energy problems at social level.
Week 13 Energy Sources as the major causes of social conflicts.
Week 14 The energy consciousness and unconsciousness of Hungarian society.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
During the semester students have to write an essay dealing with a selected subject of course.
The course ends in a written **examination**. Based on the result of examination and the quality of essay, the final grade is calculated as an average of them:

- the quality of the essay (15%)
- the result of the examination (85%)

The grade for the course is given according to the following table:

Score	Grade
0-50	fail (1)
50-59	pass (2)
60-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

If the score of student result is below 50, students can take a new written examination in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:

Person responsible for course: Dr. Zsolt Radics, assistant professor, PhD

Lecturer: Dr. Zsolt Radics, assistant professor, PhD

Title of course: Wind energy **Code: TTGME5503_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The aim of the course is to provide theoretic aspects of the utilization of wind energy from meteorological-climatological aspects via technology of wind energy utilization to environmental and social issues. Methods for the calculation of wind energy potential, technical features and environmental impacts of wind turbines are discussed in the frame of the course.

Literature

Compulsory literature:

Mohamed A. El-Sharkawi: Wind Energy: An Introduction 1st Edition CRC Press; (2015) ISBN-10**:** 1482263998

Recommended literature:

Tar, K.: Statistical structure of the surface layer wind field in Hungary. Direction, speed and energy of the wind. (2014) Lambert Academic Publishing, ISBN: 978-3-8484-0139-0, p 88.

Schedule:

1st week
Methods and instruments used for determination of wind energy potential 1.
2nd week
Methods and instruments used for determination of wind energy potential 2.
3rd week
Methods and instruments used for determination of wind energy potential 3.
4th week
Instruments of wind energy utilization 1: wind wheels.
5th week
Instruments of wind energy utilization 1: wind turbines.
6th week
Instruments of wind energy utilization 3: other instruments.
7th week
Position of wind energy within the energy production of the world 1.
8th week
Position of wind energy within the energy production of the world 2.
9th week

Position of wind energy within the energy production of Hungary 1.
10th week
Position of wind energy within the energy production of Hungary 1.
11th week
Social aspects of wind energy utilization 1.
12th week
Social aspects of wind energy utilization 2.
13th week
Environmental aspects of wind energy utilization 1
14th week
Environmental aspects of wind energy utilization 2.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
The course ends in an **exam**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. István Lázár, assistant professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD

Title of course: Wind energy practice **Code: TTGMG5504_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: 2 hours/week - laboratory: -	
Evaluation: mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: 28 hours - laboratory: - - home assignment: 32 hours - preparation for the exam: Total: 60	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s):	
Further courses built on it:	

Topics of course

The aim of the course is to provide practical aspects of the utilization of wind energy from meteorological-climatological aspects via technology of wind energy utilization to environmental and social issues. Students can gain an insight into the steps of realisation of a wind turbine project via case studies.

Literature

Compulsory literature:

J. F. Manwell, J. G. McGowan, A. L. Rogers: Wind Energy Explained: Theory, Design and Application 2nd Edition Wiley; 2 edition (2010) ISBN-10: 0470015004

Recommended literature:

Motes: Solar and Wind Power: The Basics AM Photonics (2015)

Schedule:

1st week
Wind energy database building 1.
2nd week
Wind energy database building 2.
3rd week
Methods and instruments used for determination of wind energy potential 1.
4th week
Methods and instruments used for determination of wind energy potential 2.
5th week
Methods and instruments used for determination of wind energy potential 3.
6th week
Practical applications of wind climatological methods 1.
7th week
Practical applications of wind climatological methods 2.
8th week
Practical applications of wind climatological methods 3.
9th week
Modelling of wind fields 1.

10th week
Modelling of wind fields 2.
11th week
Modelling of wind fields 3.
12th week
Modelling of wind fields in urban environment 1
13th week
Modelling of wind fields in urban environment 2
14th week
End test.

Requirements:
- for a signature
Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be discussed with the tutor. If a student's behavior or conduct doesn't 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.
- for a grade
The course ends in a **practice grade**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. István Lázár, assistant professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD

Title of course: Solar energy **Code: TTGME5509_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The aim of the course is to provide knowledge on the methods of the determination of solar energy potential. Methods and instruments of solar energy utilization, types of photovoltaic panels, solar collectors and other instruments are presented. Position of solar energy in the energy mix in the world and in Hungary is discussed. Social and environmental aspects of wind energy utilization are revealed as well.

Literature

Compulsory literature:

I. Olindo – K. Jager: Solar Energy: The Physics and Engineering of Photovoltaic Conversion, Technologies and Systems. UIT Cambridge Ltd. (2016) ISBN-10: 1906860327

Recommended literature:

V. Sivaram: Taming the Sun: Innovations to Harness Solar Energy and Power the Planet The MIT Press (2018) ISBN-10: 0262037688

Schedule:

1st week
Methods and instruments for determination of solar energy potential 1.
2nd week
Methods and instruments for determination of solar energy potential 2.
3rd week
Methods and instruments for determination of solar energy potential 3.
4th week
Instruments of solar energy utilization 1: solar collectors.
5th week
Instruments of solar energy utilization 2: solar panels.
6th week
Instruments of solar energy utilization 3: other instruments.
7th week
Position of solar energy utilization within the energy supplies of the world 1.
8th week
Position of solar energy utilization within the energy supplies of the world 2.

9th week
Position of solar energy utilization within the energy supplies of Hungary 1.
10th week
Position of solar energy utilization within the energy supplies of Hungary 2.
11th week
Social aspects of solar energy utilization 1.
12th week
Social aspects of solar energy utilization 1.
13th week
Environmental aspects of solar energy utilization 1.
14th week
Environmental aspects of solar energy utilization 2.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
The course ends in an **exam**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Sándor Szegedi, associate professor, PhD

Lecturer: Dr. Sándor Szegedi, associate professor, PhD

Title of course: Solar energy practice **Code: TTGMG5510_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The aim of the course is to provide knowledge on practical aspects of the utilization of solar energy from meteorological-climatological aspects via technology of solar energy utilization to environmental and social issues. Students can gain an insight into the steps of realisation of a solar panel/ collector project.

Literature

Compulsory literature:

M. Boxwell: Solar Electricity Handbook - 2018 Edition: A Simple, Practical Guide to Solar Energy - Designing and Installing Solar Photovoltaic Systems. Greenstream Publishing; (2018) ISBN-10: 1907670688

Recommended literature

J. Burdick, P. Schmidt: Install Your Own Solar Panels: Designing and Installing a Photovoltaic System to Power Your Home Storey Publishing, LLC; (2017) ISBN-10**:** 1612128254

Schedule:

1st week
Instruments for measuring solar irradiation.
2nd week
Passive utilization of solar energy 1: exposition.
3rd week
Passive utilization of solar energy 2: solar spaces.
4th week
Active utilization of solar energy 1: solar collectors.
5th week
Active utilization of solar energy 2: solar panels.
6th week
Auxiliary solar collector systems for different heating systems.
7th week
Opportunities of the application of solar panels in island working mode or attached to the mains.
8th week

Possibilities, conditions and limits of the solar irradiation modelling
9th week
Solar irradiation modelling 1.
10th week
Solar irradiation modelling 2.
11th week
Solar irradiation modelling 3.
12th week
Solar power plants
13th week
Environmental aspects of the utilization of solar energy
14th week
End test

Requirements:
- for a signature
Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be discussed with the tutor. If a student's behavior or conduct doesn't 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.
- for a grade
The course ends in a **practice grade**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. István Lázár, assistant professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD

Title of course: Bioenergy **Code: TTGME5505_EN**	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: - - preparation for the exam: 62 hours Total: 90 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s):	
Further courses built on it:	

Topics of course

The aim of the course is to introduce students into theoretical issues of the utilization of bio energies. Natural basics and technologies of biomass utilization are discussed in the frame of the course. Students learn how to evaluate feasibility of bio energy projects from financial and social aspects. Students gain comprehensive knowledge on theoretical issues of solid biomass, bio fuel and biogas production.

Literature

Compulsory literature:

C- Pinto McCarthy: The Science of Biomass Energy (Science of Renewable Energy) Referencepoint Pr Inc (2018) ISBN-10: 1682823016

Recommended literature:

K. J. Ptasinski: Efficiency of Biomass Energy: An Exergy Approach to Biofuels, Power, and Biorefineries Wiley (2016) ISBN-10: 1118702107

Schedule:

1st week

Meteorological-climatological background of biomass utilization. Natural-environmental conditions of biomass production.

2nd week

Types and ways of utilization of biomass. Sources of biomass (solid, liquid, gaseous) used for energy production.

3rd week

Characteristics of centralized and decentralized energetic systems. Issues of the cooperation and parallel operation of the two systems. Advantages, disadvantages, strengths and weaknesses of biomass based systems.

4th week

Characteristics, (structure and technical parameters) of biomass based power plants, heat generating and power plants and heat generating plants. Short review of district-heating and biomass based district-heating plants.

5th week

Characteristics of biomass based village heating plants. Natural, economic and social conditions of implementation of village heating plants. Working projects in Hungary and abroad.
6th week
Characteristics of biomass based institution heating. Natural, economic and social conditions of implementation of institution heating. Working projects in Hungary and abroad
7th week
Opportunities for residential use of biomass. The sources (ligneous and herbaceous) and the technical instruments of residential use of biomass.
8th week
Sources of biodiesel production. Technologies of the production of first and second generation biodiesel. Alga as base material for biodiesel production.
9th week
Sources of bioethanol production. Technologies of the production of first and second generation bioethanol. Biogas as fuel
10th week
Opportunities of application of bio fuels (biodiesel, bioethanol and biogas). Environmental effects and social aspects of the production and usage of bio fuels.
11th week
Characteristics of biogas. Review of the spoil-gas production. Basic materials of biogas production. Phases and processes of gas formation. Structure of biogas plants.
12th week
The process of biogas production based on sewage sludge. Working projects in Hungary and abroad
13th week
International and Hungarian practice of biogas production from wastes. Structure of the spoil area. The process and yield of biomass development.
14th week
Opportunities of usage of biomass inside the plants and outside (energy production, feeding into the gas network, traffic). Environmental effects of biogas production, advantages, disadvantages, strengths and weaknesses of biogas production. Complex energetic projects.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
The course ends in an **exam**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Ferenc Wantuch, assistant professor, PhD

Lecturer: Dr. Ferenc Wantuch, assistant professor, PhD

Title of course: Bioenergy practice **Code: TTGMG5506_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The aim of the course is to introduce students into practical issues of the utilization of bio energies. Students learn the methods for the calculation of biomass potential, the technologies and limits of biomass energy production. They learn how to evaluate financial, social and technical conditions of bioenergy projects. Students gain comprehensive knowledge on practical issues of solid biomass, bio fuel and biogas production.

Literature

Compulsory literature:

E. Dahlquist: Technologies for Converting Biomass to Useful Energy: Combustion, Gasification, Pyrolysis, Torrefaction and Fermentation (Sustainable Energy Developments)CRC Press (2013) ISBN-10: 0415620880

Recommended literature:

K. J. Ptasinski: Efficiency of Biomass Energy: An Exergy Approach to Biofuels, Power, and Biorefineries Wiley (2016) ISBN-10: 1118702107

Schedule:

1st week

Review of solid biomass used for heat generation 1. Types of ligneous and herbaceous biomass from conventional sources, determination of the potentials.

2nd week

Review of solid biomass used for heat generation 2. Ligneous and herbaceous wastes what can be used for heat generation, determination of their potential 2.

3rd week

Technologies of the chopped wood, wooden fuel cake and pellet production. Opportunities of their application on household and local scales.

4th week

Problems and logistical challenges arise during the production, transportation and usage of biomass

5th week

Review of solid biomass used for heat generation (potential, sources). Availability of raw materials, potential logistical problems

6th week

Workplaces created by biomass production transportation and procession. Spared cost 1.
7th week
Workplaces created by biomass production transportation and procession. Spared cost 2.
8th week
Opportunities for the use of solid biomass for energy production. Review on the projects materialized, and analyses of the tendencies in that field internationally.
9th week
Opportunities for the use of solid biomass for energy production. Review on the projects materialized, and analyses of the tendencies in that field in Hungary.
10th week
How to prepare a bioenergy project plan, portfolio planning, financial sources.
11th week
Types of bioenergy tenders, their availability and criteria. A review on current bioenergy tenders.
12th week
Planned and taken increase in the frame of National Action Plan, materialized projects, supported project plans.
13th week
Energy budget of first second and third generation bio fuels. Review of the biomass dilemmas.
14th week
Comparative review of different biogas plants using waste dumps, sewage sludge, feral or vegetal wastes via international and Hungarian examples.

Requirements:
- for a signature
Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be discussed with the tutor. If a student's behavior or conduct doesn't 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.
- for a grade
The course ends in a **practice grade**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Ferenc Wantuch, assistant professor, PhD

Lecturer: Dr. Ferenc Wantuch, assistant professor, PhD

Title of course: Geothermal energy **Code: TTGME5001_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The aim of the course is to introduce students into the theoretical issues of the utilization of geothermal energy. Theoretical aspects of the following issues are discussed in the frame of the course: analytic and numeric modelling methods of heat transfer in the Earth's crust and in the producing units, thermodynamic processes of geothermal power plants, undersurface heat storage, energetic conditions and sizing of heat pumps, hydrodynamic modelling in geothermics, resource and potential calculations in geothermal energy utilization. Best practice of geothermal energy utilization are presented as well.

Literature

Compulsory:

- Stober, I. – Bucher, K. (2013): Geothermal Energy. From Theoretical Models to Exploration and Development, Springer, 291 p.

Recommended:

- Watson, A. (2013): Geothermal Engineering. Fundamentals and Applications, Springer, 336 p.
- Pasquale, V. – Verdoya, M. – Chiozzi, P. (2014): Geothermics. Heat Flow in the Lithosphere, Springer, 119 p.

Schedule:

1st week Main branches of the geothermal energy utilization (Lindal diagram, direct use and electricity generation).

2nd week Analysis of the thermodynamic processes of the geothermal power plants, combined and hybrid power plants.

3rd week Operation of geothermal heat pumps. Energetic efficiency, primer energy demand and greenhouse gas emission of different systems.

4th week Designing process of ground loop of heat pump systems based on the heat demand and environmental attributes

5th week Modelling heat conduction. Analytical solutions around a solely borehole heat exchanger and field. Numerical modelling in different types of software.

6th week Realization of underground thermal energy storage coupled to heat pump systems.

7th week Geological and technological conditions of water production and injection and its practice in porous and karstic environments.

8th week Installation and modelling of geothermal doublets and triplets.

9th week Balneological thermal water utilization and its energetic optimization.

10th week Types of geothermal potential, reserve and resource calculations and its geological background.

11th week EGS technology in theory and practice.

12th week Geothermal play types, hydrothermal and petrothermal systems in different tectonic environments.

13th week Geothermal energy utilization in the Carpathian Basin I. (case study) - geological aspect

14th week Geothermal energy utilization in the Carpathian Basin II. (case study) - present status and future possibilities

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
The course ends in a written **examination**.
The minimum requirement for the examination is 60%. The grade for the examination is given according to the following table:

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, students can take a retake test in conformity with the Education and examination rules and regulations.

Person responsible for course: Dr. Tamás Buday, assistant professor, PhD

Lecturer: Dr. Tamás Buday, assistant professor, PhD

Title of course: Geothermal energy practice **Code: TTGMG5002_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade (written exam and presentation)

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 18 hours
- preparation for the exam: 14 hours

Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The aim of the course is to introduce students into the practical issues of the utilization of geothermal energy. Practical aspects of the following issues are discussed in the frame of the course: analytic and numeric modelling methods of heat transfer in the Earth's crust and in the producing units, thermodynamic processes of geothermal power plants, undersurface heat storage, energetic conditions and sizing of heat pumps, hydrodynamic modelling in geothermics, resource and potential calculations in geothermal energy utilization.

Literature

Compulsory:
- Stober, I. – Bucher, K. (2013): Geothermal Energy. From Theoretical Models to Exploration and Development, Springer, 291 p.

Recommended:
- Watson, A. (2013): Geothermal Engineering. Fundamentals and Applications, Springer, 336 p.

Schedule:

1st week Introduction to the course. Heat conduction of the crust - analytical and numerical analysis.

2nd week Energetic calculations connected to the operation of geothermal power plants.

3rd week Characteristic curves of several types of heat pump. Annual changes in the operation parameters due to the meteorological conditions.

4th week Using of the VDI 4640 standard for designing the ground loop of geothermal heat pumps.

5th week Designing the ground loop of geothermal heat pumps with different programs.

6th week Designing the underground thermal energy storage - theoretical and practical considerations.

7th week Hydrodynamic modelling for geothermal energy utilization, finite element and finite difference methods.

8th week Thermal breakthrough in hydrothermal and petrothermal systems.

9th week Calculation of convective heat transport and gas emission in wells and in active volcanic fields.

10th week Geoinformatics in geothermal energy utilization: geological-geographical conditions, demands and cost-optimization.

11th week Geothermal resource calculation methods.

12th week Case studies (student task)

13th week Written examination

14th week Case studies (student task). Written examination (retake if necessary)

Requirements:
- for a signature
Participation at classes is compulsory. A student must attend the courses 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.
- for a grade
The case studies are presented by the students. It gives 30 points in the final score.
The course ends in a written **examination**. It gives 70 points in the final score. The minimum requirement for the examination is 60%. Based on the summarized score of the tests and the presentation, the grade for the practice is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-69	satisfactory (3)
70-79	good (4)
80-100	excellent (5)

If the score of the test is below 60 %, students can take a retake test in conformity with the Education and examination rules and regulations.

Person responsible for course: Dr. Tamás Buday, assistant professor, PhD

Lecturer: Dr. Tamás Buday, assistant professor, PhD

Title of course: Hydropower **Code: TTGME5507_EN**	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The aim of the course is to provide knowledge on the methods of the determination of hydropower potential. Methods and instruments of hydropower energy utilization, types of water turbines, hydropower-plants and other instruments,such as tidal powerplants are presented. Position of hydropower energy in the energy mix in the world and in Hungary is discussed. Social and environmental aspects, best and worst practices of hydropower energy utilization are revealed via case studies sa as well.

Literature

Compulsory literature:

M. Doeden Finding Out About Hydropower. Searchlight Books. Lerner Classroom (2014) ISBN-10: 1467745553

Recommended literature:

J. S. Gulliver, R. E. A. Arndt: Hydropower Engineering Handbook (1990)

Schedule:

1st week
Methods and instruments for determination of hydropower energy potential 1.
2nd week
Methods and instruments for determination of hydropower energy potential 2.
3rd week
Methods and instruments for determination of hydropower energy potential 3.
4th week
Instruments of hydropower energy utilization 1: water turbines.
5th week
Instruments of hydropower energy utilization 2: hydropower plants.
6th week
Instruments of hydropower energy utilization 3: other instruments.
7th week
Position of hydropower energy utilization within the energy supplies of the world 1.
8th week
Position of hydropower energy utilization within the energy supplies of the world 2.

9th week
Position of hydropower energy utilization within the energy supplies of Hungary 1.
10th week
Position of hydropower energy utilization within the energy supplies of Hungary 2.
11th week
Social aspects of hydropower energy utilization 1.
12th week
Social aspects of hydropower energy utilization 1.
13th week
Environmental aspects of hydropower energy utilization 1.
14th week
Environmental aspects of hydropower energy utilization 2.

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
The course ends in an **exam**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Ferenc Wantuch, assistant professor, PhD

Lecturer: Dr. Sándor Szegedi, associate professor, PhD

Title of course: Hydropower practice **Code: TTGMG5508_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: practice grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The aim of the course is to provide practical aspects of the utilization of wind energy from meteorological-climatological aspects via technology of wind energy utilization to environmental and social issues. Students can gain an insight into the benefits and drawback of hydropower projects via some case studies.

Literature

Compulsory literature:

M. Doeden Finding Out About Hydropower. Searchlight Books. Lerner Classroom (2014) ISBN-10: 1467745553

Recommended literature:

J. S. Gulliver, R. E. A. Arndt: Hydropower Engineering Handbook (1990)

Schedule:

1st week
Methods and instruments for measuring runoff.
2nd week
Methods for the estimation of the amount runoff.
3rd week
Methods and instruments for determination of hydropower energy potential. Practical applications 1.
4th week
Methods and instruments for determination of hydropower energy potential. Practical applications 2.
5th week
Methods and instruments for determination of hydropower energy potential. Practical applications 3.
6th week
Types and characteristics of penstocks 1.
7th week
Types and characteristics of penstocks 2.
8th week

Types of hydropower turbines 1: the Kaplan turbine
9th week
Types of hydropower turbines 2: the Francis turbine
10th week
Types of hydropower turbines 3: the Bánki turbine
11th week
Types of hydropower turbines 4: the Pelton turbine
12th week
Planning of hydropower plants
13th week
Ecological impacts of hydropower plants
14th week
End test

Requirements:
- for a signature
Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be discussed with the tutor. If a student's behavior or conduct doesn't 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.
- for a grade
The course ends in a **practice grade**.
The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Ferenc Wantuch, assistant professor, PhD

Lecturer: Dr. István Lázár, assistant professor, PhD

Title of course: GIS in Energetics **Code: TTGML7026_EN**	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: -
- practice: -
- laboratory: 2 hours/week

Evaluation: practical grade and written test

Workload (estimated), divided into contact hours:
- lecture: -
- practice: -
- laboratory: 28 hours
- home assignment: 16 hours
- preparation for the exam: 16 hours

Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The aim of the course is to introduce students into the application of GIS in renewable energy utilization. The following topics are discussed in the frame of the course: terminology of geoinformatics; data types; the vector data bases and their editing; creation of vector data bases, topologic rules; attribute data sets and their features; operations with attributes; creation of thematic maps; scale and printing.

Literature

- G. S. Srivastava: An Introduction to Geoinformatics (2014) McGraw Hill Education (India) Private Limited ISBN-10: 9339218825
- M. Penzkofer: Geoinformatics. Books on Demand (2017) ISBN-10: 3741263109
- Shrestha, B., Bajracharya, B., & Pradhan, S. (2001). GIS for beginners: introductory GIS concepts and hands-on exercises. International Centre for Integrated Mountain Development (ICIMOD).
- Kapetsky, J. M., & Aguilar-Manjarrez, J. (2007). Geographic information systems, remote sensing and mapping for the development and management of marine aquaculture (No. 458). Food & Agriculture Org..
- Matejicek, L. (2017). Assessment of Energy Sources Using GIS. Springer.
- QGIS Documentation: https://www.qgis.org/en/docs/index.html

Schedule:

1st week Introduction to the course. GIS, spatiality. Datatypes. Database, attribute types, and properties.

2nd week Introduction to QGIS, graphical interface, menu system. Opening vector data, and attribute table. Set projection.

3rd week Create vector layer, editing vector layer, vectorization I. Topology.

4th week Create vector layer, editing vector layer, vectorization II. Topology.

5th week Operating with attributes, insert, delete, calculate attributes. Queries (SQL).

6th week Query based on spatial location. Combination of queries. Practice.

7th week Visualizing methods – thematic maps. Labelling. Projections, Graticule, measured grid. Layout. Practice.

8th week Projections, Graticule, measured grid, layout, scale setting, printing. Practice.

9th week Summarizing knowledge, practicing. Complex problem-solving with lecturer's guidance.

10th week WMS layers, OSM, Problem solving – searching, download plug-ins.

11th week Database searching, access, download which are relevant in Energetics. Practicing.

12th week Practicing with lecturer's guidance.

13th week Practical grading – offered grade.

14th week Practical grading.

Requirements:
- for a signature
Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be 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 behavior or conduct doesn't 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.
- for a grade
The course ends in a practical grading.
If the practical grading is not successful, students can repeat the referring in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.
-an offered grade:
it may be offered for students in the 13th week if the grade is at least satisfactory (3).

Person responsible for course: Dr. Boglárka Balázs, assistant professor, PhD

Lecturer: Dr. Boglárka Balázs, assistant professor, PhD

Title of course: Renewable energy field trip **Code: TTGMG5512_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: -	
Evaluation: practice grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: - - laboratory: - - home assignment: 60 hours - preparation for the exam: - Total: 60 hours	
Year, semester: 2nd year, 1st semester	
Its prerequisite(s):	
Further courses built on it:	

Topics of course

The aim of the course is to provide opportunity for the students to gain knowledge on the working of renewable energy projects. The course consists of visits to wind turbines, solar panel and collectors facilities, to hydropower-plants and biomass energy projects to get a close look into their functioning.

Literature

Compulsory literature:

N. Jenkins, J. Ekanayake: Renewable Energy Engineering Cambridge University Press; (2017) ISBN-10: 1107680220

Recommended literature:

G. Boyle: Renewable Energy: Power for a Sustainable Future. Oxford University Press; (2012) ISBN-10: 0199545332

Schedule:

Requirements:

- for a signature

Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be discussed with the tutor. If a student's behavior or conduct doesn't 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.

- for a grade

The course ends in a **practice grade**.

The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade

0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)
Person responsible for course: Dr. István Lázár, assistant professor, PhD	
Lecturer: Dr. István Lázár, assistant professor, PhD	

Title of course: Renewable energy project work **Code: TTGMG5513_EN**	**ECTS Credit points: 2**
Type of teaching, contact hours - lecture: - - practice: - - laboratory: -	
Evaluation: practice grade	
Workload (estimated), divided into contact hours: - lecture: - - practice: - laboratory: - - home assignment: 60 hours - preparation for the exam: - Total: 60 hours	
Year, semester: 2nd year, 1st semester	
Its prerequisite(s):	
Further courses built on it:	

Topics of course

The aim of the course is to introduce students into the steps of the implementation of renewable energy projects step by step. They can gain insight into the scheduling of the phases and into the management of renewable energy projects.

Literature

Compulsory literature:

D. Chiras: The Homeowner's Guide to Renewable Energy: Achieving Energy Independence Through Solar, Wind, Biomass, and Hydropower. New Society Publishers (2011) ISBN-10: 0865716862

Additional literature:

J. Seneideman, E. Twamley: Renewable Energy: Discover the Fuel of the Future With 20 Projects (Build It Yourself) Nomad Press (2016) ISBN-10: 1619303604

Schedule:

Requirements:

- for a signature

Participation at **practice classes** is compulsory. A student must 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. A student can't 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, to be discussed with the tutor. If a student's behavior or conduct doesn't 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.

- for a grade

The course ends in a **practice grade**.

The minimum requirement is 50%. the grade for the tests and the examination is given according to the following table:

%	Grade

0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)
Person responsible for course: Dr. Sándor Szegedi, associate professor PhD	
Lecturer: Dr. Sándor Szegedi, associate professor PhD	