University of Miskolc, Faculty of Earth Science and Engineering
Environmental Engineering MSc program
Course syllabus list

May, 2017

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Mineralogy – geochemistry

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<tr><td>Course Title: Mineralogy – geochemistry

Instructor: Dr. Sándor Szakáll, associate professor, department head</td><td>Code: MFFAT710001A

Responsible department/institute: Department of Geology and Mineral Resources</td></tr>
<tr><td>Position in curriculum (which semester): 1</td><td>Pre-requisites (if any): -</td></tr>
<tr><td>No. of contact hours per week (lecture + seminar): 2+1</td><td>Type of Assessment (examination/ practical mark / other): exam</td></tr>
<tr><td>Credits: 4</td><td>Course: full time</td></tr>
<tr><td colspan="2">Course Description:
Students will get the knowledge of the principals of the distribution of chemical element in the Earth. They will also know the most important thermodynamic processes concerning solid materials, the geochemical classification of elements, the geochemical aspects of the genesis of the most important minerals and mineral assemblages. The geochemistry of isotopes, which explores the chemical evolution of the Earth will also be introduced, as well as the geochemical characteristics of water, organic matter, magmatic, sedimentary and metamorphic rocks by which we can describe the mineral-and rock-forming processes in the crust and mantle.

The short curriculum of the subject:
Abundance of chemical elements. Meteorites. Geochemical classification of elements. Chemical composition of Earth. Chemical composition of minerals. Genetic charateristics of mineral parageneses. Isotopes and the Periodic Table. Radioactivity and geochronology. Stable isotopes and geology. Short thermodynamics. Water chemistry. Characteristics of natural water. Geochemistry of soils. Organic geochemistry. Organic geochemistry of freshwater and seawater. Geochemistry of sedimentary rocks. Chemical weathering. Geochemistry of igneous and metamorphic rocks.
Practical work: self-made solutions of simple case-study problems.</td></tr>
<tr><td colspan="2">Assessment and grading:
Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:
% value — Grade
90 -100% — 5 (excellent)
80 – 89% — 4 (good)
70 - 79% — 3 (satisfactory)
60 - 69% — 2 (pass)
0 - 59% — 1 (failed)</td></tr>
<tr><td colspan="2">Compulsory or recommended literature resources:
Albared, F. (2005): Geochemistry. An introduction. Cambridge Univ. Press.
Brownlow, A. H. (1996): Geochemistry. Prentice Hall, New Jersey.</td></tr>
<tr><td colspan="2">Competences: T1, T16, K7, F1</td></tr>
</table>

Environmental Geology

Course Title: Environmental Geology **Instructor:** Dr. Éva Hartai, honorary assistant professor	**Code:** MFFAT710008 **Responsible department/institute:** Department of Geology and Mineral Deposits
Position in curriculum (which semester): 1	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 4	**Course:** full time

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.

The short curriculum of the subject:
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.
Practical work: self-made solutions of simple case-study problems.

Assessment and grading:
Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:

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

Compulsory or recommended literature resources:
F. G. Bell: Geological Hazards: their assessment, avoidance and mitigation. E & FN Spon, London, 1999
L. W. Lundgren: Environmental Geology. Prentice-Hall Inernational, London, 1999.
C. W. Montgomery: Environmental Geology. McGraw-Hill Companies, Boston, New York, San Francisco, 2005

Competences: T1, T16, K6, K7

Basics of environmental processing

Course Title: Basics of environmental processing **Instructor**: Dr. József Faitli, habilitated assistant professor	**Code:** MFEET710005 **Responsible department/institute:** Institute of Raw Mineral Preparation and Environmental Processing
Position in curriculum (which semester): 1.	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1 +1	**Type of Assessment (examination/ practical mark / other):** practical mark
Credits: 2	**Course:** full time

Aim of the course:
Environmental processing deals with the processes, machines and technologies of cleaning and keeping clean the air, water and soil. The aim of the course is let the students learn the mainly mechanical processing theoretical and practical fundamental knowledge necessary for the design, sizing and operation of the processes, machines and technologies of environmental processing.

Course description:
Physical characterization of coarse disperse systems. Rheological properties of one- and multiphase media. Steady-state and unsteady-state particle motion in Newtonian and non-Newtonian media. Motion of particles bulks. Flow through a particles bulk. Permeability tests. Particle motion in electrostatic field. Particle motion in centrifugal field. Forming of bubbles in liquids and their motion. Forming of droplets in gases and their motion. *Phase separation of solid – liquid coarse disperse systems.* Liquid bonds in particulate materials. Solid – liquid phase separation by mechanical processes. Settling in gravitational and centrifugal fields. Filtration in gravitational and centrifugal fields and by pressure difference supplied by pumps. Solid – liquid phase separation by pressing. *Phase separation of solid – gas coarse disperse systems* in gravitational, centrifugal and electrostatic fields. Phase separation of solid – gas coarse disperse systems by the application of filtering media and the wet dust separation.

Assessment and grading
Requirements of the practical mark:; Less than 20 % class missing; Presenting the laboratory measurements reports; Writing the classroom test successfully
Assessment: Five grades scale
Assessment according to a five grade scale:
Missing basic knowledge – unacceptable
Student demonstrates basic knowledge – acceptable
Student demonstrates basic knowledge and can apply it in practice – intermediate
Student demonstrates system level knowledge in contexts – good
Student demonstrates outstanding system level knowledge in contexts - excellent
Assessment: 88 – 100: excellent (5), 75 – 87: good (4), 63 – 74: intermediate (3), 51 – 62: acceptable (2), ≤50: unacceptable (1).

Compulsory or recommended literature resources:

Lecture notes

Fejes G – Tarján G.: Vegyipari gépek és műveletek. Tankönyvkiadó, Budapest, 1979.
Tarján I.: A mechanikai eljárástechnika alapjai. Miskolci Egyetemi Kiadó, 1997.
Faitli J. – Mucsi G. – Gombkötő I. – Nagy S. – Antal G.: Mechanikai eljárástechnikai praktikum. Miskolci Egyetemi Kiadó, 2017.
Faitli J. - Tarján I.: Mérési Gyakorlatok (A mechanikai eljárástechnika alapjai II.) Jegyzet. Miskolc, 1997. ME Eljárástechnikai Tanszék
Stieβ, M: Mechanische Verfahrenstechnik 1,2. Springer (Lehrbuch) 1995.
Tarján G.: Mineral Processing (Vol. 1, 2). AK. Bp.1981.

Competences: T1, K1, A1

Computer science for engineers

Course Title: Computer science for engineers **Instructor:** Dr. Józsefné Mészáros Dr., associate professor	**Code:** GEMAK713M **Responsible department/institute:** Department of Applied Mathematics
Position in curriculum (which semester): 1	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination/ practical mark / other):** practice mark
Credits: 2	**Course:** full time

Course Description:

Extend the application of the computer as engineering training aids for numerical and symbolic computation.

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.

The short curriculum of the subject:

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.

Assessment and grading:

Students will be assessed with using the following elements.

Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%

Grading scale:

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

Compulsory or recommended literature resources:

Text books:

Stoyan G. (szerk.): *MATLAB,* Typotex, 2005.

Other references:

The MATH WORKS Inc., Release 13 Product Family Documentation Set, 2002.

Competences: T2, T7

Eecology and nature conservation

Course Title: Eecology and nature conservation **Instructor:** Dr. Teofil Fülöp, invited lecturer	**Code:** MFKHT710009 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 1	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1+2	**Type of Assessment (examination/ practical mark / other):** practice mark
Credits: 3	**Course:** full time

Course Description:

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.

Assessment and grading:
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. .

Compulsory or recommended literature 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.

Competences: T1, T9, K6, F6

Soil chemistry

Course Title: Soil chemistry **Instructor:** Dr. János Lakatos, associate professor	**Code:** AKKEM6007M **Responsible department/institute:** Institute of Chemistry
Position in curriculum (which semester): 1	**Pre-requisites (if any):** AKKEM 6003 equivalent
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** practice mark
Credits: 3	**Course:** full time

Course Description:
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.
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.

Assessment and grading:
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.

Compulsory or recommended literature 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).

Competences: T1, T3, T16, K6, K7

Applied physical chemistry

Course Title: Applied physical chemistry **Instructor:** Dr. Béla Viskolcz, full professor	**Code:** AKKEM6008M **Responsible department/institute:** Institute of Chemistry
Position in curriculum (which semester): 2	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 3	**Course:** full time

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.

Assessment and grading:

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.

Compulsory or recommended literature 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.
Competences: T1, T2, T10, K6

Water chemistry

Course Title: Water chemistry **Instructor: Dr. János Lakatos, associate professor**	**Code: AKKEM6005** **Responsible department/institute: Department of Chemistry**
Position in curriculum (which semester): 2	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other): practice mark**
Credits: 2	**Course: full time**

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.

The short curriculum of the subject:
The structure of water molecule. The state diagram of water. Properties of ice, liquid water and steam. Supercritical state of water. Water as a solvent, polar character of water molecule. Solubility of gases liquids and solids in water. The dissociation of water. Acid-base equilibriums in water. Complexation and redox process in water. Water quantity and quality. Composition and main feature of natural waters. Production of different quality water: high purity water, soft water, desalination of water. Type of water contamination.

Assessment and grading:
Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:

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

Compulsory or recommended literature 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.

Competences: T1, T2, T3, T11, K7

Numerical Methods and Optimization

Course Title: Numerical Methods and Optimization **Instructor:** Dr. Józsefné Mészáros Dr., associate professor	**Code:** GEMAK712M **Responsible department/institute:** Department of Applied Mathematics
Position in curriculum (which semester): 1	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 2	**Course:** full time

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.

Assessment and grading:
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.

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

Competences: T7

Environmental and Waste Management Law

Course title: Environmental and Waste Management Law **Name of the course coordinator lecturer:** Dr. Ede János Szilágyi, habilitated associate professor	**Neptun code:** AJAMU04MF1N **The course coordinator department/institute:** Department of Agricultural and Labour Law
Position in curriculum (which semester): 1	**Precondition:** none
No. of contact hours per week (lecture + seminar): 2+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 2	**Course:** full time
The language of the course: English **Thematic of the subject** (in weekly periods): 1. A brief introduction to law I. 2. A brief introduction to law II. 3. The concept of sustainable development 4. The development, the subject and the system of environmental law 5. The sources and the methods of environmental law 6. International environmental law I 7. International environmental law II 8. The EU's environmental law I 9. The EU's environmental law II 10. Constitutional aspects of environmental law 11. Waste management law I 12. Waste management law II 13. The presentation of the course participants I 14. The presentation of the course participants II 15. The presentation of the course participants III	
Method of examination: The examination includes: a, an oral presentation on a topical issue of environmental law and b, a written exam. The presence is compulsory on the course.	
Required/Compulsory literature: The basis of the written exam is the hand-outs prepared by the lecturer(s) of the course. The sources of these hand-outs are the followings: **In Hungarian language**: Csák Csilla: *Környezetjog*, I. kötet, Miskolc, Novotni Kiadó, 2008 Szilágyi János Ede: *Környezetjog*, II. kötet, Miskolc, Novotni Kiadó, 2010 Fodor László: *Környezetjog*, Debrecen, Debreceni Egyetemi Kiadó, 2014 **In foreign language**: Bell, Stuart – McGillivray, Donald – Pedersen, Ole.: *Environmental law*, Oxford, Oxford University Press, 2013 Krämer, Ludwig: *EU environmental law*, London, Sweet & Maxwell, 2012 Kubasek, Nancy – Silverman, Gary: *Environmental law*, Boston [etc.], Pearson, 2014 **Recommended literature**: Raisz Anikó: A Constitution's Environment, *Est Europa*, 2012/special edition 1, pp 37-70	
Competences: T21, F1	

Methods of environmental assessment

Course Title: Methods of environmental assessment **Instructor:** Dr. Balázs Zákányi, assistant professor	**Code:** MFKHT730013 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 3	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination/ practical mark / other):** practice mark
Credits: 2	**Course:** full time

Course Description:
Students awareness of the environmental assessment procedures, the methods can be used to make the study.

The short curriculum of the subject:
The history of environmental impact assessment. The legal regulation of the environmental impact assessment. Environmental assessment, environmental impact assessment, uniform environmental permit. The qualification of environmental test activities can be combined with the functionality and connectivity of the procedures. The phases of environmental testing, the method of the official method. The preliminary environmental study. The detailed requirements for environmental compatibility studies. Acting factors stakeholders, impact processes, the spread effects. The effect areas, control areas. The main aspects of recruitment procedures and environmental standards. In the effectiveness test methods and procedures. Impact Assessment. Monitoring. The impact assessment public of the hearing, public hearing. Analysis of practical examples. Preparation of an impact test, study management, presentation, public discussions.

Assessment and grading:
Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:

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

Compulsory or recommended literature resources:
Charles H. Eccleston: Environmental Impact Assessment: A Guide to Best Professional Practices. CRC Press, 2011
John Glasson: Methods of Environmental Impact Assessment. Routledge, 2009.
M. Schmidt, J. Glasson, L. Emmelin, H. Helbron: Standards and Thresholds for Impact Assessment Springer, 2008.
EU directives

Competences: T2, T5, T10, T19

Environmental Economics

Course Title: Environmental Economics **Instructor:** dr. Klára Tóthné Szita, associate professor	**Code:** GTERG204MKM **Responsible department/institute: Institute of World and Regional Economics**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 2	**Course:** full time

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 a 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.

Assessment and grading:

Grading Limits: > 90%: excellent,80-89%: good, 70-79%: medium, 60-69%: satisfactory, < 60%: unsatisfactory.

Compulsory or recommended literature 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

Competences: T6, T20

Quality Management

Course Title: Quality Management **Instructor:** Dr. László Berényi, associate professor	**Code:** GTVVE7002MA **Responsible department/institute:** Institute of Management Science
Position in curriculum (which semester): 3	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+0	**Type of Assessment (examination/ practical mark / other):** practice mark
Credits: 2	**Course:** full time

Course Description:

The objective of the course is to prepare students to perform professional tasks on a higher level by applying the approach of quality management, including managing or participating related projects. The student will learn about principles, concept and terminology of quality management, quality-related corporate activities, requirements of the ISO 9001 standard and the specialities of project quality management.

week: Terminology of quality management (principles, 5 approaches, 9 influencing factors), history of quality management.
week: Quality management standardization. ISO 9000 family. Concept of quality management by ISO 9001.
week: Process approach in quality management. Kaizen.
week: ISO 9001 requirement: Management system.
week: ISO 9001 requirement: Product and production.
week: Auditing quality management system. ISO 19011:2011 standard.
week: Total Quality Management. Lean approach in quality management.
week: Enhancing quality management, integrated management systems.
week: Quality tools: 7 old&new tools, finding the root cause, 8D
week: Quality tools: FMEA, QFD
week: Business excellence. Quality Awards. Tools and methods of self-evaluation.
week: Project quality management: planning.
week: Project quality management: risk analysis.
week: Project quality management: monitoring and performance evaluation.

Assessment and grading:
40%: successful midterm test; 20%: presentation about a chosen quality management tool; 40%: oral exam
Grading scale:
89-100 excellent (5), 76-88 good (4), 63-75 satisfactory (3), 50-62 pass (2), 0-49 fail (1)

Compulsory or recommended literature resources:
Berényi L: Fundamentals of Quality Management. LAP, Saarbrücken, 2013.
Vivek, N.: Quality management system handbook for product development companies, CRC Press, Boca Raton, 2005.
Foster, S.T.: Managing Quality Integrating the Supply Chain, Pearson, London, 2011
P. J. Lederer, U. S. Karmarka: The Practice of Quality Management, Springer, 1997.
Kanji, G.K., Asher, M.: 100 Methods for Total Quality Management, SAGE , London, 1996
Griffith G.: Quality Technician's Handbook, Pearson, London, 2003.

Competences: K5, K9, K13

Occupational Health and Safety

Curse Title: Occupational Health and Safety **Instructor**: Dr. Zákányiné Dr. Renáta Mészáros, invited lecturer, EHS leader, TS Hungária Kft.	**Code:** To be determined **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 4.	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2 +0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 2	**Course:** full time

Course Description:

The aim of the subject for students is to learn the basics of work safety and health. Get knowledge about the skills of an EHS specialist in practice.

Basic Concepts. Basis of law. Occupational health. Mental health. Safety of machinery and equipment. Chemical safety. Biological hazards. Personal protective equipment. Realization of work safety in practice. OHS Tasks at a Workplace (EHS Work Safety, Change Management). OHSAS.

Assessment and grading Participation on the project courses and preparation of an advancement documentation based on the topic discussed. Project work in a chosen topic. Oral Exam

Assessment: based on the advancement doc.
Assesment according to a five grade scale:

1. Structure and clearness of the work. (max. 10 points)
2. Aims and goals are clear: (max. 10 points)
3. Literature study: (max. 15 points)
4. Methodology: (max. 15 points)
5. Results and discussion: (max. 25 points)
6. Rate of independent work: (max 25 points)

Assessment: 88 – 100: excellent (5), 75 – 87: good (4), 63 – 74: intermediate (3), 51 – 62: acceptable (2), ≤50: unacceptable (1).

Compulsory or recommended literature resources:

Presentations

Edward W. Finucane: Definitions, Conversions, and Calculations for Occupational Safety and Health Professionals. CRC Press, 2006.
National Safety Council: Handbook of Occupational Safety and Health. CRC Press, Chicago, 2010.
Thomas D. Schneid: Creative Safety Solutions. SECOND EDITION. CRC Press, 2016

Competences: T8, T15, F2

Basics of waste management

Course Title: Basics of waste management **Instructor:** Dr. Gábor Mucsi, associate professor	**Code:** MFEET710010 **Responsible department/institute:** Institute of Raw Material Preparation and Environmental Processing
Position in curriculum (which semester): 1.	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 3	**Course:** full time

Course Description:

The aim of the subject for students is to learn knowledge about the waste management. History and development of waste management. Generation and types of industrial and municipal wastes.
Introduction, position and aim of the subject in the course. Generation, types, composition, environmental effect of wastes. Definition and basics of sustainable development and sustainable raw material management. Determination of material characteristics (chemical and physical properties) and evaluation of the results. Material flow of production and consumption wastes. Relationship of waste management and environmental protection. Product and production integrated environmental protection. Treatment and preparation of wastes based on various utilization needs. Processes of mechanical waste preparation. General waste preparation technologies.
Competences:
Students will know the fundamentals of waste management and the generation of wastes. Furthermore, they will be able to characterize – from process engineering and chemical point of view – and utilize the various wastes.

Assessment and grading:
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)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Compulsory or recommended literature resources:
Bernd Bilitewski: Waste management. 1997. Springer Science & Business Media
Jacqueline Vaughn: Waste Management: A Reference Handbook. 2009
Ramesha Chandrappa: Solid Waste Management: Principles and Practice. 2012. Springer
Lecture PowerPoint

Competences: T1, T14, K10

Waste disposal, landfill operation and reclamation

Curse Title: Waste disposal, landfill operation and reclamation **Instructor**: Dr. Tamás Madarász, associate professor	**Code:** MFKHT720040 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 2.	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2 +2	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 4	**Course:** full time

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.

Assessment and grading

Grading Limits: > 90%: excellent,80-89%: good, 70-79%: medium, 60-69%: satisfactory, < 60%: unsatisfactory.

Compulsory or recommended literature 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

Competences: T1, T14, K10

Environmental and Engineering Geophysics

Course title: Environmental and Engiennering Geophysics **Repsonsible Instructor:** Dr. Mátyás Krisztián, PhD	**Code of the Subject:** MFGFT720018 **Responsible institute:** Institute of Geophysics
Semester: 2	**Prerequisites: -**
No. of contact hours per week (lecture + seminar): 2+2	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 5	**Course:** Full time

Course Description:

Scope and goal of the course:

Understanding the basic methods of environmental geophysics, through which geometric and geophysical parameters of the subsurface environment can be traced, observed and interpreted, primarily for environmental research purposes.

Introduction to geophysical methods: Gravitational magnetic, radiometric, geothermal, electric Induced polarisation, electromagnetic, seismic methods. Application of engineering geophysical probes, well geophysics investigation tools to solve environmental problems, with special emphasis on recording contaminated plumes, underground void spaces and other natural and anthropogenic near surface objects. Interpreting physical features, introduction to case studies.

Method of evaluation: Participation on classes according to the rules determined in the relevant regulations of the university/faculty. Minimum conditions: Completing 3-5 single assignments during the semester, getting familiar with introduced software, and evaluation of case studies introduced as part of the course. Completing two mid-term assessments. 1 credit (out of 5) must be obtained through an individual or small group (max 3 person) work of a geoenvironmental case study, highlighting the applied geophysical methods. The presentation can be the basis of the final grade of the course

Grading scale:

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

Compulsory or recommended literature resources:

Presentation outlines

John M. Reynolds: An Introduction to Applied and Environmental Geophysics, 2nd Edition, Wiley and Blackwell, 2011

Telford W. M., Geldart L. P. and Sheriff R. E., 1990: Applied Geophysics. 2nd Edition. Cambridge, University Press.

Scientific papers to be highlighted during the course.

Competences: T1, T14, T16

Water quality protection

Course Title: Water quality protection **Instructor:** Dr. Péter Szűcs, full professor	**Code:** MFKHT720023 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 2	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 3	**Course:** full time

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.

The short curriculum of the subject:
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. Practical work: self-made solutions of simple case-study problems.

Assessment and grading:
Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:

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

Compulsory or recommended literature resources:
Liu David, Lipták Béla: Groundwater and Surface Water Pollution. Lewis Publishers, 2000, ISBN 1-56670-511-8, pp. 1-150.
Merkel Broder, Planer-Friedrich Britta: Groundwater Geochemistry. Springer, 2005, ISBN 3-540-24195-7, pp. 1-200.
David M. Nielsen, Gillian L. Nielsen: The Essential Handbook of Ground-Water Sampling. CRC Press, 2006, ISBN 1-4200-4278-5, pp 1-300.

Competences: T1, T3, K7

Waste incineration, air quality control

Course title: Waste incineration, air quality control **Repsonsible Instructor:** Dr. András Kállay, assistant professor	**Code of the Subject:** MFKHT730018 **Responsible institute:** Institute of Energy and Quality Affairs
Semester: 3	**Prerequisites: -**
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 4	**Course:** Full time

Course Description:

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).

Assessment and grading:

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

Compulsory or recommended literature resources:

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

Water and waste water treatment

Course Title: Water and waste water treatment **Instructor:** Dr. Sándor Nagy, associate professor	**Code:** MFEET730001A **Responsible department/institute: Institute of Raw Material Preparation and Environmental Processing**
Position in curriculum (which semester): 3	**Pre-requisites (if any):** MFKHT720023
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** practice mark
Credits: 2	**Course:** full time

Course Description:

The students will be familiar with the basic elements and concepts of modern water and waste water purification technology and processes. The students will be able to choose the right purification technology concerning environmental protection aspects.

The short curriculum of the subject:
Contamination and pollution processes in water. Pollution limits in water and in groundwater. The most typical contaminants and their physical and chemical properties. Sampling, and preparations of samples. Cleaning and purification technology for municipal and industrial waste water. Technology design.

Assessment and grading:
Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:

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

Compulsory or recommended literature resources:
Dr. Takács János: Oktatási segédletek;
Papp Sándor – R. Kümmel: Környezetkémia, Tankönyvkiadó, Bp. 1992.; B
Berecz Endre: Kémia Műszakiaknak. Tankönyvkiadó, Bp. 1991.;
Toxikológiai lexikon;
Kovács Margít: A környezetvédelem biológiai alapjai. Mezőgazdasági Kiadó, Bp. 1975.;
Klaus Görner- Kurt Hübner: Gewaesserschutz und Abwasserbehandlung; Springer-Verlag Berlin heidelberg, 2002.
M Henze; P Harremoes; J la C Jansen; E Arvin: Wastewater Treatment; Springer-Verlag Berlin heidelberg, 2002
Hungarian and English textbooks, and Internet resources

Competences: T4, T11

Sustainable development and environmental policy (Elective course 2)

Course Title: Sustainable development and environmental policy (Elective course 2) **Instructor:** Enikő Darabos, assistant lecturer	**Code:** MFKHT740003 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 4	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1+2	**Type of Assessment (examination/ practical mark / other):** practical mark
Credits: 3	**Course:** full time

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:
The idea of sustainable development, the aspects of sustainable development, the reasons of unsustainability
Sustainable development policy of EU and UN
Economic sectors and the sustainable development
Society policy
Environmental policy and the sustainability
Energy and the sustainability
Sustainable production and consumption
Sustainable life
Environmentally sound technology in building
Environmental aspects around our house
Field course: Gömörszőllős, a sustainable village

Assessment and grading:
Test-paper on the last week
Grading Limits:
> 80%: excellent,
70-79%: good,
60-69%: medium,
50-59%: satisfactory,
< 50%: unsatisfactory.

Compulsory or recommended literature 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

Competences: T1, T10, T17

Hydrogeology

Course Title: Hydrogeology **Instructor:** Dr. Péter Szűcs, full professor	**Code:** MFKHT710017 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 1	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+2	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 5	**Course:** full time

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 short curriculum of the subject:
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. Practical work: self-made solutions of simple casestudy problems.

Assessment and grading: Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:

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

Compulsory or recommended literature resources:
Péter Szűcs: Hydrogeology. Course materail for Geothermal engineers. University of Miskolc, 2011.
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.
Competences: T11, T16, K5, K6

Groundwater flow and contaminant transport modeling

Course Title: Groundwater flow and contaminant transport modeling (Project practice) **Instructor:** Dr. Balázs Kovács, honorary associate professor	**Code:** MFKHT7200061 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 2	**Pre-requisites (if any):** MFKHT710004
No. of contact hours per week (lecture + seminar): 2+2	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 5	**Course:** full time

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.

The short curriculum of the subject:

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.

Assessment and grading:

Students will be assessed with using the following elements.

Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%

Grading scale:

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

Compulsory or recommended literature 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
Competences: T1, T2, T7, T11

Geotechnical engineering

Course Title: Geotechnical engineering **Instructor:** Dr. Tamás Madarász, assistant professor	**Code:** MFKHT720025 **Responsible department/institute:** Deparment of Hydrogeology and Engineering Geology
Position in curriculum (which semester): 2	**Pre-requisites (if any):** MFKHT710003
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 4	**Course:** full time

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.

The short curriculum of the subject:

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.
Practical work: self-made solutions of simple case-study problems

Assessment and grading:
Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:

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

Compulsory or recommended literature resources:
I. Vanícek, M. Vanícek: Earth Structures. Springer, ISBN: 978-1-4020-3963-8, 2008. pp. 497-606

Competences: T1, T10, T16, T21, K6

Contaminated site remediation

Course Title: Contaminated site remediation (Project practice) **Instructor:** Dr. Tamás Madarász, associate professor	**Code:** MFKHT720030 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 2	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 4	**Course:** full time

Course Description:
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

Assessment and grading:
Students will be assessed with using the following elements.
Attendance:15 %; Short quizzes 10 %; Midterm exam 40 %; Final exam 35 %; Total 100%
Grading scale:

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

Compulsory or recommended literature 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

Environmental Geotechnics

Course Title: Environmental Geotechnics **Instructor:** Dr. Andrea Tóth Kolencsikné, assistant lecturer	**Code:** MFKHT730030 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 3	**Pre-requisites (if any):** MFKHT710003
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 2	**Course:** full time

Course Description:
The students will be familiar with the basic concepts of environmental geotechnics.
The short curriculum of the subject:
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.

Assessment and grading:
Students will be assessed with using the following elements.
Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%
Grading scale:

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

Compulsory or recommended literature 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.

Competences: T10, T16, T21, K6, K8

Chemical technologies in environmental protection

Course Title: Chemical technologies in environmental protection **Instructor:** Dr. Ljudmilla Bokányi, Associate Professor	**Code:** MFEET730016 **Responsible department/institute:** Institute of Raw Material Preparation and Environmental Processing
Position in curriculum (which semester): 3	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** practical mark
Credits: 2	**Course:** full time

Course Description:

Acquired store of learning:
Study goals: To introduce the chemical techniques on environmental pollution treatment, waste recycling and treatment, as well as on pollution control.

Course content: Theory of mass transfer, laws, relationships, diffusion equations. Principles and fundamentals of design of chemical techniques and reactors. Solid-liquid extraction as a technique for the treatment of solid wastes, methods and equipment. Treatment of contaminated fluids: adsorption, precipitation (cementation), ion exchange, liquid-liquid separation. Thermal techniques like rectification, thermal oxidation, pyrolisys and gasification.
Education method: Lectures, seminars and lab practice.

Competencies to evolve:
Knowledge to be able to judge the applicability of different chemical techniques in environmental protection.
Ability to analyze, choose and dimension the unit operations and equipment.
Intuition, systematism, learning skill.
Demand for continual renewal of technical skills.
Active professional English language skills.

Assessment and grading:

During the semester the following tasks should be completed: laboratory work and report, written test.
GradingLimits:
> 80%: excellent,
70-79%: good,
60-69%: medium,
50-59%: satisfactory,
< 50%: unsatisfactory.

Compulsory or recommended literature resources:
Prof. Dr J. Clifford Jones Thermal Processing of Waste ISBN: 978-87-7681-590-5
Robert Noyes Unit Operations in Environmental Engineering.

Competences: T14, K1, K2, K11

Environmental Risk Assessment and Remediation

Course Title: Environmental Risk Assessment and Remediation (Project practice) **Instructor:** Dr. Tamás Madarász, associate professor	**Code:** MFKHT730026 **Responsible department/institute:** Institute of Environmental Management
Position in curriculum (which semester): 3	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+0	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 3	**Course:** full time

Course Description:

The students will be familiarized with the basic concept and framework of Environmental and Human Health Risk assessment and its relationship to contaminated land remediation. The students shall be competent in reading and understanding risk assessment documentation and evaluating its correctness. They will be able to work together with other field specialists in a risk assessor team. They will get a brief introduction to remediation practices and their design and the European practice of remediation planning and monitoring.

The short curriculum of the subject:

History of Risk Assessment, principles and background of RA methodology, Overview of risk related terminology and definitions, Elements of HHRA methodology, Problem formulation, Exposure assessment, Toxicity assessment, Risk Characterization, Risk assessment and its role in site remediation, Risk interpretation, EU legislation and practice of RA methods, Hungarian legal background, various applications of RA methods, risk based target value and its determination, Case studies.

Practical work: self-made solutions of simple case-study problems.

Assessment and grading:

Students will be assessed with using the following elements.

Attendance: 15 %
Short quizzes 10 %
Midterm exam 40 %
Final exam 35 %
Total 100%

Grading scale:

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

Compulsory or recommended literature resources:

CARACAS (1998): Risk Assessment for Contaminated Sites in Europe, Volume 1: Scientific Basis; LQM Press, Nottingham,

UK USEPA, (1986): Guidelines for Carcinogen Risk Assessment. 51 Federal Register 33992.

Vegter, J.J. (2001): A Risk-Based Land Management Approach; Land Contamination and Reclamation, Vol. 9, No. 1, Richmond, UK

Health Canada (1993): Human Health Risk Assessment of Chemicals from Contaminated Sites, Volume 1 and 2.: Risk Assessment Guidance Manual; Ottawa, ON. Covello, V. – Mumpower, J. (1985): Risk Analysis and Management: A Historical Perspective, Risk Analysis, Vol. 5, No. 2 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.
Competences: T2, T4, T14, T16, T21

Geographic Information Systems I.

Course Title: Geographic Information Systems I. **Instructor:** Dr. János Vágó, associate professor	**Code:** MFKFT730012 **Responsible department/institute:** Institute of Geography and Geoinformatics
Position in curriculum (which semester): 3.	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** practice mark
Credits: 3	**Course:** full time

Course Description:

The aim of the course:
The aim of the course is to teach the basic knowledge of geographic information system and to give an overview on the most commonly used GIS softwares and application possibilities. The main goal of the course is to teach the use of ESRI ArcGIS. The course covers the tution of both vector and raster based GIS analysis, the geographic data collection, data processing and modeling tools

1. GIS basics, vector and raster format, digital mapping.
2. Vector based data format, setup of GIS databases.
3. Setup and characteristics of geometric data model.
4. Setup and characteristics of semantic data model.
5. Setup and characteristics of metadata.
6. The use of ESRI ArcMAP, data formats.
7. Tools and methods of digitization.
8. Setup of point databases.
9. Setup of polyline databases.
10. Setup of polygon databases.
11. Possibilities of visualization, theamatic mapping.
12. Data analysis, basics of spatial analsyiy.
13. Digital mapping
14. Creation of a pilot project.

Assessment and grading:

Students will be assessed with using the following elements.
Attendance: 50 %
Final exam 50 %
Total 100%

Grading:
> 85%: excellent (5);
75 – 84%: good (4);
63 – 74%: satisfactory (3);
50 – 62%: pass (2);
< 50%: failed (1).

Compulsory or recommended literature resources: ESRI. 2001. Getting started with ArcGIS. USA ESRI. 1994. PC Arc/INFO user guides. USA
Competences: T7, A6

Handling and processing of Biodegradable Wastes

Course Title: Handling and processing of Biodegradable Wastes **Instructor:** Dr. Ljudmilla Bokányi, associate professor	**Code:** MFEET710006 **Responsible department/institute:** Institute of Raw Material Preparation and Environmental Processing
Position in curriculum (which semester): 1	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination/ practical mark / other):** written exam
Credits: 3	**Course:** full time

Course Description:

Acquired store of learning:
Study goals: To introduce the sustainable biological treatment systems for the conversion of biowastes into marketable materials or energy, or safe disposal.

Course content: Quality and quantity biowastes according to the EU List. Microbiological and thermodynamic fundamentals of aerobic and anaerobic biodegradation. Composting processing systems, technology, equipment, quality assurance and control. Production of biogas: technological solutions, reactors, quality assurance and control, application of biogas. Technological design and dimensioning. Economics of the technologies. Innovative biotreatment of biowastes for the sake of "green chemistry". Sustainability and environmental aspects.

Education method: Lectures and seminars.

Competencies to evolve:
Ability to analyze the composition of the MSW and to select a proper treatment strategy and technology.
Intuition, systematism, learning skill.
Demand for continual renewal of technical skills.
Active professional English language skills.

Assessment and grading:

During the semester the following tasks should be completed: laboratory work and report, written test.
GradingLimits:
> 80%: excellent,
70-79%: good,
60-69%: medium,
50-59%: satisfactory,
< 50%: unsatisfactory.

Compulsory or recommended literature resources:
Heribert Insam, Nuntavun Riddech, Susanne Klammer Microbiology of Composting. Springer Science & Business Media, 2002.
Paul T. Williams Waste Treatment and Disposal John Wiley & Sons, 2013

Competences: T4, T14, K1, A1

Mechanical and Biological Treatment of Municipal Solid Waste

Course Title: Mechanical and Biological Treatment of Municipal Solid Waste **Instructor:** Dr. Ljudmilla Bokányi, associate professor	**Code:** MFEET720015 **Responsible department/institute:** Institute of Raw Material Preparation and Environmental Processing
Position in curriculum (which semester): 2	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1+2	**Type of Assessment (examination/ practical mark / other):** written exam
Credits: 4	**Course:** full time

Course Description:

Acquired store of learning:
Study goals: To introduce the necessity of treatment of the residual fraction of municipal solid waste (MSW) to recover valuable materials (metals) and energy (refuse derived fuel (RDF) and biogas) for the creating of circular economy.

Course content: Quality and quantity of MSW and its residual fraction. Biostabilisation of degradables, recovery of metals, RDF and/or biogas: evaluation of technologies meeting different processing goals, machinery and economics, their design.

Education method: Lectures and seminars

Competencies to evolve:
Ability to analyze the composition of the MSW and to select a proper treatment strategy and technology.
Intuition, systematism, learning skill.
Demand for continual renewal of technical skills.
Active professional English language skills.

Assessment and grading:

During the semester the following tasks should be completed: laboratory work and report.

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

Compulsory or recommended literature resources:
Heribert Insam, Nuntavun Riddech, Susanne Klammer Microbiology of Composting. Springer Science & Business Media, 2002.
Paul T. Williams Waste Treatment and Disposal John Wiley & Sons, 2013

Competences: T4, T14, K1, A1

Sampling and qualification of waste

Course Title: Sampling and qualification of waste **Instructor**: József Faitli, PhD, habilitated doctor	**Code:** MFEET720016 **Responsible department/institute:** Institute of Raw Mineral Preparation and Environmental Processing
Position in curriculum (which semester): 2.	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1 +1	**Type of Assessment (examination/ practical mark / other):** practical mark
Credits: 2	**Course:** full time

Aim of the course:

Let the students know the engineering, mathematical statistics, physical – chemical - biological analytical and legal authorization knowledge by with they will be able to sample and qualify of wastes in waste management.

Course description:

Summary of applied engineering knowledge of mathematical statistics and its theoretical and practical application for wastes. The identification, classification and notation systems of wastes according to their origin and tax and customs clearance system. Types of waste landfills and limit values for the acceptable wastes. Waste characterization: basic characterization – examination of identity – examination of conformity – on-site inspection. Physical, chemical and biological analytical methods of waste characterization.

Assessment and grading
Requirements of the practical mark:
Less than 20 % class missing
Presenting the laboratory measurements reports
Writing the classroom test successfully
Assessment: Five grades scale
Assessment according to a five grade scale:
Missing basic knowledge – unacceptable
Student demonstrates basic knowledge – acceptable
Student demonstrates basic knowledge and can apply it in practice – intermediate
Student demonstrates system level knowledge in contexts – good
Student demonstrates outstanding system level knowledge in contexts - excellent
Assessment: 88 – 100: excellent (5), 75 – 87: good (4), 63 – 74: intermediate (3), 51 – 62: acceptable (2), ≤50: unacceptable (1).

Compulsory or recommended literature resources:

Lecture notes

Standards

Faitli J. – Mucsi G. – Gombkötő I. – Nagy S. – Antal G.: Mechanikai eljárástechnikai praktikum. Miskolci Egyetemi Kiadó. 2017.

MSZ 21420-28:2005. Hulladékok jellemzése. 28. rész: Települési szilárd hulladékok vizsgálata. Mintavétel. MSZ 21420-29:2005. Hulladékok jellemzése. 29. rész: települési szilárd hulladékok vizsgálata. A minta előkészítése, az anyagi összetétel meghatározása anyagfajták szerinti szétválogatással.

Csőke B. - Bokányi L. - Bőhm J. – Buócz Z. - Faitli J. - Kiss T.: Szilárd települési hulladékok előkészítése és hasznosítása. Miskolci Egyetem Mérnöktovábbképző Központ. (215. p.) 1999.

Competences: T1, T2, T4 K10, A1

Recycling of Metallic and Rubber Wastes

Course Title: Recycling of Metallic and Rubber Wastes (Project practice) **Instructor:** Dr. Sándor Nagy, associate professor	**Code:** MFEET730018 **Responsible department/institute:** Institute of Raw Material Preparation and Environmental Processing
Position in curriculum (which semester): 3	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination/ practical mark / other):** pr. mark
Credits: 3	**Course:** full time

Course Description:

Scope and objective of subject:
Understand the importance of metallic and rubber waste management for recovery of structural materials. Get acquainted with metallic and rubber waste material flows, compositions, and the possible recycling technologies.

Thematic description of subject:
Technologies of processing and utilization of metal and rubber containing wastes. Main groups of introduced wastes: electronic wastes, end of life vehicle wastes, slugs. Mechanical, chemical and thermal processes of preparation. Knowledge of quality related to products.

Assessment and grading:

Signature:
Participation in lessons and laboratory excercises.
During the semester the following tasks should be completed: short presentation of exercise (introduction of given problem), exam.
Grading Limits:
> 80%: excellent,
70-79%: good,
60-69%: medium,
50-59%: satisfactory,
< 50%: unsatisfactory.

Compulsory or recommended literature resources:
V. Goodship: Waste Electrical and Electronic Equipment (WEEE) handbook. Woodhead Publishing Limited, 2012.
M. E. Schlesinger: Aluminium Recycling. CRC Press
R. E. Hester: Electronic Waste Management, RSC Publishing, 2009.
J. Földessy: Criticel Monography Series 10: Research of Strategic Raw Materials in Hungary. Miskolc, 2014.

Competences: T4, T14, K1, A1

Treatment and processing of construction industrial- and glass wastes

<table>
<tr><td>Course Title: Treatment and processing of construction industrial- and glass wastes

Instructor: Dr. Gábor Mucsi, associate professor</td><td>Code: MFEET720017

Responsible department/institute: Institute of Raw Material Preparation and Environmental Processing</td></tr>
<tr><td>Position in curriculum (which semester): 2</td><td>Pre-requisites (if any): -</td></tr>
<tr><td>No. of contact hours per week (lecture + seminar): 1+1</td><td>Type of Assessment (examination/ practical mark / other): examination</td></tr>
<tr><td>Credits: 3</td><td>Course: full time</td></tr>
<tr><td colspan="2">Course Description:
The aim of the subject for students is to learn knowledge about the treatment and processing of construction industrial- and glass wastes.
Construction industry wastes’ types, their generation. Their fundamental process engineering and chemical properties, international experience of their utilization in the road construction. Process engineering technologies. General utilization possibilities.
Main types, properties, generation of glass wastes. Types, composition and properties of glass, with special regards to the process engineering, mechanical and chemical characteristics. Utilization. Preparation technologies. Recovery of valuable components. Mechanical and thermal processes. Quality control methods.
Competences:
Students will know the main types of construction industrial- and glass wastes and their generation. Furthermore, they will be able to characterize – from process engineering and chemical point of view – and utilize the various wastes generated in enormous big quantity worldwide.</td></tr>
<tr><td colspan="2">Assessment and grading:
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)
80 – 89% — 4 (good)
70 - 79% — 3 (satisfactory)
60 - 69% — 2 (pass)
0 - 59% — 1 (failed)</td></tr>
<tr><td colspan="2">Compulsory or recommended literature resources:
Lecture PowerPoint
Jorge de Brito, Nabajyoti Saikia: Recycled Aggregate in Concrete: Use of Industrial, Construction and Demolition Waste (Green Energy and Technology) Springer 2013.
Csőke B.: Építési Hulladékok előkészítése és hasznosítása. Környezetvédelmi Füzetek . OMIKK (ISBN 963 593 414 9, ISSN 0866-6091), 1999./19
Gabor Mucsi, Barnabas Csőke, Mark Kertész, Laszlo Hoffmann: Physical Characteristics and Technology of Glass Foam from Waste Cathode Ray Tube Glass. JOURNAL OF MATERIALS 2013: pp. 1-11. (2013)</td></tr>
</table>

Gábor Mucsi, Barnabás Csőke: Power plant fly ash as a valuable raw material. Journal of Geosciences and Engineering Published by The Faculty of Earth Science and Engineering Miskolc University, Vol. 1. Joseph Davidovits: Geopolymer Chemistry and Applications. Institut Geopolymer, 2008. (Second edition) ISBN: 9782951482012
Competences: T1, K1, A1

Recycling of Plastic and Paper Wates

Curse Title: Recycling of Plastic and Paper Wates (Project practice) **Instructor**: Dr. Imre Gombkötő, associate professor	**Code:** MFEET730019 **Responsible department/institute:** Institute of Raw Mineral Preparation and Environmental Processing
Position in curriculum (which semester): 3.	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 0 ea +2 gy	**Type of Assessment (examination/ practical mark / other):** practical mark
Credits: 3	**Course:** full time

Course Description:

The aim of the subject for students is to learn knowledge about paper and plastics as material, their properties and their production methods and technologies, and their utilisation as secondary raw material. Also, to learn paper and plastic appearance in different waste streams, and their recycling goth technologies and unit operation level.
Paper and plastic production. Properties of plastics, their production and utilisation. Waste streams and major apparence of paper and plastic in these waste streams, quality and quantity. Properties of paper and plastics focusing the properties relevant to their recycling and separation. Technical solution of paper recycling. technical solution of plastic recycling, equipment and unit operation in paper and plastic recycling, energetic and as secondary raw material utilisation of plastics and paper.

Assessment and grading Participation on the project courses and preparation of an advancement documentation based on the topic discussed.
Assessment: based on the advancement doc..
Assesment according to a five grade scale:

1. Structure and clearness of the work. (max. 10 points)
2. Aims and goals are clear: (max. 10 points)
3. Literature study: (max. 15 points)
4. Methodology: (max. 15 points)
5. Results and discussion: (max. 25 points)
6. Rate of independent work: (max 25 points)

Assessment: 88 – 100: excellent (5), 75 – 87: good (4), 63 – 74: intermediate (3), 51 – 62: acceptable (2), ≤50: unacceptable (1).

Compulsory or recommended literature resources:

EU BREF - Production of Pulp, Paper and Board
EU BREF - Production of Polymers
Ernst Worrell And Markus A. Reuter Handbook Of Recycling State-Of-The-Art For Practitioners, Analysts, And Scientists ISBN: 978-0-12-396459-5
Brent Strong Plastics materials and processing, 2006 ISBN 0-13-114558-4
Donald E. Hudgin (Manas Chanda, Salil K. Roy ed) PLastic Technology Handbook 2006, ISBN 978-0-8493-7039-7
Tukker Plastics Waste – Feedstock Recycling, Chemical Recycling and Incineration ISBN 1-85957-331-2
CP Rader, SD Baldwin, DD Cornell, GD Sadler, RF Stockel Plastics, Rubber, and Paper Recycling A Pragmatic Approach ISBN 0-8412-3225-X

Competences: T4, T14, K1, A1

Design fundaments of waste preparation technological processes

Course Title: Design fundaments of waste preparation technological processes **Instructor**: József Faitli, PhD, habilitated associate professor	**Code:** MFEET720018 **Responsible department/institute:** Institute of Raw Mineral Preparation and Environmental Processing
Position in curriculum (which semester): 2.	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2 +2	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 5	**Course:** full time

Aim of the course:
Let the students know the theoretical and practical fundaments of the design of waste preparation unit operations and technological processes of waste management.

Course description:
Fundamental terms and application fields of unit operations and process engineering. Production and consumption wastes. Characterization of coarse disperse systems. Characterization of waste materials in unit operations point of view. The unit operations and processes of changing of the disperse- and mixed state of multi-phase dispersed materials. The acting forces during the change of the state of the processed dispersed materials. The characterization and evaluation of comminution and agglomeration technological processes. Features of the change of the particle size and volume, rate of comminution and the breakage work. The material and energy transfer balances of material component separation technological processes. The unit operation features of the separation processes, evaluation of productivity (component content, yield and recovery, efficiency). Production of secondary raw materials and secondary fuels from municipal solid wastes (MSW). The comparison of different MSW processing technologies in respect of the material and energy balances.

Assessment and grading
Requirements of the practical mark:
Less than 20 % class missing
Presenting the laboratory measurements reports
Writing the classroom test successfully
Assessment of the exam: Five grades scale
Assessment according to a five grade scale:
Missing basic knowledge – unacceptable
Student demonstrates basic knowledge – acceptable
Student demonstrates basic knowledge and can apply it in practice – intermediate
Student demonstrates system level knowledge in contexts – good
Student demonstrates outstanding system level knowledge in contexts - excellent
Assessment: 88 – 100: excellent (5), 75 – 87: good (4), 63 – 74: intermediate (3), 51 – 62: acceptable (2), ≤50: unacceptable (1).

Compulsory or recommended literature resources:

Lecture notes

Drzymala J.: Mineral processing, foundations of theory and practice of metallurgy. Wroclaw University of Technology Publisher, 2007.

Faitli J. – Mucsi G. – Gombkötő I. – Nagy S. – Antal G.: Mechanikai eljárástechnikai praktikum. Miskolci Egyetemi Kiadó. 2017.

MSZ 21420-28:2005. Hulladékok jellemzése. 28. rész: Települési szilárd hulladékok vizsgálata. Mintavétel. MSZ 21420-29:2005. Hulladékok jellemzése. 29. rész: települési szilárd hulladékok vizsgálata. A minta előkészítése, az anyagi összetétel meghatározása anyagfajták szerinti szétválogatással.

Csőke B. - Bokányi L. - Bőhm J. – Buócz Z. - Faitli J. - Kiss T.: Szilárd települési hulladékok előkészítése és hasznosítása. Miskolci Egyetem Mérnöktovábbképző Központ. (215. p.) 1999.

Competences: T1, T2, T14, K1, K4

Waste Processing Machines and their operationon

Curse Title: Waste Processing Machines and their operationon **Instructor**: Dr. Ádám Rácz, assistant professor	**Code:** MFEET730020 **Responsible department/institute:** Institute of Raw Mineral Preparation and Environmental Processing
Position in curriculum (which semester): 3.	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 2 +2	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 5	**Course:** full time

Course Description:
The aim of the subject for students is to learn knowledge about the design, operation and selection of machinery and equipment used in waste processing (shredding equipment, classification equipment, separators, biological thermal and chemical processing equipment (eg reactors).

Shredding equipment (hammer schredder, cutting mill, rotary cutter shredder) design, operation and selection. Classification equipment (flat and drum screen) design, operation and selection. Separator (magnetic, eddy current, electrostatic, air-flow separators) design, operation and selection. Biological thermal and chemical processing equipment (eg reactors) design, operation and selection.

Assessment and grading
Requirements of the signature:
Less than 20 % class missing
Presenting the laboratory measurements reports
Writing the classroom test successfully

Examination: Written and oral exam
Five grades scale
Assessment according to a five grade scale:
Missing basic knowledge – unacceptable
Student demonstrates basic knowledge – acceptable
Student demonstrates basic knowledge and can apply it in practice – intermediate
Student demonstrates system level knowledge in contexts – good
Student demonstrates outstanding system level knowledge in contexts – excellent

Assessment: 85 – 100: excellent (5), 75 – 84: good (4), 63 – 74: intermediate (3), 51 – 62: acceptable (2), ≤50: unacceptable (1).

Compulsory or recommended literature resources:
Lecture presentation slides and notes
Ernst Worrell And Markus A. Reuter Handbook Of Recycling State-Of- The-Art For Practitioners, Analysts, And Scientists ISBN: 978-0- 12-396459- 5

Tarján G.: Mineral Processing (Vol. 1, 2). AK. Bp.1981.

Competences: T4, T14, K10, F6