Semester 1

Course Title: Mine waste geochemistry and characterization	**Credits: 2**
Lessons/week (lecture + seminar) 1 lecture + 1 seminars	
Methods of assessment during course: **Signature:** Participation in lessons and laboratory excercises. **Grade:** The assessment consists of a written report and presentation of the laboratory group work and a written exam **Grading limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*: Chemistry, Physics, Mathematics, Economic Geology and Mineralogy	
Course Description:	
Acquired store of learning: **Scope and objective of subject:** Understand the importance of mining waste management for the mineral extraction industry; Detailed understanding of sulphidic ore weathering processes, ARD/ML; Have practice in main characterization and analytical tools **Thematic description of subject:** Waste categories in the extractive industries, Acid Rock Drainage and Metal Leaching (ARD/ML); Sampling Plan, Objectives and Approach of mine waste sampling; Characterization methods: field methods, Static tests, Kinetic test; Interpretation and evaluation: Reaction Rates; Sulphate release; Oxygen Depletion; Leaching Rate; EU legal framework of mining waste management, best practices.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
GARD Guide (www.gardguide.com), Walder I.F. & Schuster P.: Environmental geochemistry of ore deposits and mining activities. Short course notes, Albuquerque, New Mexico. Dold B.: Basic Concepts of Environmental Geochemistry of Sulfide Mine-Waste (UNESCO-SEG course material, 2005) Lapakko K.: Metal Mine Rock and Waste Characterization Tools: An Overview (International Institute for Environment and Development, 2002)	
Responsible Instructor (*name, position, scientific degree):* **Ferenc Mádai, associate professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -	

Course Title: Contaminated soil characterization and treatment	**Credits: 2**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **lec 18 h, lab classes 6 h**

Type of Assessment (exam. / pr. mark. / other): **pr. mark**
During the semester the following tasks should be completed: short presentation on soil cleaning (10%), exam (90%)
GradingLimits:
> 80%: excellent,
70-79%: good,
60-69%: medium,
50-59%: satisfactory,
< 50%: unsatisfactory.

Position in Curriculum (which semester): **first**

Pre-requisites *(if any)*:

Course Description:

Acquired store of learning:
Study goals: To give knowledge about the soil complex composition, possible contaminants, Dutch List and the interactions between soil and the contaminant; soil remediation processing systems: in situ, off situ, on site, of site; remediation of soil contaminated with organic substances; basics of bio remediation; aerobic and anaerobic treatment and enhancement; remediation of sites contaminated with heavy metals: chemical and bio leaching in heaps and reactors, treatment of obtained after leaching aqueous phase, as well as contaminated ground water, technologies and equipment.
Education method: Lectures and laboratory classes
Competencies to evolve:

- Knowledge to be able to judge the applicability of remediation techniques, to choose the proper one.
- Ability to analyze environmental hazards caused by mining and mineral processing activity.
- Demand for continual renewal of technical skills.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

1. http://www.epa.gov/superfund/remedytech/remed.htm
2. Groundwater and Soil Cleanup: Improving Management of Persistent Contaminants Committee on Technologies for Cleanup of Subsurface Contaminants in the DOE Weapons Complex, National Research Council. ISBN: 0-309-51961-6, 304 pages, 6 x 9, (1999)
3. **Innovations in Ground Water and Soil Cleanup: From Concept to Commercialization** Committee on Innovative Remediation Technologies, National Research Council ISBN: 0-309-52148-3, 310 pages, 6 x 9, (1997)
4. Bajpai, R.K.-Zappi, M.E.: Bioremidiation of Surface and Subsurface Contamination.New York Academy of Sciences, 1997. ISBN:1-57331-065-4
5. Noyes, R. Unit operations in Environmental Engineering. Noyes Publications, USA, 1994.

Responsible Instructor (*name, position, scientific degree):*
Dr. Ljudmilla BOKÁNYI CSc, Associate Professor

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):Dr. Sándor NAGY PhD, Senior Lecturer

Course Title: Environmental Geology	**Credits: 4**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 + 1**

Type of Assessment (exam. / pr. mark. / other): **examination**
Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
75 – 89%	4 (good)
63 – 74%	3 (satisfactory)
50 – 62%	2 (pass)
0 – 50%	1 (failed)

Position in Curriculum (which semester): **1st**

Pre-requisites *(if any)*: -

Course Description:

The main objective of the course is to make the students familiar with the effects of geological medium on the state and changes of the environment, and prepare them for revealing the geological background of environmental problems as well as mitigating or minimizing these problems.

System approach in geology, changes in the four main systems of the Earth. The objects, methods and legal background of environmental geology. Environmental minerals, their characteristics and role in causing and mitigating of environmental problems. Geological hazards (volcanism, earthquakes, mass movements). The role of geological medium in the anthropogenic contamination and pollution (processes of environmental geochemistry, interactions between soil, rocks and contamination, geological conditions effecting on the spreading of contamination). Geological and geochemical concerns of the effects of mining on the environment. Geological background of the radioactive waste disposal. Geology in nature protection. Geological tasks in the environmental assessment.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- F. G. Bell: Geological Hazards: their assessment, avoidance and mitigation. E & FN Spon, London, 1999
- Horváth Zs.: A felszín alatti víz és a földtani közeg szennyezés elleni védelme. ELTE, L. W. Lundgren: Environmental Geology. Prentice-Hall Inernational, London, 1999.
- C. W. Montgomery: Environmental Geology. McGraw-Hill Companies, Boston, New York, San Francisco, 2005

Responsible Instructor (*name, position, scientific degree):*
Dr. Éva Hartai, associate professor

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Tailings management	**Credits: 2**
Lessons/week (lecture + seminar) 1 lecture + 1 seminars	
Methods of assessment during course: **Signature:** Participation in lessons and laboratory excercises. **Grade:** The assessment consists of a written report and presentation of the laboratory group work and a written exam **Grading limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*: Chemistry, Physics, Mathematics, Economic Geology and Mineralogy	
Course Description:	
Acquired store of learning: **Scope and objective of subject:** Understand the importance of mining waste management for the mineral extraction industry; Understand the concept of mine waste sampling and management in different phases of the mining cycle, with special emphasis to tailings. **Thematic description of subject:** Physical characterisation of tailings materials. Tailings transport and deposition technologies. Safety issues of tailings dams. Dilute-, dense- and paste slurry hydraulic transport systems. Case studies: Aznacollar, Verespatak, Kolontár.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
1. Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities. January 2009. (http://eippcb.jrc.ec.europa.eu/reference/mmr.html) 2. Mineral Processing Plant Design, Practice, and Control. Volume 1 and 2. Edited by: A. L. Mular, D. N. Halbe, D. J. Barratt Society for Mining, Metallurgy, and Exploration, Inc. (SME) 3. Solid – Liquid Flow, Slurry Pipeline Transportation. E. J. Wasp, J. P. Kenny, R. L. Gandhi, Trans Tech Publications, 1977.	
Responsible Instructor (*name, position, scientific degree):* **József Faitli, associate professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -	

Course Title: Mineral processing basics	**Credits: 2**
Lessons/week (lecture + seminar) 1 lecture + 1 seminars	
Methods of assessment during course: **Signature:** Participation in lessons and field trips. **Grade:** The assessment consists of an interim quiz, a written report and presentation of the laboratory group work and a written exam. **Grading limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*: -	
Course Description:	
Acquired store of learning: **Scope and objective of subject:** Gaining Basic Knowledge in processing methods, treatment and management of mineral ore reserve and waste materials. **Thematic description of subject:** Characterization of disperse systems. Physical parameters, their determination and mathematical distribution and their relevance. Mineral intergrowth and liberation, determination of degree of liberation. Yield, assay and recovery. Washability curves. Separation efficiency and partition curve (Tromp-curve). Balance equations. Typical equipments, their working principals and technological flow-sheets.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
The slides will be provided digitally, with complementary library literature search. Barry A. Wills, Tim Napier-Munn: Mineral Processing Technology. 2006 Elsevier Science & Technology Fuerstenau and Han (ed).: Principles of Mineral Processing, SME, 2003. Tarján, G. Mineral Processing, Volume I. Akadémiai Kiadó, Budapest, 1982.	
Responsible Instructor (*name, position, scientific degree):* **Imre Gombkötő, associate professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -	

Course Title: Computer Science for Engineers	**Credits: 2**
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **sem. 2**	
Type of Assessment (exam. / pr. mark. / other): **pr. mark** **During the semester the following tasks should be completed**: three computerized tests **Grading Limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*:	
Course Description:	
Acquired store of learning: **Study goals:** Extend the application of the computer as engineering training aids for numerical and symbolic computation. **Course content** Programming and using of MATLAB environment (desktop): opration with matrices, elements of linear algebra, plot of one, two or three dimensional functions, printing, control statements, handle graphics and user interface. Object-oriented programming. Design of programming. Computer aided solution plan for chosen problems. Numerical kernel: numerical methods, input-output. Using of files. User interface with karakters and graphics. Writing, testing an documentation for programs. Online and printed description of programs. Help and demo in programs. Printability for the results. Basic concepts, objects of Maple programming language: definition and using of assign, variable, set, array, function. The Maple as programming language: using of array, conditional and loop statement. Definition and application of procedure. Main algorithm in Maple. Graphics of Maple: plot and plot3d, animation statements. Using of files, applications.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
1. Stoyan G. (szerk.): *MATLAB,* Typotex, 2005. 2. The MATH WORKS Inc., Release 13 Product Family Documentation Set, 2002. 3. Attaway: MATLAB: A Practical Introduction to Programming and Problem Solving, Elsevier Science, 2013.	
Responsible Instructor (*name, position, scientific degree):* **Dr. Mészáros Józsefné dr., associate professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):	

Course Title: Eecology and nature conservation	**Credits: 3**

Lessons/week (lecture + seminar) 1 lecture + 2 seminars

Methods of assessment during course:
Signature: Participation in lessons and field trips.
Grade: nature protection description of a certain area (course) during the semester.
Assessments (tests, exam, documentation, etc.).

Grading limits: > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory. .

Position in Curriculum (which semester): **first**

Pre-requisites *(if any)*: Grade in Nature conservation subject

Course Description:

Acquired store of learning:

- **Scope and objective of subject:** To familiarize students with ecology, one of the bases of nature protection sciences. It is followed by laying the foundations and practicing field work introducing the living and non-living elements (objects) of nature, taking the ecological viewpoint into consideration; the work is completed by documenting its results. Emphasizing the necessity of practical activity for the students, and preparing them to use the basic nature protection approach in a creative way in their future professional activities.
- **Thematic description of subject:** Objects, factors and definition of ecology. Biotic and abiotic ecological factors. Elements of the ecosystem and its greater units. Characteristics and loadibility of ecosystems. Material cycles and food chain, energy flow. The circuit of biogeochemical cycles (C, nitrogene, water, phosphor, sulphur, biogenic elements). Anthropogenic effects and their roles. The relationship system of ecology and nature protection (nature conversation). Connection of nature protection (nature conversation) to environmental protection, complementing each other. Elements and tasks of nature protection. Emphasizin mind shaping, presentation and research activities among the practice-centred ecological-nature protection tasks. The organizations of the Hungarian and international nature protection. International nature protection values in Hungary. International law of nature protection, the system of Hungarian nature protection laws. Legal and economics connections of nature protection.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

David W. Goodall [Eds.**]:** ECOSYSTEMS OF THE WORLD 4B. Mires: swamp, bog, fen and moor; Regional studies. Elsevier Scientific Pubilshing Company, Amsterdam, 1983.
David W. Goodall [Eds.**]:** ECOSYSTEMS OF THE WORLD 23. Lakes and Reservoirs, Elsevier Scientific Pubilshing Company, Amsterdam, 1984.
J.P. Kimmins: FOREST ECOLOGY. Macmillan Publishing Company, New York, 1987.
Michael Begon, John L. Harper, Colin R. Townsend: ECOLOGY. Individuals, Populations and Communities. Second Edition. Blackwell Scientific Publications, 1990.
Scott Ferson and Mark Burgman (Eds.): Quantitative Methods for Conservation Biology. Springer, 2002, 322 p.
Malcolm Hunter and James Gibbs: Fundamentals of Conservation Biology - 3rd Edition. Blackwell Publishers, 2006, 497 p.
Navjot S. Sodhi and Paul R. Ehrlich (Eds.): Conservation Biology for All. Oxford University Press, 2010, 344 p.
Richard B Primack: Essentials of Conservation Biology - sixth edition. Sinauer Associates, 2014, 603 p.
Stephen B Glass, Evelyn A Howell and John A Harrington: Introduction to Restoration Ecology. Island Press, USA, 2011, 464 p.

Responsible Instructor (*name, position, scientific degree):*

László LÉNÁRT Dr., associate professor, PhD

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Soil Chemistry **(Regular MSc course)**	**Credits: 3**

Type (1ec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 lec+1 lab**

Type of Assessment (exam. / pr. mark. / other): **pr. mark**

During the semester the following tasks should be completed: take part the lecture min 60%, Fulfil the laboratory practice work. One missing is allowed. Answer the minimum questions properly min. 50 %, must be correct. Writing the the test from the subject of lecture. Mark: (final test mark 2x + lab practice mark 1x)/3

GradingLimits:

> 80%: excellent,
70-79%: good,
60-69%: medium,
50-59%: satisfactory,
< 50%: unsatisfactory.

Position in Curriculum (which semester): **first**

Pre-requisites *(if any)*: **AKKEM 6003 equivalent (General, inorganic and organic chemistry)**

Course Description:

Acquired store of learning:

Study goals: To highlight the colloidal, and chemical structure of the soil, the main equilibriums take place in the soil and which has govern the possible transformation of inorganic and organic substances are present or placed into the soil. The goal is to provide a skill to solve the environmental protection problems related to the soils.

Course content: Definition and classification of soils. Characterization of the solid, solution and gas phase of the soils. Sorption, dissolution, acid-base equilibriums in the soils. Red-ox reactions. Inorganic and organic substance transformation in the soil environment. Contamination of soils and remediation possibilities. Importance of soil protection.

Education method: Oral lectures with slides, five 2 h laboratory practice focused to investigate the structure and composition of the soils (Study the soil suspensions, humidity, organic content determination of soils, investigation of acid-base character and buffer capacity of soils, preparation and investigation of soil extracts.

Competencies to evolve:

- Recognize the hazardous and non hazardous actions for the soil. Ability to solve the environmental protection problems related to the soils.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- **D. L. Sparks:** Environmental Soil Chemistry, Acad. Press, London (2002). Elsevier BV, ISBN: 978-0-12-656446-4
- **B. Yaron, R. Calvet, R. Prost**: Soil pollution, Springer, (1996).
- **M.R. Ashaman and G. Puri:** Essential Soil science, Blackwell Publ,(2002.)
- **Kim H. Tan** : Principles of Soil Chemitry, CRC Press, (1998)
- **Hinrich L. Bohn, Rick A. Myer, George A. O'Connor:** Soil Chemistry, 2nd Edition, ISBN: 978-0-471-27497-1, E book, Wiley (2002).

Responsible Instructor (*name, position, scientific degree):*

Dr. Janos Lakatos, assoc. prof., Cand. Sci, PhD.

Other Faculty Member(s) Involved in Teaching: -

Course Title: Geothermal energy (elective)	**Credits: 4**
Lessons/week (lecture + seminar) 2 lecture + 1 seminars	
Methods of assessment during course: **Signature:** Participation in lessons and laboratory excercises. **Grade:** The assessment consists of a written report including an oral presentation and written exam **Grading limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*: **Mechanics, Physics, Thermodynamics, Deep Drilling**	
Course Description:	
Acquired store of learning: **Scope and objective of subject:** Gaining basic knowledge in geothermal energy resources and their economical application. Calculation and design of geothermal projects. Capability to consider requirements in near surface and deep geothermal production technologies; calculation and control production of heat and electricity. Understanding of environmental impacts in using geothermal energy **Thematic description of subject:** Global uses of geothermal energy; kinds of deposits; exploration- and exploitation – technologies; utilization of geothermal resources; conversion technologies e.g. direct heat use, heat and cold storage, electricity generation. Fundamentals and environmental aspects of ground source heat pump systems; heat exchangers. Environmental impacts. Specifics in geothermal deep drilling, directional drilling, casing and cementing. Economic consideration for geothermal drilling and production. The evaluation and presentation of a geothermal project is an integral part of the lecture.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
The PPP will be provided digitally and partly as hard copy	
Responsible Instructor (*name, position, scientific degree):* **Helmut Wolff, full professor, visiting professor, TU Berlin**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -	

Course Title: Geohydrology and Environmental risk assessment	**Credits: 5**

Lessons/week (lecture + seminar) 2 lecture + 2 seminars

Methods of assessment during course:
Signature: Participation in lessons and laboratory excercises.
Grade: Lectures and involvement of simple practical calculations, forum and workshop tasks, web search and literature interpretations. During the hydrodynamic and transport modeling task they shall have hands on practice with modeling software

Grading limits: > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.

Position in Curriculum (which semester): **first**

Pre-requisites *(if any)*: Geochemistry (Bio, lithogeochemistry), geology, hydrology

Course Description:

Acquired store of learning:
Scope and objective of subject:
Introduction to environmental risk assessment and its role in contaminated site remediation, as a part of it the course gives a strong emphasis on subsurface transport phenomena and their modelling to give a better understanding of how contaminants move in groundwater. Provides the basic knowledge of hydrodynamic and transport modeling and the practice of human health risk assessment. Keywords: basics of hydrogeology, groundwater flow systems, hydrodynamic and transport modeling, contaminant transport, site remediation, human health, adverse health effect, Risk, hazard terminology, risk assessment methodology, conceptual model construction, exposure assessment, exposure modeling, toxicology background, dose response relation, toxicological character of chemicals, carcinogen, threshold concept in toxicology, toxicological parameter for risk studies.
Understanding the basics of contamination transport processes and risk assessment . The students complete the course shall be able

1. to interpret human health risk assessment documentation
2. to complete simple risk assessment calculations
3. work together in a risk assessment team
4. understand the risk based remediation of contaminated land
5. understand risk based perform assessment
6. understand groundwater flow systems and subsurface transport processes

Thematic description of subject: 1, Hydrogeology part: Darcy-law, flow and seepage equations. Flow systems under the surface. Groundwater as a geologic agent. Determination of hydraulic conductivity. Transport processes in groundwater. Basics of well hydraulics. Flow and transport modeling. Numerical simulations.
Definition of terms (hazard, risk, exposure, risk assessment, conceptual site model, contaminated land, etc.)
2. Risk assessment in various contexts, eg. geohazards; human health, ecological risk assessment
3. The detailed study of risk assessment framework related to human health
3.1.Elements of the risk assessment protocol Problem formulation (Hazard identification) (elements, steps, conceptual site model, relationship to site investigation)
Exposure Assessment (elements and steps of Exposure Assessment, the role of measurements and modeling, calculation of dose)
Hydrodynamic and contaminant transport modeling and its role in the RA procedure
Toxicity Assessment (elements, and steps, doze-response relationships, threshold and non-threshold chemicals, toxicological data, RfD, TDI, SF, etc, default assumptions in toxicity assessment)
Risk Characterization (Risk estimation and interpretation of risk values, description of uncertainties, HQ, ER, NCR, etc)
3.2. Case studies and simple risk calculations
3.3 Risk based performance assessment (applications and case studies,)
3.4. Risk assessment in contaminated site remediation, (roles and limitations, risk assessment ancontaminant specific target values)

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

Handouts and CD based course material. The lecturer shall refer to web materials, such as articles, online databases and tools that the students will be able to access and use for themselves in the future.

Charles R. Fits: Groundwater Science. Academic Press, 2002. pp. 1-450.
Responsible Instructor (*name, position, scientific degree):* **Tamás Madarász, associate professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): Péter Szűcs, fullprofessor, DSc

Semester 2

Course Title: Applied physical chemistry (compulsory subject)	**Credits: 3**

Type and Number of Contact Hours per Week: **2 hours lectures & 1 hour seminar**

Type of Assessment: **exam mark**

During the semester the following tasks should be completed:

- two writing test during the semester (min. 50% performance is necessary for the signature)
  Conversion the obtained test ponints to mark:
  0 - 25 points – unsatisfactory, 26 - 32 pont – satisfactory, 33 – 37 points – medium, 38 - 45 points – good, 46 – 50 points – excellent
- Signature for approval, participation at least on 60% of lessons.

Grading Limit of the exam (oral or writing):

> 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory

Evaluation of students' performance:

50% written mid-term tests, 50% end-term oral exam performance.

Position in Curriculum (which semester): **second**

Pre-requisites *(if any)*: -

Course Description:

Acquired store of learning:

Study goals:

Acquiring the knowledge of main topics of physical chemistry, as thermodynamics, thermodynamic equilibrium, reaction kinetics, transport phenomena and electrochemistry, which are essential for the design of environmental engineering approach.

The exercise is intended to: practice the above mentioned topics through calculation examples.

Course content:

Basic concepts, characterization of the material systems. The basic laws of thermodynamics. Application the basic laws of thermodynamics regarding to gases, vapors, liquids, and solids systems. Equilibrium conditions of chemical reactions and phase transfer processes. Equilibrium of homogeneous and heterogeneous systems. Phase diagrams of two- and multi-component systems. Rate and mechanism of homogeneous and heterogeneous chemical reactions. The main factors influencing the reaction mechanism.

Transport phenomena: viscosity, diffusion, thermal conductivity and electrical conductivity. Transport phenomena in heterogeneous systems, surface and interfacial phenomena

Electrochemistry: electrolytes, thermodynamic properties of electrolyte systems, electrode processes, corrosion of electrolyte systems.

Education method:

Presentations using projector. Numeracy practices at blackboard (and chalk) using interactive method with the students.

Competencies to evolve:

- Base knowledge of physical chemistry, which is necessary for other disciplines.
- Intuition, systematism, learning skill.
- Communication skills.
- Demand for continual renewal of technical skills.
- Active professional English language skills.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- János Török, Lipót Fürcht, Tibor Bódi; PVT properties of reservoir fluids; University of Miskolc, 2012.
- Peter Atkins; Julio de Paula; Physical Chemistry; W. H. Freeman and Company;2006.
- Prof. Ing. Anatol Malijevsk´y, CSc., et al.; Physical Chemistry in Brief; Institute of Chemical Technology, Prague Faculty of Chemical Engineering; 2005.

• Howard Devoe; Thermodynamics and Chemistry; Pearson Education; 2012.
Responsible Instructor (*name, position, scientific degree):* **Judit Némethné Sóvágó, associate professor, PhD**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Sustainable development, environmental policy	**Credits: 2**
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **sem. 2**	
Type of Assessment (exam. / pr. mark. / other): **pr. mark** Test-paper on the last week **Grading Limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **second**	
Pre-requisites *(if any)*: **no**	
Course Description:	
To know the idea of sustainable development, the realization and the problems. To introduce the global conventions, the international and the national programs concern with sustainable development. Thematic: 1. The idea of sustainable development, the aspects of sustainable development, the reasons of unsustainability 2. Sustainable development policy of EU and UN 3. Economic sectors and the sustainable development 4. Society policy 5. Environmental policy and the sustainability 6. Energy and the sustainability 7. Sustainable production and consumption 8. Sustainable life 9. Environmentally sound technology in building 10. Environmental aspects around our house 11. Field course: Gömörszőllős, a sustainable village	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
• **Gyulai Iván** (2012): A fenntartható fejlődés. Kiadja: az Ökológiai Intézet A Fenntartható Fejlődésért Alapítvány. Miskolc. • **Ökológiai Intézet A Fenntartható Fejlődésért Alapítvány** (2011): Környezettudatosság a házunk táján. Miskolc. • **Ökológiai Intézet A Fenntartható Fejlődésért Alapítvány** (2011): Környezetbarát technológiák az építkezésben és praktikus megoldások a ház körül. Miskolc • **Report of the World Commission on Environment and Development, Our Common Future** (1987). United Nations. • **Jason Potts, Jessica van der Meer, Jaclyn Daitchman** (2010): The State of Sustainability Initiatives Review 2010. Sustainability and transparency. London	
Responsible Instructor (*name, position, scientific degree):* **Enikő Szegediné Darabos**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -	

Course title: Waste management I.: Recycling technologies	**Credits: 5**
Type: 2 lectures+2 practices, overall 4	
Type of assessment (exam. / pr. m.. / other): exam	
Position in the Curriculum (hányadik félév): 2. semester	
Pre-requisites *(if any)*: Applied Physics, Process Engineering, Applied Biology for Engineer s	
Course description:	
Types of waste, quantitative and qualitative characterization of the waste for recycling. Wastes as raw material and energy sources. Processes and equipments of dismantling, comminution, mechanical sorting and agglomeration of the waste. Designing of the processes and the recycling technology of waste shredder plants. Secondary raw material and fuel production from solid wastes, based on the differences in the physical and biological properties of the municipal solid waste components and constructional materials. Designing of the preparation technologies of solid wastes by the minimization of the residue. Estimation of the investment and operating costs.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
Recommended literature. 1) CSŐKE B-NAGY S: Waste management-I (lecture materials in English, PDF) 2) Waste management II. (Ed..: Kurdi R.). ISBN 978-615-5044-44, http://mkweb.uni-pannon.hu/tudastar 3) NIJKERK, A.A., DALMIJN, W.L. : Handbook of Recycling Techniques. The Hague, February 2001, 5th Revised edition (pp.1-254) 4) G. Thobagonolus, H Theisen, S Vigil; Integrated solid waste management: Engineering principles and management issues, McGraw-Hill, Inc (1993) ISBN: 0-07-063237-5 5) Tarján, G.: Mineral Processing. Akadémiai Kiadó (Printed in Hungary: ISBN 953 05 2243 8), Budapest 1981. Vol.1 (pp.1-573) and Vol.2 (pp.1-727)	
Responsible instructor: Prof.Dr.habil. Barnabás Csőke, CSc, PhD (ME)	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): **Dr. Bokányi Ljudmilla, associate professor, Csc, PhD (ME)**	

Course Title: Engineering and mining geophysics	**Credits: 3**
Lessons/week (lecture + seminar) 2 lecture + 1 seminars	
Methods of assessment during course: **Signature:** Participation in lessons and laboratory excercises. **Grade:** Report on the results of field work, written exam. **Grading limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*: Mathematics, Physics, Geology	
Course Description:	
Acquired store of learning: **Scope and objective of subject:** Fundamental understanding of applied geophysical methods. Introduction to selected chapters in applied environmental and underground in-mine geophysics. Gain experience in geophysical data acquisition, processing and interpretation. **Thematic description of subject:** The course consists of the theory and practice of engineering and mining geophysical methods and geophysical data processing techniques. The material is subdivided into the following parts: 1. The classification of applied geophysical methods. General overview on the most important engineering, environmental, borehole and in-mine geophysical surveying methods. The basics and applications of gravity, magnetic, direct current geoelectric, electromagnetic and induced polarization, seismic, guided wave, borehole (well- logging (lithology, porosity, saturation logs) methods. Special in-mine seam-wave- and seam-sounding methods. 2. Planning of geophysical surveys, geophysical data acquisition and processing, linear and global inversion methods. 3. Geological-, geotechnical-, environmental- and in-mine interpretation. 4. Field measurements, processing and interpretation of the collected geophysical data by commercial and special softwares developed by the Geophysical Department.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
Kearey P., Brooks M. and Hill I., 2002: An Introduction to Geophysical Exploration. 3rd edition. Blackwell Science Ltd. Telford W. M., Geldart L. P. and Sheriff R. E., 1990: Applied Geophysics. 2nd Edition. Cambridge University Press. Blakely R. J., 1996: Potential theory in gravity and magnetic applications. Cambridge University Press. Ellis D. V. and Singer J. M., 2007: Well Logging for Earth Scientists. 2nd Edition. Springer. Serra O., 1984: Fundamentals of well-log interpretation. Elsevier. Menke W., 1984: Discrete Inverse Theory, Academic Press. Scientific papers. Handouts.	
Responsible Instructor (*name, position, scientific degree):* **Norbert Péter Szabó, associate professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -	

Course Title: Water chemistry	**Credits: 2**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **1 + 1**

Type of Assessment (exam. / pr. mark. / other): **practical mark**
Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
75 – 89%	4 (good)
63 – 74%	3 (satisfactory)
50 – 62%	2 (pass)
0 – 50%	1 (failed)

Position in Curriculum (which semester): **2nd**

Pre-requisites *(if any)*: **-**

Course Description:

The students will be familiar with the structure and chemical properties and reactivity of water molecule, and will learn about the main principle of the equilibriums exist in aquatic system.

1 lecture (2 hours): The subject of water chemistry. Material Structural Funds. The atomic structure. Properties of the nucleus. Registration number, mass number. Isotopes. The electron properties. Electronegativity. The chemical bonds. Molecules.
2 lecture (2 hours): The structure of water, its unique properties. The physical properties of water.States of water, and changes in the laws of the physical state.
3 lecture (2 hours): Chemical properties of the water. Water-soluble substances. Properties of real solutions. Chemical processes. The law of mass action. The water dissociation. The pH concept and significance. Oxidation and reduction. Acids, alkalis, salts. Acid-base theories. Buffers, buffer capacity, buffer systems.
4 lecture (2 hours): Gases, liquids and solids dissolution in water and its laws of.
5 lecture (2 hours): Features of water and natural water. Natural processes. The aquatic ecosystem material and energy flows. The water cycle in nature. The water balance components of the metabolic order. Human impacts on the water balance components.
6 practice (2 hours): Laboratory Practice
7 practice (2 hours): Laboratory Practice
8 practice (2 hours): Laboratory Practice
9 practice (2 hours): Laboratory Practice
10 practice (2 hours): Laboratory Practice
11 practice (2 hours): Laboratory Practice
12 practice (2 hours): potential replacement lab
13 2 hours: Write a classroom test
14 2 hours: Replacement of classroom test

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Orbán Vera: Vízkémia, PMMF, Baja, 1980.
- Orbán Vera: Vízkémiai parktikum, Egyetemi jegyzet, Tankönyvkiadó, 1976.
- Papp Sándor, Rolf Kümmel: Környezeti Kémia, Tankönyvkiadó, Budapest, 1992.
- Kirnerné Kiss Andrea: A víz kémiája, Kémia Műszakiaknak, 3. 1 fejezet. Szerk. Berecz E.

- Tankönyvkiadó, Budapest, 1991.
- Stanley E. Manahan: Environmental Chemistry, 7.th ed. Lewis Publishers, 2000.

Responsible Instructor (*name, position, scientific degree):*
Dr. Zákányiné Dr. Mészáros Renáta, lecturer

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Water quality protection	**Credits: 3**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **1 + 1**

Type of Assessment (exam. / pr. mark. / other): **examination**
Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
75 – 89%	4 (good)
63 – 74%	3 (satisfactory)
50 – 62%	2 (pass)
0 – 50%	1 (failed)

Position in Curriculum (which semester): **2nd**

Pre-requisites *(if any)*:

Course Description:

The students will be familiar with the basic concepts, tasks and purposes of water quality protection. The students will also learn about the contamination transport processes in surface water as well as in groundwater. The students will be prepared to assess and solve different water quality and contamination problems. The students will learn about the different tasks given by the European Water Framework in order to achieve the good status of water resources.

Water as an environmental agent. General tasks and objectives of water quality protection. Water chemistry. Qualification of water samples. Transport processes in water. Vulnerability methods concerning groundwater resources. Remediation methods in case of different contaminations. Water quality models. Current quality status of national water resources. Water quality balance calculations. Natural water purification methods.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Dr. Szűcs Péter és Sallai Ferenc (szerkesztők): Vízkészleteink természetes állapotának megőrzése. Jegyzet kézirat. 2006.
- Dr. Pásztó Péter: Vízminőség-védelem, vízminőség-szabályozás. Veszprémi Egyetemi Kiadó, 1998.
- Dr. Juhász József: Természet- és vízvédelem. Miskolci Egyetemi Kiadó, 1994.
- Jolánkai G. (1997): Basic River Water Quality Models; Computer aided learning (CAL) programme on water quality modelling (WQMCAL version 1.1), UNESCO/IHP-V, Technical Documents in Hydrology, No. 13, UNESCO Paris p. 52 + software.
- Jolánkai G. (1999): A vízminőség-védelem alapjai különös tekintettel a rendszerszemléletű ökohidrológiai módszerekre. Közreműködött: Bíró István. Egyetemi jegyzet. ELTE -TTK. pp. 1-139

Responsible Instructor (*name, position, scientific degree):*

Dr. Péter Szűcs, associate professor, subject leader and lecturer

Ferenc Sallai, invited lecturer

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Groundwater flow and contaminant transport modeling	**Credits: 5**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 + 2**

Type of Assessment (exam. / pr. mark. / other): **examination**
Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
75 – 89%	4 (good)
63 – 74%	3 (satisfactory)
50 – 62%	2 (pass)
0 – 50%	1 (failed)

Position in Curriculum (which semester): **2nd**

Pre-requisites *(if any)*:

Course Description:

The students will be familiar with the theoretical and practical aspects of the numerical methods widely used in the modern hydrogeology. The students will be able to use a worldwide known numerical environment. Using this environment the students will possess an ability to solve simple problems in the field of hydrodynamics and contaminant transport, and will learn that basic knowledge based on which getting more experiences they will be later able to solve also more complex simulation problems.

Tasks and aims of GW flow and contaminant transport modeling. Theory of GW flow modeling: the flow equation and its numerical solutions. The phenomena of contaminant transport in porous medium, the different forms of the transport equation. Analytic and numerical solutions. Particle tracking algorithms. Data-system of GW flow and contaminant transport models. The reliability of data, the aspects of data evaluation and control, type of dataset errors. Calibration of models. GW flow and contaminant transport modeling using the Processing MODFLOW environment. Solution of demo problems and investigation of case studies. Practical work: self-made models of simple real problems.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Chiang, W-H. – Kinzelbach, W.(2001): 3D-Groundwater Modeling with PMWIN, A Simulation System for Modeling Groundwater Flow and Pollution, Springer-Verlag Berlin, Heidelberg, New York, ISBN 3-540-67744-5, SPIN 10774334
- Kinzelbach, W. (1986): Groundwater Modelling (An Introduction with Sample Programs in BASIC), Elsevier, p.331.
- Kovács B.**:** Hidrodinamikai és transzportmodellezés Processing MODFLOW környezetben I., 2004, Miskolci Egyetem – Szegedi Tudományegyetem – GÁMA-GEO, p. 160., ISBN 963 661 637 X
- Kovács – Szanyi: Hidrodinamikai és transzportmodellezés II., 2005, Miskolci Egyetem – Szegedi Tudományegyetem – GÁMA-GEO, p. 213., ISBN 963 661 638 8
- Neven Kresic (1997): Quantitative Solutions in Hydrogeology and Groundwater Modeling. Lewis Publishers

Responsible Instructor (*name, position, scientific degree):* **Dr. Balázs Kovács, associate professor**

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Geotechnical Engineering	**Credits: 4**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 + 1**

Type of Assessment (exam. / pr. mark. / other): **examination**
Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
75 – 89%	4 (good)
63 – 74%	3 (satisfactory)
50 – 62%	2 (pass)
0 – 50%	1 (failed)

Position in Curriculum (which semester): **2nd**

Pre-requisites *(if any)*:

Course Description:

The students will be familiar with the basic concepts of geotechnical engineering, with the principles of designing and with the construction methods of different buildings and objects.

Review of foundation studies. Legal and authorization background. EUROCODE 7. Concrete as building material. Engineering design, stresses and loads. Design of concrete and reinforced concrete structures. Design of retaining walls. Jet-grouting. Building of slurry wall. Digging/excavations. Building of water-supply and channeling networks. Underground structures. Utility ducts. Hydraulic engineering structures: river walls, dams, controlling objects.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Szabó Imre: Alapozás egyetemi jegyzet, Tankönyvkiadó, 1988
- Ulrich Smoltczyk: Grundbau Taschenbuch, Ernst and Sohn Verlag, 1980
- Bálint Julianna: Építőanyagok I.
- Geotechnikai tervezés elvei és gyakorlata az EUROCODE 7 alkalmazásával
- Dr. Bárczi István – Falu Gyula – Dr. Zalka Károly: Mechanika II. Szilárdságtan
- Antal Ákos, Fazakas Zsolt, Szilvási Ferencné, Szűcs Sándor és Tápai Antal: Tartószerkezetek I. Vasbeton szerkezetek.
- Dr. Bartos Sándor – Králik Béla: Mélyépítés II. I. kötet Földművek
- Dulovics Dné, Králik B., Szabó T.(2004) : Közmű- és mélyépítés II.

Responsible Instructor (*name, position, scientific degree):*
Dr. Imre Szabó, professor

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Contaminated site remediation	**Credits: 3**
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: lecture+sem, 2+1	
Type of Assessment (exam. / pr. mark. / other): **exam (oral or written)** **Grading Limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **second**	
Pre-requisites *(if any)*:	
Course Description:	
The main objectives of the subject: The course aims to enable registered students to identify soil and groundwater contamination issues, to train them in contaminated site investigation, remediation design and implementation. The students shall be able to understand the main elements of contaminated land management tools e.g. problem formulation, risk based target value setting and risk assesment, site investigation, hydrodynamic and contaminant transport modeling, remediation action, and monitoring. **The short curriculum of the subject:** • Setting the stage, context of contaminated site remediation • Historical overview of site remediation • The process of site remediation • Site Investigation on contaminated land • type and behaviour of contaminants in the subsurface environment • behaviour of contaminants in groundwater • chemistry of site investigation • Threshold value systems and their role in remediation • Quantitative risk assessment and site specific, risk based remediation • Remediation methods and aspects of their selection • Remediation without excavation • Remediation with soil excavation • Hydrauliy protective measures • Isolation from the environment • Monitoring activities • Legal framework • Risk Assessment and its role in remediation • Case studies	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
CLARINET and NICOLE (2001): The Sustainable Management and Remediation of Contaminated Land, Special Edition of Land Contamination and Reclamation, Editors: Bardos, P. and Lewis, A., Richmond, UK David L. Russell - Remediation Manual for Contaminated Sites Hardcover 2nd edition, 2011 Alok Bhandari, Contaminants of Emerging Environmental Concern, ASCE Publications, 2009 Suthan S. Suthersan, Remediation Engineering: Design Concepts CRC Press, 1996.	
Responsible Instructor (*name, position, scientific degree):* **Tamás Madarász, associate professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):	

Semester 3

Course Title: Impact assessment, review (PEIA, EIA, ER) **Code: MFKHT720018**	**Credits: 2**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week**: 0 + 2**

Type of Assessment (exam. / pr. mark. / other): **practical mark**
lab Classroom exam at the end of the semester in the lecture materials.
Grading scale:

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Position in Curriculum (which semester): **2nd**

Pre-requisites *(if any)*:

Course Description:

To introduce the procedures of environmental impact assessment and the applicable methods for the students.
Thematic description of the subject
The history of environmental impact assessments. The legal regulation of environmental impact assessment procedures. Environmental assessment, environmental impact assessment, environmental Unified licensing. Stages of the environmental assessment procedures, the process of official proceedings. The preliminary environmental study substantive issues. Content requirements of a detailed environmental impact study. Factors, receptors, impact processes, propagation effects. The impact areas demarcation, control area.
The most important aspects and basic methods of environmental conditions on board. Used in the impact assessment methods and procedures. Evaluation of the impact. Monitoring.
The publication of the impact assessment, negotiation, public hearing. Analysis of practical examples.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- **Actual laws and regulations**
- **Directives: 85/337/EGK, 97/11EK, 2003/35EK**
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991) - the 'Transboundary EIA Convention' (Source: **http://www.unece.org/env/eia/eia.htm)**
- **Marcus, Jerrold J**. (editor): Mining Environmental Handbook. Effects of Mining on the Environment and American Environmetal Controls on Mining. Imperial College Press, 1997.
- **Liu, David H. F.** (Second Editon Editor) - Lipták, Béla G. (Hanbook Editor): Environmental Engineers' Handbook. Second Edition. Lewis Publishers. Boca Raton, New York, 1977.

Responsible Instructor (*name, position, scientific degree):*
Balázs Zákányi, PhD

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Waste incineration, air quality control MAKETT3MFK	**Credits: 4**

Type (lec. /lab. / consult.) and Number of Contact Hours per Week: Lectures, laboratory, **3 hours**

Type of Assessment (exam. / pr. mark. / other): **exam.**
Grading Limits: > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.

Position in Curriculum (which semester): **third;** Pre-requisites *(if any)*: -

Course Description:

1.) Flow diagram of waste processing; basic regulations for thermal treatment and disposal.
2.) Combustion parameters of wastes: physical state (solid, liquid, gaseous), particle composition, density, moisture and ash content; chemical composition (C, H. N, S, Cl), calorific value.
3.) Calculation of combustion parameters: the chemical reactions of combustion, minimum oxigen and air requirement of fules, optimal air excess necessary for complete combustion.
4.) Gaseous wastes, normal burning velocity of fuels, flame velocity, flammability and explosion limits, operating conditions for safe combustion; methods for flame stabilization.
5.) Flame and flue gas characteristics: specific volume, chemical composition, specific heat capacity; combustion temperature (theoretical and actual), dissociation and adiabatic flame temperature (definition, calculation methods); methods for increasing/reducing combustion temperature.
6.) Technical parameters of waste incineration, auto-ignition range; grid types and grid structures, combustion chamber geometry, the construction of refractory walls (design and structure).
7.) Hazardous waste disposal (by incineration), required minimum incineration temperature, the thermal treatment of halogenated waste, present-day waste incinerators, determination of post-combustion chamber ('afterburners').
8.) Characterization of solid combustion residues: physical-chemical properties, mineral composition, thermal behaviour, sintering and ash fusion characteristics, melting temperature. Treatment and disposal of slags and fly ash.
9.) Burners: classification, geometry, sizing, fuel injection by spray nozzles (oil burners).
10.) Air pollution control: regulatory measures and provisions for waste incineration; possible allowed emission and immission concentrations (EU target values).
11.) Gaseous pollutants: CO, radicals, sulphur oxides, NOx formation (conditions, intensity), primary reduction methods, determination of gas emission concentrations.
12.) Characterization of gaseous pollutants; options for secondary emission reduction; flue gas cleaning methods and equipment.
13.) Definition of dust (for environmental regulations), properties of particulate matter (PM), separation and collection mechanisms, design and operation of dust collection systems (separators).

The most important literatures:

- C. Baukal Jr.: Industrial Combustion Pollution and Control, Oklahoma, 2004, ISBN 0-8247-4694-5
- M. Döing: Waste to Energy, Cologne, http://www.ecoprog.com, 2014 Godfrey Boyle: Renewle Energy, Oxford, 2004, ISBN 0-19-926178-4

Responsible Instructor (*name, position, scientific degree):* István SZŰCS Dr., professor,

Course Title: Environmental biology and toxicology (Regular MSc course)	**Credits: 3**

Type (1ec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 lec+1 lab**

Type of Assessment (**exam**. / pr. mark. / other): **exam**
During the semester the following tasks should be completed: A gyakorlat aláírásáért: laborlátogatási jegyzőkönyvek, terepgyakorlati jegyzőkönyv

GradingLimits:
> 80%: excellent,
70-79%: good,
60-69%: medium,
50-59%: satisfactory,
< 50%: unsatisfactory.

Position in Curriculum (which semester): **third**

Pre-requisites *(if any)*: **-**

Course Description:

Acquired store of learning:
Study goals: Overview of the principal phenomena and ecological problems if the biosphere. To understand the specific position of human beings, with special regard to life style and environmental changes and to responses for different challenges. Introduction to ecological effect of well-known and new polluting agents and their influence on the environment.
Course content: Composition and evolution of the biosphere; Global climate change; Environmentally influenced diseases, the immune system of the human body; Environment and health, mental health; Sustainability of the human life, energy resources, ecological footprint; Protection of soil and water resources; Protection of the rural environment; International efforts for protection of life on the Earth; Definition of ecotoxicology; Natural and artificial ecosystems; Main effects of rural ecosystems; Biogeochemical cycles and their changing character; The carbon cycle and its alteration; The oxygen cycle and its alteration Cycles and changes of Nitrogen, Hydrogen (water), Phosphorous; Sulphur and other elements; Basic pronciples of toxicology and ecotoxicology; Industrial materials, Chemicals in agriculture; Classification of pesticides; Accessibility of pesticides; Biotechnology and gene technology; Ecotoxical risks; Ecotoxical monitoring

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

Vida Gábor (2008): Helyünk a bioszférában. Typotex kiadó http://mek.oszk.hu/05000/05033/
Kerényi Attila (1995): Általános környezetvédelem Szeged : Mozaik Oktatási Stúdió, 383. pp.
Kárász Imre (1996): Környezetbiológia (Szünbiológiai alapismeretek) Nemzeti Tankönyvkiadó, 446. pp.
Darvas Béla (szerk.) – Székács András (szerk.) (2010): Mezőgazdasági ökotoxikológia. L'Harmattan Kft., 382. pp.
Newman, M.C. – Jagoe, C.H. (1996): Ecotoxicology: A Hierarchical Treatment. CRC Press
Connell, D. et al (1999): Introduction to Ecotoxicology. Blackwell Science

Responsible Instructor (*name, position, scientific degree):*

Sára Felszeghy Dr., associate professor, PhD

Other Faculty Member(s) Involved in Teaching: -

Course Title: Environmental Economics	**Credits: 2**
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week:**lec. 2+0**	
Type of Assessment (exam. / pr. mark. / other): **exam. mark** **Grading Limits:** > 90%: excellent,80-89%: good, 70-79%: medium, 60-69%: satisfactory, < 60%: unsatisfactory.	
Position in Curriculum (which semester): third	
Pre-requisites *(if any)*: --	
Course Description:	
Acquired store of learning: Study goals: To show the development of environmental thinking and the reason of foundation of environmental economics as new scientific field of the economics science. To analyze the current status of space science. To highlight the relationship between environment and economy at macro and micro-economic context, the applied tools and methods. Course content: The development of environmental thinking**;** Relation between the environment and economy in the macro-economic and micro economic context; The Sustainable development ; Environmental Policy - Environmental Action Programme –and the Cardiff process; Externalities, environmental damage and environmental risk ; environmental assessment ; Cost-benefit analysis ; The role of market-based environmental policy instruments, taxes; The regulation of environmental policy and the operation of the company; Energy and climate policy ; Water Quality Protection; Efforts to reduce waste and problems- and economic impacts. Education method: Lectures (some lessons with additional short YouTube film) During the semester have to write an classroom test. It takes max. 40 % of the final mark. **Competencies to evolve:** • Knowledge to be able to increase the environmental responsibility, the environmental thinking • to understand the economic impact of environmental change	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
European Commission, DG Environment (2000): A Study on the Economic Valuation of Environmental Externalities from Landfill Disposal and Incineration of Waste Final Main Report http://ec.europa.eu/environment/waste/studies/.../econ_eva_landfill_report.pdf Lionel Nesta, Francesco Vona, Francesco Nicolli (2014): Environmental policies, competition and innovation in renewable energyJournal of Environmental Economics and Management Volume 67, Issue 3, May 2014, Pages 396–411. http://www.sciencedirect.com/science/article/pii/S0095069614000060 **Jonathan Harris & Brian Roach** (2014): Greening the Economy Ch.17 in: **Environmental and Natural Resource Economics:A Contemporary Approach** Global Development And Environment Institute Tufts University, Medford , MA 02155 USAhttp://ase.tufts.edu/gdae/Pubs/te/ENRE/3/Ch17_Greening_Economy.pdf	
Responsible Instructor (*name, position, scientific degree):***dr. Klára Tóthné Szita, professor, CSc**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):	

Course Title: Numerical Methods and Optimization	**Credits: 2**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **lec.+sem. 1+1**

Type of Assessment (exam. / pr. mark. / other): **pr. mark**

During the semester the following tasks should be completed: one test and a computerized homework

Grading Limits:

> 80%: excellent,
70-79%: good,
60-69%: medium,
50-59%: satisfactory,
< 50%: unsatisfactory.

Position in Curriculum (which semester): **third**

Pre-requisites *(if any)*:

Course Description:

Acquired store of learning:

Study goals: Upon completing the course, students shall understand the relation between engineering and mathematics; comprehend important concept of solution methods using both analytical and numerical techniques when the problems can be formulated using differential
equations, system of linear equations and system of nonlinear equations. In addition, students shall be able to apply the optimization techniques to various engineering problems.

Course content

Extrema of functions. Unconstrained and constrained optimization. Convex optimization, Minimization of functions with one variable (golden section, parabola method). Minimization of multivariable functions (Nelder-Mead, Newton, modified Newton, quasi-Newton, minimization with line search). Methods of penalty functions. Multiaided and multicriteria decision problems (Pareto effitient solutions). Linear programming. About Soft Computing (SC) methods: fuzzy systems, genetic algorithms, neural network.
Numerical solutions of ordinary diffrential equations and system of equations:
Runge-Kutta, predictor-corrector, finite differences.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

1. Égertné, M. É., Kálovics, F., Mészáros, G.: Numerical analysis I.-II. *(Egyetemi jegyzet)*, Miskolci Egyetemi Kiadó (1992), 1-175.
2. R. Fletcher: *Practical Methods of Optimization,* John Wiley &Sons, 2000.
3. P. E. Gill, W. Murray, M. H. Wright: *Practical Optimization***,** Academic Press, 1981.
4. J. Nocedal, S. J. Wright: *Numerical Optimization*, Springer, 2000.

Responsible Instructor (*name, position, scientific degree):*

Dr. Mészáros Józsefné dr., associate professor, PhD

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: WASTE MANAGEMENT II.	**Credits: 4**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **Lec 2 + Sem. 2.**

Type of Assessment (exam. / pr. mark. / other): Combination of coursework, exams

Position in Curriculum (which semester): 3rd

Pre-requisites *(if any)*: Waste management I.

Course Description:

Acquired store of learning:

Study goals: Teaching up-to-date techniques and recent results of landfilling - as one possible method of waste disposal - in the field of construction, operation, closure and recultivation, and the interaction of contaminants and the environment

Course content: Aspects of site selection of landfills, compatibility problems between contaminants and subsoil. Contaminant retention capacity of soils. Geotechnical aspects of landfilling. Priority list of selected sites. Design of landfills: construction of the base liner system and the leachate collection system. Aftercare of landfills. Up-to-date, high security landfills, maintenance-free landfills. Final closure and recultivation of landfills. Water balance control of landfills. In situ stabilization (aeration, methane-oxidation, water balance control) of landfills. Facilities of landfills, the monitoring system.

Education method: the small group size permits an extensive dialogue between students and teacher.

Competencies to evolve:

- Research skills
- Critical thinking skills
- Communication skills.
- Demand for continual renewal of technical skills.
- Active professional english language skills.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- *BAGCHI, A. (1989):* Design, construction and monitoring of sanitary landfill John Wiley and Sons, p. 285.
- *CHRISTENSEN, TH.H.-COSSU, R.-STEGMANN, R.*. (1989):Sanitary Landfilling: Process, Technology and Environmental Impact, Academic Press
- *OWEIS, I.S. - KHERA, R.P. (1990):* Geotechnology of Waste Management, Butterworths, p. 273.
- *ROWE, K.R.*: Geotechnical and Geoenvironmental Engineering Handbook Kluwer Academic Publishers, 2000.
- *SARSBY, R.:* Environmental Geotechnics, Thomas Telford, 2000.
- *SZABÓ I.-SZABÓ A.:* Hulladéklerakók rekultivációja és utógondozása. Miskolci Egyetem, 2012, ISBN 978-963-661-627-4, p. 342

Responsible Instructor (*name, position, scientific degree):*

Dr. Balázs Kovács, associate professor, PhD

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):

Course Title: Environmental Geotechnics	**Credits: 2**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **1+1**

Type of Assessment (exam. / pr. mark. / other): **examination**
Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
75 – 89%	4 (good)
63 – 74%	3 (satisfactory)
50 – 62%	2 (pass)
0 – 50%	1 (failed)

Position in Curriculum (which semester): **3rd**

Pre-requisites *(if any)*: -

Course Description:

The students will be familiar with the basic concepts of environmental geotechnics.

Physiochemistry of soils for geoenvironmental engineering. Changing of soil parameters caused by contaminants. Determination of contaminant retention capacity of soils. Barrier systems, geological and geosynthetic barrier systems, horizontal and vertical barriers.
Geotechnical aspects of landfilling. Stability and deformation of waste dumps, liner systems. Geotechnical tasks of recultivation. Investigation of contaminated sites. Geotechnical problems of remediation. Waste as constructions material. Soil improvement.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Kézdi Á.: *Talajmechanika I-II.,* Műszaki Knyvkiadó, 1969.
- Szabó I.: *Hulladékelhelyzés,* Egyetemi tankönyv, Miskolci Egyetemi Kiadó, 1999.
- Filep Gy.–Kovács B.–Lakatos I.–Madarász T.–Szabó I. (szerk. Szabó): *Szennyezett területek kármentesítése,* Miskolci Egyetemi Kiadó, 2002.
- Sarsby, R.: *Environmental Geotechnics* Thomas Telford, 2000.
- Davis, M.L.- Cornwell, D.A.: *Introduction to Environmental Engineering*, WCB McGraw-Hill, Boston, 1998.
- Bell, F.B.: *Environmental Geology*, Blackwell Science Ltd, Oxford, 1998.
- Rowe, K.R.: *Geotechnical and Geoenvironmental Engineering Handbook*, Kluwer Academic Publishers, 2000.

Responsible Instructor (*name, position, scientific degree):*
Dr. Imre Szabó, professor

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Hydrogeology	**Credits: 5**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2 + 2**

Type of Assessment (exam. / pr. mark. / other): **examination**
Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
75 – 89%	4 (good)
63 – 74%	3 (satisfactory)
50 – 62%	2 (pass)
0 – 50%	1 (failed)

Position in Curriculum (which semester): **1st**

Pre-requisites *(if any)*: -

Course Description:

The students will be familiar with the basic concepts of modern hydrogeology as well as field hydrogeology. The students will learn about the relationships of rocks and groundwater, and about the phenomena of groundwater flow through the pores and fractures. The students will be able to handle and solve basic problems in hydrogeology and contamination transport. The main relationships of well hydraulics concerning steady-state and transient problems are also discussed. The students will be able to calculate the discharge value, the depression curve and the velocity distribution of an operating well or a group of wells. The students will be able to carry out field pumping tests, and they will be able to interpret the obtained results effectively.

The main properties and quality aspects of groundwater. Classification of groundwater resources. Storage and hydraulic properties. Darcy-law, flow and seepage equations. Temperature properties under the surface. Shallow and deep groundwater. Karst water, river bank filtered water resources. Relationship between groundwater and surface water. Springs. Flow systems under the surface. Groundwater as a geologic agent. Determination of hydraulic conductivity. Transport processes in groundwater. Basics of well hydraulics. Calculation of well discharge, determination of depression curve and velocity distribution around wells. Group of wells. Pumping tests and their interpretation. Complex interpretation of groundwater data.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

- Dr. Juhász József: Hidrogeológia. Akadémiai Kiadó, Budapest, 2002.
- David Daming: Introduction to Hydrogeology, McGraw-Hill Higher Education, 2002.
- P. F. Hudak: Principles of Hyrogeology. Lewis Publishers, 1999.
- S. E. Ingebritsen, W. E. Sanford: Groundwater in Geologic Processes. Cabridge University Press, 1998.
- Kruseman G.P. and Ridder N.A: Analysis and Evaluation of Pumping Test Data, ILRI publication, Wageningen, Netherlamds, 1990, pp. 1-377.
- Waterloo Hydrogeologic: AquiferTest Pro, User's Manual, 2005, pp- 1-270.
- Neven Kresic: Quantitative Solutions in Hydrogeology and Groundwater Modeling. Lewis Publishers, 1997.

Responsible Instructor (*name, position, scientific degree):* **Dr. Péter Szűcs, associate professor**
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Data Aquisition in geology and Exploration Methodologies, Resource modeling and definition	**Credits: 3**
Lessons/week (lecture + seminar) 1 lecture + 2 seminars	
Methods of assessment during course: **Signature:** Participation in lessons and field trips. **Grade:** The assessment consists of an interim quiz, a written report and presentation of the laboratory group work and a written exam. **Grading limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*: Grade in Nature conservation subject	
Course Description:	
Acquired store of learning: **Scope and objective of subject:** Gaining Basic Knowledge in Exploration geology; Resource assessment methods, treatment and management of mineral ore reserve in the economic analysis, mine design and production. Students will be capable to run basic assessment of mineral resources, decide and evaluate measures focusing grade control. Introduction in planning and carrying out a data acquisition (exploration) campaign, field and laboratory work respectively. **Thematic description of subject:** Field work: equipment and its usage. Basic documentation, maps and cross sections. Working strategies and rules in variable environments. Recording and data interpretation techniques. Extending the outcrops: data provided by remote sensing, drilling and geophysics. Sampling and assaying. Basic concepts of quantitative characterization of mineral reserves. Geometrical and numerical modeling of mineral reserves. Computational methods. Principal operations in numerical mineral resource modeling. Stochastic characterization of reserves. Visualization and docementation of modeling results. Valuation of reserves for mining purposes.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
The slides will be provided digitally, with complementary library literature search. Coe A. L: Geological Field Techniques. Wiley-Blackwell, 2010, 323 p. Sinclair A.J., Blackwell G.H.: Applied mineral inventory. Cambridge University Press, 2004, 401 p. Marjoribanks R.: Geological methods in mineral exploration and mining. Springer, 2010, 248 p. Edwards A.C. (ed.): Mineral Resource and Ore Reserve Estimation — The AusIMM Guide to Good Practice. The Australasian Institute of Mining and Metallurgy 2001, 639 p.	
Responsible Instructor (*name, position, scientific degree):* **Norbert Németh, associate professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): **József Molnár, associate professor, PhD**	

Course Title: Underground waste management and storage	**Credits: 4**
Lessons/week (lecture + seminar) 2 lecture + 1 seminars	
Methods of assessment during course: **Signature:** Participation in lessons and laboratory excercises. **Grade:** The assessment consists of a written report and written exam **Grading limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*: **Mechanics, Physics, Thermodynamics, Mining fundamentals**	
Course Description:	
Acquired store of learning: **Scope and objective of subject:** Gaining basic knowledge in calculation and design of UWM-projects; capability to consider requirements in waste storage facilities; basic knowledge in economic considerations of waste handling and disposal; understanding of environmental impacts. Gaining basic knowledge on the geological aspects and environmental concerns of CO_2 underground storage. **Thematic description of subject:** UWM includes the scientific and technical work necessary to provide safe and economic means for long term waste management protecting men and environment from harmful effects of toxic substances. Industrial and radioactive wastes are differentiated, legal and economic aspects of waste disposal; basic risk assessment. Procedures and methods adopted to address future needs will be nation- or programme specific. The carbon cycle. Effects of CO_2 emission on climate. CO_2 capture and transport. Reservoir characteristics, storage requirements. Transport of fluids in rocks. Physical, chemical and mineralogical trapping of CO_2. Geological storage sites. Current CO_2 storage activities. Risks and monitoring. Economics and legal aspects.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
The PPP will be provided digitally and partly as hard copy	
Responsible Instructor (*name, position, scientific degree):* **Helmut Wolff, full professor, visiting professor, TU Berlin**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): **Éva Hartai, associate professor, PhD**	

Semester 4

Course Title: Safety techniques and labour safety	**Credits: 2**
Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week:**lec. 2+0**	
Type of Assessment (exam. / pr. mark. / other): **exam. mark** **Grading Limits:** > 90%: excellent,80-89%: good, 70-79%: medium, 60-69%: satisfactory, < 60%: unsatisfactory.	
Position in Curriculum (which semester): fourth	
Pre-requisites *(if any)*: --	
Course Description:	
Acquired store of learning: **Course Objectives:** Understand of the basic knowledges of safety techniques and labour safety. Course content: Basics of fire and explosion protection. Fundamentals of combustion theories, burnings of different materials, autoignitions. Fire protection. Safety aspects of pressure vessels and bottles and other equipment, machines and processes: safety devices, safety questions of settlements and operating. Chemicals safety. Personal protective equipment. Legal background and regulations of labour safety. Requirements for healthy and safe working. Objective and personal conditions of working. Special requirements of processes. The most important rights and duties of employees and employers.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
Általános tűzvédelmi ismeretek, Népszava Könyv Kft, 2008. A tűzvédelmi törvény és az OTSZ, Népszava Könyv Kft, 2008. Gázpalackok biztonsága, Népszava Könyv Kft, 2001. A kémiai biztonság szabályozása, OTH OMMF kiadvány2005. A munkavédelmi törvény magyarázata, KJK KERSZÖV, 2005. ISBN 9632247752 Jogszabályok	
Responsible Instructor (*name, position, scientific degree):***dr. Tibor Szabó, associate professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*):	

Course Title: Strategic management	**Credits: 2**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week: **2+0**

Type of Assessment (exam. / pr. mark. / other): **examination**
Students will be assessed with using the following elements.

Attendance:	5 %
Homework	10 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
75 – 89%	4 (good)
63 – 74%	3 (satisfactory)
50 – 62%	2 (pass)
0 – 50%	1 (failed)

Position in Curriculum (which semester): **4th**

Pre-requisites *(if any)*: **-**

Course Description:

The aim of the subject is to represent the reasons of creation of corporations – as non-natural legal entities – (The Netherlands, 1820), development of corporate governance, and American, German, French and Japanese basic model sin the minor of Hungarian practice. Through the flow of EU Co. the subject focuses ont he buying foreseen tendencies of corporate governances in case of cluster, network and multiple corporational forms.
Structure of lectures:
Basis of corporate forms and changings from 1820. State-theoretical roots of corporate governance. Inducements of originate of corporations and stock corporations, present forms. Double responsibility, theoretical versions of trusteeship (agency – client). Framework of Board of Directors, functions of CEO, COO and responsibility. Anglo-Saxon model, double directorate. "S" form, stock guarantees and threats in case of disperse ownership structures. Features of German and French model, EU-policy, desirable changes. Disharmony of corporate thought, contradiction of globalization and roles of stockholders. Mintzberg's 5+2 model, as objective drives of corporate development. Organizational movements, detours towards networks and multiple corporational forms. Classical holding – concern. Up – to – date concern directing forms. Elements of concerns, coordinational mechanisms. International samples of multiple corporations. Inducements of strategical alliances. Alliances and globalization. Configuration of alliances. Types and features of corporate – networks. "On-demand" operation, virtual networks. Concept and types of cluster. Features of industrial and regional clusters. "R+D" networks and utilizations. Digest of company – building strategies.
Practice:
Chapters of a business plan. Task assignment. Situational training: "Bank robbery". Conclusions. "The President" case study. Election of strategic leader. „Opel" case study. "Direction of a company – group" Strategical game I.-II. (software) Evaluations of public holdings (case study). Strategical alliance (case study). Industrial cluster (case study). Presentations of Business Plan.

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:

Carayannis, E. G. − Popescu, D. − Sipp, C. − Stewart, M.: Technological learning for entrepreneurial development (TL4ED) in the knowledge economy (KE): Case studies and lessons learned, www. eisz.hu

Responsible Instructor (*name, position, scientific degree):*
István Kunos Ph.D. associate professor

Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): -

Course Title: Economic geology, Reporting of mineral reserves (elective)	**Credits: 3**
Lessons/week (lecture + seminar) 1 lecture + 2 seminars	
Methods of assessment during course: **Signature:** Participation in lessons and field trips. **Grade:** The assessment consists of an interim quiz, a written report and presentation of the laboratory group work and a written exam. **Grading limits:** > 80%: excellent, 70-79%: good, 60-69%: medium, 50-59%: satisfactory, < 50%: unsatisfactory.	
Position in Curriculum (which semester): **first**	
Pre-requisites *(if any)*: Grade in Nature conservation subject	
Course Description:	
Acquired store of learning: **Scope and objective of subject:** Gaining Basic Knowledge in Resource assessment methods, treatment and management of mineral ore reserve in the economic analysis. Students will be capable to run basic assessment of mineral resources, decide and evaluate measures focusing grade control. Introduction in field and laboratory work respectively. **Thematic description of subject:** Mineralogy / Petrology Review, Ore Deposit Formation / Modern Systems, Geochemistry / Isotopes / Fluid Inclusions, Magmatic Hydrothermal Systems, Ores in submarine environment of formation, Ores in Sedimentary Basins, Industrial Minerals, Resource Evaluation, Ore processing, Ore valuation/ore reserves, Instrumental mineral phase analysis and chemical analysis methods. Economic geology during mine closure.	
The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources**:	
The slides will be provided digitally, with complementary library literature search. Coe A. L: Geological Field Techniques. Wiley-Blackwell, 2010, 323 p. Sinclair A.J., Blackwell G.H.: Applied mineral inventory. Cambridge University Press, 2004, 401 p. Marjoribanks R.: Geological methods in mineral exploration and mining. Springer, 2010, 248 p. Edwards A.C. (ed.): Mineral Resource and Ore Reserve Estimation — The AusIMM Guide to Good Practice. The Australasian Institute of Mining and Metallurgy 2001, 639 p.	
Responsible Instructor (*name, position, scientific degree):* **János Földessy, full professor, PhD**	
Other Faculty Member(s) Involved in Teaching, if any (*name, position, scientific degree*): **Tom Henricksen, exploration geologist, qualified person**	