Syllabuses

European Geotechnical and Environmental Course

Courses instructed at the Universty of Miskolc as part of Environmental Engineering MSc, Geotechnical and Mining environmental module

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European Geotechnical and Environmental Course
Courses instructed at the Universty of Miskolc as part of
Environmental engineering MSc, Geotechnical and Mining environmental module

Mine waste geochemistry and characterization

Course Title: Mine waste geochemistry and characterization Code: EGEC-M/MW0002	**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*): -	

Contaminated soil characterization and treatment

Course Title: Contaminated soil characterization and treatment Code: EGEC-M/MW0003	**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

Tailings management

Course Title: Tailings management Code: EGEC-M/MW0004	**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*): -	

Mineral processing basics

Course Title: Mineral processing basics Code: EGEC-M/MRD005	**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*): -	

Geothermal energy

Course Title: Geothermal energy Code: EGEC-M/GE0001	**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*): -	

Geohydrology and Environmental risk assessment

Course Title: Geohydrology and Environmental risk assessment Code: EGEC-M/GERA0001	**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

Engineering and mining geophysics

Course Title: Engineering and mining geophysics Code: EGEC-M/EMG0001	**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*): -	

Underground waste management and storage

Course Title: Underground waste management and storage Code: EGEC-M/UWMS	**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**	

Economic geology, Reporting of mineral reserves

Course Title: Economic geology, Reporting of mineral reserves Code: EGEC-M/MRD0003	**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**	

Aquisition in geology and Exploration Methodologies, Resource modeling and definition

Course Title: Data Aquisition in geology and Exploration Methodologies, Resource modeling and definition Code: EGEC-M/MRD0002	**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**