University of Miskolc
Faculty of Earth Science and Engineering
Earth Science engineering masters course
Course description

Table of Contents

Numerical methods and optimization

Branch	Semester	Requirements (practice mark, exam)	Number of credits	Number of lecture and practice hours during a week	Language
All branches	1.	Practice mark	2	1l+1p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Józsefné Mészáros dr.	associate professor	Department of Applied Mathematics

The main objectives of the course:
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.

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. Multi aided 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-correktor, finite differences.

Text books:

1. Jaroslav Ramík: Soft Computing: Overview and Recent Developments in Fuzzy Optimization, Listopad, 2001.
2. R. Fletcher: Practical Methods of Optimization, John Wiley &Sons, 2000.
3. Philip E. Gill, Walter Murray, Margaret H. Wright: Practical Optimization, Academic Press, 1981.
4. Jorge Nocedal, Stephen J. Wright: Numerical Optimization, Springer, 2000.

Engineering physics

Branch	Semester	Requirements	Credit	Weekly hours	Language
All branches	1	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Mihály Dobróka	University professor	Geophysical

Main objectives of the course:

Widening the knowlegde of physics for engineer students including parts of continuum physics related to geological process and understanding geophysical methods in more details.

Short curriculum of the course:

Fundamental concepts of continuum physics, relation between microscopic and macroscopic description. Spatial and time averaging. The principles of termodinamics in non-equilibrium state. The basic equations of continuum mechanics, substance equations, rock mechanical modells, principles of rheology. Wave propagation in rocks, dispersion, absorption. Guided waves.

Recommended bibliography:

Dobróka M.: An introduction to theoretical physics. Nemzeti Tankönyvkiadó, Budapest, 1993

Physical Geology

Branch	Semester	Requirements	Credit	Weekly hours	Language
all branches	1	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Éva Hartai	associate professor	Department of Geology and Mineral Resources

Main objectives of the course:

The main objective of the course is to extend the students' knowledge in the geological approach of phenomena and processes in / on the lithosphere and make them be familiar with the reconstruction of the geological processes.

Short curriculum of the course:

The role of physical geology in the geological research and exploration. Principles of stratigraphy, stratigraphic nomenclature. Stratotype, litho- bio- and chronostratigraphy. Modern stratigraphic methods: magneto-, chemo, seismo-, sequence- and cycle-stratigraphy. Reconstruction of paleogeographic environments. Recognition end interpretation of rock-forming processes and tectonic events, determination of their succession.

Recommended bibliography:

BARNES, C. W. (1988): Earth, Time and Life. John Wiley and Sons, New York
SKINNER, B. J., PORTER, S. C. (1995): The Dynamic Earth. *John Wiley and Sons,* New York
BROOKFIELD, M. (2006): Principles of Stratigraphy. *Blackwell Publishing,* New York

Mineralogy and Geochemistry

Branch	Semester	Requirements	Credit	Weekly hours	Language
all branches	1	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Sándor Szakáll	associate professor	Institute of Mineralogy and Geology

Main objectives of the course:

Students will get the knowledge of the principals of the distribution of chemical elements 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 deals with 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.

Short curriculum of the course:

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.

Recommended bibliography:

Albared, F. (2005): Geochemistry. An introduction. Cambridge Univ. Press.
Brownlow, A. H. (1996): Geochemistry. Prentice Hall, New Jersey.

Geodesy, spatial informatics

Branch	Semester	Requirements (practice mark, exam)	Number of credits	Number of lecture and practice hours during a week	Language
All branches	1.	Exam	4	2l+1p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Gábor Bartha	Full professor	Institute of Geophysics and Geoinformatics

The main objectives of the subject:
The students will acquire the principles of modern geomatics, its measuring methods and the application of IT in the subject. They will be prepared to apply the modern measuring technics, the remote data-acquiring methods and use them to solve practical problems. They will learn the application fields of geoinformatics and GIS programs. The students will be competent in the application of modern geodetic technology and geoinformatics in their field .

The short curriculum of the subject:
Coordinate Systems in geodesy. Geometric shape and gravitational field of Earth. Projections and mapping. Hungarian projections and mapping. Modern measuring technics in Geodesy: photogrammetry, remote-sensing, GPS, inertial measurements, SAR technology. Geo-objects and geo-models. Raster and Vectormodel. Datastoring technics. Database-modelling in geoinformatics. Thematical data and their storage problems. GIS packages. Digitalization, analitical problems, knowledge based systems in GIS environment.
Practical work: self-made solutions of simple case-study problems.

References:
Quest: Geodesy Tutorial
Vanicek,P.:Geodesy
Burkard,R.K.: Geodesy for the Layman
Short,N.: The Remote Sensing Tutorial

References are available for the students on CD.

Computer science for engineers

Branch	Semester	Requirements (practice mark, exam)	Number of credits	Number of lecture and practice hours during a week	Language
All branches	1.	Practice mark	2	0l+2p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Józsefné Mészáros dr.	associate professor	Department of Applied Mathematics

The main objectives of the course:

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

Programming and using of MATLAB environment (desktop): operation with matrices, elements of linear algebra, plot of one, two or three dimensional functions, printing, control statements, handle graphics and user interface.
Object-oriented programming. Design of programming. Computer aided solution plan for chosen problems. Numerical kernel: numerical methods, input-output. Using of files. User interface with karakters and graphics. Writing, testing an documentation for programs. Online and printed description of programs. Help and demo in programs. Printability for the results.

Basic concepts, objects of Maple programming language: definition and using of assign, variable, set, array, function. The Maple as programming language: using of array, conditional and loop statement. Definition and application of procedure. Main algorithm in Maple.
Graphics of Maple: plot and plot3d, animation statements. Using of files, applications.

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

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

Gradual research seminar

Branch	Semester	Requirements	Credit	Weekly hours	Language
all branches	1	p	2	0 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Ferenc Mádai	associate professor	Department of Geology and Mineral Resources

Main objectives of the course:

Introduction to the methods and rules of information gatering and scientific communication in fields of earth sciences.

Short curriculum of the course:

Editorial requirements of scientific publications and abstracts,
Referencing rules,
Rules of citation, ethical questions of citation,
Library usage, the screening of important journals,
Internet-based scientific literature,
Rules and requirements for oral presentations
Tips and requirements for poster presentation
“This is the way I do it” - opinions and advice of researchers on these topics,
Analysis and elaboration of selected papers, oral and writing presentation on a selected topic.

Recommended bibliography:

Textbooks and scientific journals in different fields of earth sciences

Legal and economic studies with regard to mining and geology

Branch	Semester	Requirements (practice mark, exam)	Number of credits	Number of lecture and practice hours during a week	Language
All branches	3.	exam	2	2l+0p	English

Subject leader and lecturer:

Name	Position	Department
Dr. Tamás Hámor	Invited lecturer, Head of department	Hungarian Office for Mining and Geology
Dr. Ferenc Mádai	Associate professor	Department of Mineralogy and Petrology

The main objectives of the subject:
The main objective is to provide an in-depth and practical knowledge of the supranational and national legislation and regulatory framework with regard to mining and geology.

The short curriculum of the subject:

1. Essential legal terms and definitions
2. Specific Community legislation of the European Union (the „acquis")
3. International conventions and standards
4. The Hungarian national mining and geology legislation
5. Other Hungarian acts on the environment, energy, water, etc.
6. Other national quasi-legislation (orders of MBFH) and the licensing framework

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1. The concept of sustainable development, its role for the mineral ectractive industry, marginal cost defining factors, concept of mineral rent,
2. The Hotelling rule and its resolution under certain conditions,
3. Financial analysis of mining projects, cost types, deposit parameters (flow, fund, bonity, quality),
4. Discounted cash flow methods in the mineral industry, mineral taxation

References:

Wagner H. et al. 2006: Minerals planning policies and supply practices in Europe – European Commission Directorate General Enterprise, University of Leoben, http://ec.europa.eu/enterprise/steel/index_en.htm

Hámor T. 2004: Sustainable mining in the European Union: The legislative aspect – Environmental Management, Vol. 33., pp. 252-261.

http://eur-lex.europa.eu/, http://www.mbfh.hu/hu/, http://www.eurogeosurveys.org/, http://www.euromines.org/

Pearce, D.W. & Turner R.K. *Economics of natural resources and the environment* (Harvester Wheatsheaf, London, 1990)

The minerals and metals policy of the Government of Canada: Partnerships for the sustainable development Ministry of Public Works and Government Services Canada, 1996

Tilton, J.E. *Exhaustible resources and sustainable development* 22 (1-2) Resources Policy 91 (1996)

Whateley, M.K.G. & Harvey, P.K. (eds.) *Mineral resource evaluation II: Methods and case stories* (Geological Society Spec. Publ. No. 79., London, 1994)

J. Otto & J. Cordes. *The Regulation of Mineral Enterprises: A Global Perspective on Economics, Law and Policy*; (RMMLF, 2002.)

J. Otto (Ed); *The Taxation of Mineral Enterprises*, (Graham and Trotman/Kluwer, London, 1995)

Quality management

Branch	Semester	Requirements (practice mark, exam)	Number of credits	Number of lecture and practice hours during a week	Language
All branches	3.	exam	2	2l+0p	Hungarian, English

Name of subject:	**Quality Management**	Classification of subject:
Subject leader:	**Dr. István Szintay, professor**	
Lectures: **D: 2+0/wk;**	Accomplishment: terminal examination	Credits: **2**
Preconditions:		

Description of knowledge of the subject, abilities to develop:

The objective of the subject is to let he students know the story of quality management and the main toolset and models of quality assurance and quality management. Theoretical and practical knowledge will be taught to make the students able to bear the basis of ISO 900x standards, TQM and EFQM excellence evaluation.

Lectures:

1. History of quality-management. EU-vision of quality: excellence, competitiveness
2. 8 dimensions of quality. Terms of quality. Influence factors of quality. Cost of quality.
3. Quality standards. General overview. ISO 900x standards. Model of quality assurance. Solutions based on requirements.
4. ISO 9001 standard: Commitment of management. Processes.
5. ISO 9001 standard: HRM. Measurement. Development.
6. IST analysis. Documents of quality management. Connection with the organizational regulation system.
7. Environmental management systems. ISO 14000 standard, structure of EMAS.
8. Documentation of integrated management systems. Quality audit: typology and systems.
9. Terminology of TQM. The 3 pillars of TQM. TQM techniques.
10. Processes of CQI and Kaizen. Connection with general problem analysis and solution methods.
11. Organizational self-evaluation and quality management. Blocks of EFQM modell (Enablers).
12. Blocks of EFQM model (Results). Test and descriptive evaluation.
13. Integrated management model. Connection between EFQM and BSC.
14. Convergence of quality management solutions. Product signs.

Excersises, students work: Analysis of case-studies and situations.

Literature to study:

- Minőségmenedzsment I. Elmélet. Ed: Szintay I. Bíbor kiadó, Miskolc, 2005.

Advised literature:

- A.R. Tenner – I.J. De Toro: Teljeskörű Minőségmenedzsment. Műszaki Kiadó, Budapest, 1997.
- Juhász G. – Kornai T.: Környezetirányítási kézikönyv. Az agrárium környezetirányítási vezetői és környezetvédelmi megbízottai számára. Budapest, Szaktudás Kiadóház, 2002.
- Kövesi J. – Topár J.: Minőségmenedzsment alapjai. TYPOTEX, Budapest, 2006.

Strategic management

Branch	Semester	Requirements (practice mark, exam)	Number of credits	Number of lecture and practice hours during a week	Language
All branches	4.	exam	2	2l+0p	English

Name of the subject:	**Strategic Management**		***Classification of the subject:*** KV
Responsible of the course:	István Szintay Ph.D. professor, institute director		
Participant instructors:	István Kunos Ph.D. associate professor		
Number of hours: 2+2 per week for full time students	**Requirement:** examination	**Number of credits:** 4	

Preliminarily conditions: -

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

Requirements during the semester:
Solving of tasks, creation of Business Plan.

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

Other remark: -

Safety techniques and labour safety

Branch	Semester	Requirements (practice mark, exam)	Number of credits	Number of lecture and practice hours during a week	Language
All branches	4	exam	2	2l + 0p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Tibor Szabó	Assistant professor	Petroleum Engineering

Prerequisites: -

Course Objectives:

Understand of the basic knowledges of safety techniques and labour safety.

Topics Covered & Course Description:

Basics of fire and explosion protection. Fundamentals of combustion theories, burnings of different materials, autoignitions. Fire protection. Safety aspects of pressure vessels and bottles and other equipment, machines and processes: safety devices, safety questions of settlements and operating. Chemicals safety. Personal protective equipment. Legal background and regulations of labour safety. Requirements for healthy and safe working. Objective and personal conditions of working. Special requirements of processes. The most important rights and duties of employees and employers.

Textbooks:

Általános tűzvédelmi ismeretek, Népszava Könyv Kft, 2008.
A tűzvédelmi törvény és az OTSZ, Népszava Könyv Kft, 2008.
Gázpalackok biztonsága, Népszava Könyv Kft, 2001.
A kémiai biztonság szabályozása, OTH OMMF kiadvány2005.
A munkavédelmi törvény magyarázata, KJK KERSZÖV, 2005. ISBN 9632247752
Jogszabályok

Applied geophysics I

Branch	Semester	Requirements	Credit	Weekly hours	Language
all branches	1	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Ákos Gyulai	professor	Department of Geophysics

Main objectives of the course:

to ensure suitable knowledge in surface geophysical methods and well logging in order to plan, carry out and interpret geophysical research/measurement after courses in data processing, inversion method and geophysical interpretation.

Short curriculum of the course:

Relationship between petrologic /rock physical and geophysical parameters. The solution of forward problem for 1D, 2D, 3D geological structures. Gravimetry, magnetic, electric, electromagnetic and seismic method in applied geophysics. Well logging methods. The interpretation methods of geophysical data.

Recommended bibliography:

Sharma P.V. : Environmental and engineering geophysics, Cambridge Univ. Press, 1997
Serra O. & L.: Well Logging data acquation and application, Serra Log, 2004

Data and information processing

Branch	Semester	Requirements	Credit	Weekly hours	Language
all branches	1	p	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Mihály Dobróka Dr. Endre Turai	university professor associate professor	Geophysical Department

Main objectives of the course:

Introducing students of Earth Science and Engineering to the basics of data and information processing.

Short curriculum of the course:

The principles of information theory. The theory of signals. The principles of data and information processing by means of inversion methods. Modeling, model types. Theoretical and measured characteristics. Error characteristic parameters in the data and the model space. The purport of local and global inversion methods. Spectral transformations (Fourier integral transformation, DFT, FFT, Z-transformation). Convolution, discrete convolution. Correlation functions, discrete correlation functions. Deterministic filtering. Image processing filters.

Recommended bibliography:

M. Bath: Spectral Analysis in Geophysics, Elsevier Scien. Publ. Co., Amsterdam - Oxford - New York, 1974.
A. Meskó: Digital Filtering, Akadémiai Kiadó, Budapest, 1984.

Structural geology

Branch	Semester	Requirements	Credit	Weekly hours	Language
All branches	2	e	4	1 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. György Less Dr. Norbert Németh	Associate professor Junior lecturer	Institute of Mineralogy and Geology

Main objectives of the course:

To introduce the students to the representation of the spatial position and structure of the rock bodies, furthermore, the deformation processes and features concerning these bodies and their physical background.

Short curriculum of the course:

Subject of the structural geology and tectonics, basic concepts. Tools and techniques of representation and analysis: maps, cross sections, stereograms. Description of stresses in rocks and deformations caused by them. Material behaviour and the formed brittle and ductile deformation features. Informations about the inner structure of the Earth. Tectonic features, plate tectonics.

Recommended bibliography:

Németh Norbert: A szerkezeti földtan és tektonika alapjai [Basics of structural geology and tectonics]. Manuscript (electronical). University of Miskolc, 2005, 60 p.

Ramsay, J. G. & Huber, M. I: The techniques of modern structural geology. Vol. 1: Strain Analysis. *Academic Press, London, 1983*, 1-308 p.

Ramsay, J. G. & Huber, M. I: The techniques of modern structural geology. Vol. 2: Folds and Fractures. *Academic Press, London, 1987*, 309-700 p.

Ramsay, J. G. & Lisle, R. J: The techniques of modern structural geology. Vol. 3: Applications of continuum mechanics in structural geology. *Academic Press, London, 2000*, 701-1062 p.

Twiss, R. J. & Moores, E. M: Structural Geology. *Freeman & Co., New York, 1992*, 532 p.

Twiss, R. J. & Moores, E. M: Tectonics. *Freeman & Co., New York, 1995*, 415 p.

Mineral Deposits

Branch	Semester	Requirements	Credit	Weekly hours	Language
All branches	2	e	4	2 l+1p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. János Földessy	Professor	Department of Geology and Mineral Deposits

Main objectives of the course:

The purpose of the course is to train the Earth Science and Engineer students to be familiar with the structures of the mineral deposits, the character and the spatial distribution of the mineral enrichments furthermore the qualitative and quantitative features in connection with the mineral ore deposits.

Short curriculum of the course:

In the introduction the students review the main mineral groups (ores, industrial minerals, fossil fuels, construction minerals) and the history of their exploration and application.
The next part introduces the students to the main types of the geological processes and their way of appearance. It covers the genetic and practical grouping of the ore minerals. It gives particular details about domestic and global occurrences of the major deposit types, their metallogeny. It prepares the students to recognize the geological attributes, the rock alteration, and structural preparedness. At the end it shows the more important industrial minerals quarries in Europe and in the world.
During the practical training the students become familiar with the geological parameters of the ore, non-metallic and fossil fuel sites and their ways of appearance. They learn about the material characteristics of industrial minerals and determination methods of the chemical and mineral phases. The students get acquainted with reading, constructing of geological maps, profiles and 3D interpretation concerning the economic minerals. On the practical training they study exploration sites and active mines.

Recommended bibliography:

Robb, L., (2005): Introduction to Ore-Forming Processes: Blackwell Publishing Co., 373 p. (ISBN 0-632-06378-5).
Dunning F.W. and A.M. Evans, editors (1986): Mineral Deposits of Europe. Vol. 3. Central Europe, The Institute of Mining and Metallurgy and The Mineralogical Society, London, 1986, 355 pp.
Cox, D.P., Singer D.A (1987): Mineral Deposit Models. USGS Bulletin 1693. 379 p.

Engineering- and Hydrogeology

Branch	Semester	Requirements	Credit	Weekly hours	Language
All branches	2	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Péter Szűcs Krisztina Beáta Faur	Associate professor Engineer	Department of Hydrogeology and Engineering Geology

Main objectives of the course:

The students will be familiar with the basic concepts of engineering geology, modern hydrogeology as well as field hydrogeology. The students will study about the soil classification, soil formation, laboratory and on-site soil tests, the relationships of rocks and groundwater, and about the phenomena of groundwater flow through the pores and fractures.

Short curriculum of the course:

Soil formation. Soil classification. Laboratory and on-site soil tests. Dynamic geological processes. Engineering geological analysis of buildings and plants. Engineering geological mapping. Engineering geological aspects of environmental protection. 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.

Recommended bibliography:

David Daming: Introduction to Hydrogeology, McGraw-Hill Higher Education, 2002.
F. G. Bell: Engineering Geology, Oxford, Blackwell Scientific Publications, 1992
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.
Neven Kresic: Quantitative Solutions in Hydrogeology and Groundwater Modeling. Lewis Publishers, 1997.

Analytical technics in mineralogy and petrology

Branch	Semester	Requirements	Credit	Weekly hours	Language
All branches	2	p	2	1 l+1p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Norbert Zajzon	Research fellow	Institute of Mineralogy and Geology

Main objectives of the course:

To give an introduction of the different analytical methods and instruments in mineralogy and petrology. The personal practice is an important part of the subject beside the theoretical knowledge. During these exercises, students can learn what kind of analytical technique could be used to solve a geological problem.

Short curriculum of the course:

Physical properties of minerals, hardness, cleavage, density measurement. Phase analysis, principle of the x-ray powder diffraction with individual practice. Theory of the differential thermal analysis, the thermogravimetry and the differential thermogravimetry with individual practice. Principles of the scanning electronmicroscopy, energy- and wavelength-dispersive x-ray microanalysis with individual practice. Data analysis, chemical formula calculations.

Recommended bibliography:

King M et al. (1993): Mineral Powder Diffraction File Search- and Databook. ICDD, USA.

Geological Interpretation and Prospecting

Branch	Semester	Requirements	Credit	Weekly hours	Language
All branches	3	e	4	2 l +2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. János Földessy	Professor	Department of Geology and Mineral Deposits

Main objectives of the course:

During the course the students get capacity to connect the methods of the geological environment and the different mineral resources investigations with field data collection, taking samples of drilling and interpreting the results of the observation and the preparation of the decision in the economical aspects of the investigation and evaluation of the results.

Short curriculum of the course:

The students get to know the most important methods of the investigations of the geological media and the exploration of the mineral resources. They become acquainted with the field work and the office evaluation processes. They work at the calculation, estimation, statistical methods with regard to the variability of the parameters of the geological media and the geological sampling. They learn about the procedure and methods of the preparation of the documentation furthermore the estimation process of the industrial mineral resource. The students get knowledge about the errors of the geological parameters and the ways of their reduction using archived exploration documentation.

During the practical training the students learn about data processing of the investigation data of the economic mineral deposits, the reading and construction of the maps of mineral occurrences, the quality assurance methods of the sampling procedure and the statistical elaboration of the raw material quality data from the samples furthermore the assessment of the statistical parameters. They train to apply the computer program packages for the geological documentation and evaluation.

Recommended bibliography:

Reedman J.H. (1979): Techniques of Mineral Exploration – Applied Science Publishers London 533 p.
Marjoribanks R.W. (1996): Geological methods in mineral exloration and mining – Chapman Hill, London, 115 p.
Kuzvart M., Böhmer M (1986): Prospecting and Exploration of Mineral Deposits. Elsevier, Amsterdam, 508 p. ISBN 0-444-99515-3

Geophysical interpretation and prospecting

Branch	Semester	Requirements	Credit	Weekly hours	Language
All branches	3	e	4	2 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Tamás Ormos	associate professor	Geophysical

Main objectives of the course:

In the scope of this subject students acquire knowledge about the closing phase of geological-geophysical exploration and study the linkage and hierarchy of different geophysical methods. They learn how to determine the most probable geological model by using geophysical measurement results and other geoscientific information jointly. They study the points of view of exploration and measurement planning related to the interpretation of data acquited.

Short curriculum of the course:

The principles of geological-geophysical exploration. The different phases of the geological-geophysical interpretation of geophysical measurement data. Solving the inverse problem in case of different geophysical methods, models and mineral stock types. Special problems of exploration: hydrocarbon, solid mineral and water exploration. Geophysical interpretation from the aspects of the protection of environment. Tackling theory with examples from Hungarian explorations with the help of recent computer-based interpretation systems.

Recommended bibliography:

Books:
Sheriff, R.E., Geldart L.P.: Exploration Seismology, Cambridge University Press 1995.
Goudswaard W. Jenyon, M.K.: Seismic Atlas of Structural and Stratigraphic Features. EAGE 1985.
Journals:
Different papers from Magyar Geofizika, Acta Geophysica at Geodetica, Geophysical Transactions, The Leading Edge, First Break, etc.
Work-help tutorials, geophysical softwares.

Historical geology

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geological Engineer	2	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. György Less	associate professor	Department of Geology and Mineral Resources

Main objectives of the course:

The aim of the subject is to give knowledge (1) on the role of time in the geological processes, (2) on the different methods of age-determination, (3) on the structural evolution of the Earth and (4) on the history of life in the Earth with special emphasis on the utility of all these in prospecting raw materials.

Short curriculum of the course:

Basic principles of stratigraphy, litho-, bio- and chronostratigraphy. Different methods of stratigraphical correlation and their significance in raw material prospecting. Age-determining methods: biostratigraphy, radiometry, magnetostratigraphy, chemostratigraphy, event stratigraphy, sequence stratigraphy. Reconstruction of different palaeoenvironments and their application in raw materail prospecting. Different magmatic, metamorphic and sedimentary facies types. The geological time scale, the structural, climatological and biological evolution of the Earth during the Precambrian, the Paleozoic, the Mesozoic and the Cenozoic. The evolution of Homoidea.

Recommended bibliography:

Levin, H.L. (2006) – The Earth Through Time, 8th Ed., 616 p., Wiley
Barnes, C.W. (1988): Earth, Time and Life. John Wiley and Sons, New York
Brookfield, M. (2006): Principles of Stratigraphy. *Blackwell Publishing,* New York

Hydrocarbon Geology

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geological Engineer	2	e	2	2 l+0 p	English

Subject leader and lecturer:

Name	Position	Department
Dr. István Bérczi	Professor	Department of Geology and Mineral Resources

Main objectives of the course:

To give a general overview of the

- terms and definitions;
- geological investigation and evaluation methods in the Upstream value chain (prospecting, exploration, field development, production)
- basic skills to conduct hydrocarbon geological studies.

Short curriculum of the course:

The genesis of oil and gas deposits/fields: geodynamic background, fundamentals of organic geochemistry, primary and secondary migration.
Basin analyses and thereafter: phases and methods of prospecting and exploration.
After a discovery: put your field on stream (from the end of exploratipon to the commencement of the production.
Core description, lithofacies modelling, depth matching, seismic validation. Hydrocarbon Geology in the field development. Stratigraphic and tectono-sedimentological modelling.
Lithology, pore-structure, contacts: key issues in calculating resources, reserves.
Saturation anomalies and their interpretation.
Static (geological) modelling: pressure surveys, production, daily rates as a validation of the static model
Geological fundaments of the dynamic model: a deterministic and a probabilistic approach.
Integrated G&G studies: OOIP/GIIP/PIIP, resources reserves
Oil and Gas Provinces of the Globe: resources/reserves and the future supply.

Recommended bibliography:

Bérczi István: Reservoir Geology (Manuscript, MOL 2007)

Geological mapping

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geological Engineer	2	p	4	1 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. György Less	associate professor	Department of Geology and Mineral Resources

Main objectives of the course:

The subject gives knowledge on the figuration of geological phenomena on topographic maps, on preparing geological maps, cross-sections, their legend and on assembling explanatory report.

Short curriculum of the course:

The aim of preparing geological maps. The geological map and its additional parts (geological cross-sections, stratigraphical columns and legend). Geological phenomena figured in the geological maps: lithostratigraphical units, structural chacteristics. Different types of geological boundaries and their recognition on the field. Orientation on the field with topographical map and with GPS. Documentation of field observations in the field booklet and on the topographical map. Preparation of covered and uncovered (without Quaternary deposits) geological map of an about 2 sq. km territory with one geological cross-section, with stratigraphical column and legend. Assembly of a short explanatory report (Introduction with technical data, Physiography, Previous geological investigations, Stratigraphy, Structural geology, Review of the geological development, Hydrogeology, Mineral raw materials, References).

Recommended bibliography:

Tearprock, D.J. & Bischke, R.E. (2002) – Applied Subsurface Geological Mapping with Structural Methods 2nd Edition, 846 p., Prentice Hall

Sedimentology

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geological Engineer	2	p	2	1 l+1 p	English

Subject leader and lecturer:

Name	Position	Department
Dr. István Bérczi	Professor	Department of Geology and Mineral Resources

Main objectives of the course:

To give a general overview of the

- fundamentals of the sedimentology (weathering, transport, depositional environments, diagenesis);
- the methods of sedimentological investigations (rock/core descriptions, textural-, mineralogical investigations, establishment of lithofacies matrix);
- steps of building a sedimentological model.

Short curriculum of the course:

- Sedimentology: a part and parcel of the Earth Sciences (scales and elements)
- Processes of sedimentation (weathering, transport, deposition/precipitation)
- Processes of diagenesis
- The geodynamic control on weathering, transport, deposition/precipitation, diagenesis
- The genesis, transport, deposition and diagenesis of clastic sediments
- Classification of the clastic sedimentary rocks
- Classification of the calcareous rocks
- Sedimentology of the fossil energy sources (coal, petroleum, uranium)
- Sedimentology of the ores and non-metallic minerals

Recommended bibliography:

Selley (2000): Applied sedimentology.- Academic Press, London

Geochemical exploration methods

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geological Engineer	2	p	4	1 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Ferenc Mádai	Associate professor	Department of Mineralogy and Petrology

Main objectives of the course:

Introduction into a basic area of mineral exploration methods, including the theorethical background of geochemical sampling, the detailed discussion of different sampling and analytical methods, as well as the methods of data processing and interpretation.
Completion of a geochemical exploration project, including field sampling, sample preparation, data processing and interpretation is an important part of the course.

Short curriculum of the course:

Geochemical distribution of chemical elements in different rock types, Concept of the geochemical background. Delineation of a mineralization, a mineral deposit. Primary dispersion, methods of its exploration. Geochemical aspects of weathering. Secondary dispersion and methods of its exploration. Sampling methods, sampling standards. Soil surveys, vegetation and water surveys. Stream sediment sampling methods. Heavy minerals geochemistry. Major analytical methods. Data processing and statistical methods.

Recommended bibliography:

Reedman J.H.: Techniques in mineral exploration (Appl. Sci. Publ. London, 1979)
Kuzvart M., Böhmer M (1986): Prospecting and Exploration of Mineral Deposits. Elsevier, Amsterdam, 508 p. ISBN 0-444-99515-3

Non-metallic industrial minerals

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geological Engineer	3	e	4	2 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. János Földessy	Professor	Department of Geology and Mineral Deposits

Main objectives of the course:

The purpose of the course is to train the Earth Science and Engineering students to be familiar with the structures of the non-metallic mineral deposits, the character and the distribution of the enrichments furthermore the qualitative and quantitative features in connection with the exploration sites and the industrial technological requirements concerning these materials.

Short curriculum of the course:

In the introduction the students review the main non-metallic mineral groups (industrial minerals, fossil fuels, construction minerals) furthermore these exploring and using history.
The first part shows the genetic classification of the industrial mineral. It gives particular examples about national and international occurrences from the upper groups.
The next part introduces the students to the main types of the geological processes and their way of appearance which influence the qualitative parameters of the non-metallic industrial mineral (like cation exchange capacity, bonding capability, whiteness, refractoriness, caloric heat).
It prepares the students to recognize the deleterious geological attributes and how to decrease these effects. At the end it presents the most important industrial mineral deposits in Europe and in the world.

During the practical training the students become familiar with the geological parameters of the non-metallic and fossil fuel sites and their ways of appearance, resource calculation, determination methods. They learn about the material characteristics of industrial minerals and determination methods of the chemical and mineral phases. The students get acquainted with reading, constructing of geological maps, profiles and 3D interpretation concerning the industrial minerals. On the practical training they study exploration sites and active mines.

Recommended bibliography:

Kuzvart M., Böhmer M (1986): Prospecting and Exploration of Mineral Deposits. Elsevier, Amsterdam, 508 p. ISBN 0-444-99515-3

Applied Environmental Geology

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geological Engineer	3	e	4	2 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Viktor Mádai	assistant professor	Institute of Geology and Mineral Resources

Main objectives of the course:

Preparing the students to predict undesirable changes of geosphere.

Short curriculum of the course:

Geological environment, natural potential, distinctive petrological characteristics of rocks, litostratigraphy, diagnostic features of surfacial rock-generating environment. Structural geology of surfacial geological environment. Changing of the surface of the Earth, surfacial movement. Weathering of rocks, pollution of eluviums and sediments. Changing of the geological media in urban places. Environmental classification, ecogeological danger, conflicts of using of lands. Scheme of geological (geoenvironmental) management, legal background of it. Effects of surfacial mass movements on man-made environment. Prevention of damages caused by mass movements. Geological problems of placement of communal and dangerous wastes.Basic data of environmental and hydrogeological effect studies. Evaluation, classification and necessity of archive information. Geoenvironmental surveying of effects of opening and closing mines. Construction principles of geomechanical atlases. Geology of environmental protection.

Recommended bibliography:

Erickson, J.: (2002) Environmental Geology: Facing the Challenges of Our Changing Earth (Living Earth) Amazon.com

Geophysical measurements

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	2	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Tamás Ormos	associate professor	Geophysical

Main objectives of the course:

Engineering Geophysicist students study the application of geophysical methods in different phases of mineral exploration including the planning of measurements and co-operation with collegues during the reserch and exploration work. Another purpose of the subject is acquiring field experiences about recently used geophysical instruments.

Short curriculum of the course:

The main tasks and general principles of mineral exploration. The basic principles of geophysical exploration. The basic principles of measurement deployment, planning. The technical phases of surveys, data processing and interpretation. Requirements for research reports. Field practice in the form of large-block.

Recommended bibliography:

Books:
Sheriff, R.E., Geldart L.P.: Exploration Seismology, Cambridge University Press 1995.

Journals:
Different papers from Magyar Geofizika, Geophysical Transactions, The Leading Edge, First Break, Near Surface Geophysics, etc.

Work-help tutorials, user manuals, geophysical softwares.

Engineering and environmental geophysics

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	2	p	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Tamás Ormos	associate professor	Geophysical

Main objectives of the course:

Analysis of the applicability of near-surface geophysical methods for geotechnical, engineering geological, hydrogeological and environmental issues. Overview of special geophysical methods and their developmental trends.

Short curriculum of the course:

Presenting DC and AC geoelectrical, GPR, seismic guided wave and recent refraction seismic methods in the frame of near-surface geophysical method group. Individual and joint interpretation (individual and joint inversion, tomography) of measured geophysical data based on different physical bases and their application to 1D, 1.5D, 2D and 3D models. Geophysical penetration sounding and applications. Studying the connection between geomechanical properties of rocks and geophysical parameters. Methods based on the synthesis and joint application of geophysical methods are learned by field and laboratory examples.

Recommended bibliography:

Knödel, K., Krummel, H., Lange.: Geophysik (in series: Handbuch zur Erkundung des Untergrundes von Deponien) Springer, Heidelberg, 2005.
Butler, D.K. (ed): Near-Surface Geophysics (in series: Investigations in Geophysics, No. 13.) SEG, Tulsa, 2005.
Journals:
Different papers from Magyar Geofizika, Geophysical Transactions, The Leading Edge, First Break, Near Surface Geophysics, etc.
Work-help tutorials. Geophysical acquisition, data processing and interpretation softwares.

Geophysical inversion

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	2	e	4	2 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Mihály Dobróka	professor	Geophysical

Main objectives of the course:

Geophysical students of Faculty of Earth Science and Engineering learn the modern inversion methods of reading out geological and geophysical information from the geophysical measurement data set.

Short curriculum of the course:

Linearizing the non-linear inverse problem. Linear inversion methods in case of over-, under- and mixed determined inverse problems. Regularization, weighting in data and model space, separately. Iteratively reweighted least squares method. Quality checking of estimated parameters. Solving the non-linear inverse problem by means of global optimization methods. Simulated Annealing and Genetic Algorithms method groups. The joint inversion procedure. Applications in case of different geophysical dat asets

Recommended bibliography:

W. Menke: Geophysical Data Analysis: Discrete Inverse Theory. Academix Press, Inc. ISBN 0.12.480820.5

Applied geophysics II

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	2	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Endre Turai	associate professor	Department of Geophysics

Main objectives of the course:

Introduce to the geophysical exploration methods of mineral raw materials and environmental analysis for MSc academic specialization in geophysical engineering.

Short curriculum of the course:

Geophysical methods for hydrocarbon exploration. Geophysical methods for water exploration. Geophysical methods for ore exploration. Geophysical methods for nonmetallic raw materials exploration. Geophysical methods for structure exploration. Geophysical methods for environmental analysis.

Recommended bibliography:

Kearey, Ph., Brooks, M., Hill, I.: An Introduction to Geophysical Exploration, Blackwell Publishing, 2004.
Educational handbooks,

Selected chapters of technical books and professional articles.

Geophysical data processing

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	3	e	4	2 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Endre Turai	associate professor	Department of Geophysics

Main objectives of the course:

Introduce to areas of geoinformatical sciences and the main tools for MSc academic specialization in geophysical engineering.

Short curriculum of the course:

Basis of the spectral geophysical information theory. Hierarchical connection between data, news and information. Classification of geophysical signal. Theory of deterministic and stochastic geophysical processes. Analysis and synthesis of the geophysical systems. Discreet signal theory. Spectral information content of discreet signals. Planning of digital recording systems. Spectral data processing procedures. Methods for raising of spectral information. Deterministic Real Time (RT) and Non Real Time (NRT) filtering procedures. Stochastic filtering. The general spectral analysis. Multidimensional filtering. Architecture of geophysical subsystems in Open GIS.

Recommended bibliography:

J. V. Candy: Signal Processing, McGraw - Hill Inc., 1986.
M. Bath: Spectral Analysis in Geophysics, Elsevier Scien. Publ. Co., Amsterdam - Oxford - New York, 1974.
A. Meskó: Digital Filtering, Akadémiai Kiadó, Budapest, 1984.

R. N. Bracewell: The Fourier Transform and its Applications, McGraw - Hill Book C., 1978.

Global environmental geophysics

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	3	e	2	1 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Ákos Gyulai	University professor	Geophysical

Main objectives of the course:

Training global environmental geophysics to a degree that graduated engineers can begin to work in the field of general geophysics and maintain communication with colleagues acting as experts in global environmental geophysics.

Short curriculum of the course:

Relationship between the potential of the Earth's gravity field and pressure field at surfaces with constant values in the state of equilibrium. Conclusion for the zonary composition of the Earth. Isostatical anomalies and interpretations for the ascending and descending trends for the investigated area, relationships with plate tectonics. The approximation of the Earth's magnetic field with magnetic dipol and its characterization. Timely variations in the magnetic field. The paleomagnetic method and its application. Determining the age of rocks by means of radiological methods. Heat flux measurements, hipertermal areas in the Earth. The macroseismic characterization of earthquakes, determining focal depth. Seismic zones of the Earth, plate tectonical relations. Records of seismological observatories and conclusions: elastic wave velocity and density distributions related to depth.

Recommended bibliography:

Frank Stacey & Paul Davis: Physics of the Earth. Cambridge Univ. Press, 4. edition (28 Aug 2008). ISBN-10: 0521873622

William Lowrie: Fundamentals of Geophysics 2nd edition, Cambridge Univ. Press. 2007. ISBN-13 978-0-521-85902-8

Geophysical Survey

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	3	e	4	2 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Gábor Pethő	Associate research professor	Department of Geophysics

Main objectives of the course:

The main objective of the course is to extend the students' knowledge in surface geophysical exploration based upon the content of the earlier geophysical courses. This course is recommended those students of geophysical and geoinformatical engineering specialization who are to defend MSc Thesis in the subject of surface geophysical methods.

Short curriculum of the course:

Based on the earlier surface geophysical (gravity, magnetic, geothermic, radiometric, geoelectric, electromagnetic) method this course yields the ways of forward modeling for different geological structures including 1D to 3D situations. Investigation of factors influencing the accuracy of forward modeling. Emphasis is also put on the investigation of the lateral and vertical resolution of the individual methods. Solution of inversion and joint inversion problems. Review of problems can be solved by the selected surface geophysical method(s), case histories.

Recommended bibliography:

Telford W.M.-Geldart L.P.-Sheriff R.E.: Applied Geophysics, 2nd ed., Cambridge Univ. Press, 1993.
Sharma P.W.: Environmental and engineering geophysics, Cambridge Univ. Press, 1997
Geophysics (SEG)
Geophysical Prospecting (EAEG)
Near Surface Geophysics (EAEG)

Borehole geophysics

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	3	e	4	2 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Mihály Dobróka	University professor	Geophysical

Main objectives of the course:

Introduction to well-logging methods and their application in solid mineral and hydrocarbon & water exploration. Geophysical engineer students could learn advanced data acquisition (logging), processing and interpretation methods.

Short curriculum of the course:

Petrophysical principles. The parts of the well-logging acquisition system. Lithology-sensitive (spontaneous potential, natural gamma ray, spectral gamma ray), porosity-sensitive (density, neutron, acoustic) and resistivity-sensitive (conventional, laterolog, induction, array resistivity) logging methods. Special measurements: image measurements based on resistivity, acoustics and optics. Nuclear magnetic resonance logging. Surveys in cased holes: well diagnostics and production well-logging. Extracting petrophysical parameters from well logs. Interpretation of hydrocarbon, bauxite, ore and water exploratory boreholes.

Recommended bibliography:

O. & L. Serra: Well Logging. Data acquisition and applications, Serralog, 2004. ISBN: 978295156125

Seismics

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geophysical Engineer	3	e	4	2 l+2 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Tamás Ormos	associate professor	Geophysical

Main objectives of the course:

The subject is optional, which is for widening the knowledge of seismic methods acquired theretofore. Learning the new results and trends in seismic measurement, data processing and interpretation

Short curriculum of the course:

The subject contains topics related to new results and development trends in seismic measurement, data processing and interpretation. Special topics chosen are changing year by year from the field of mineral stock exploration (oil and gas especially) and seismic method development (direct and inverse problems). The subject serves as an intensification of the topic chosen for the diploma work as well.

Recommended bibliography:

Books:
Sheriff, R.E., Geldart L.P.: Exploration Seismology, Cambridge University Press 1995.
Helbig K., Treitel S. (Ed's): Seismic Exploration (in Series. Handbook of Geophysical Exploration) Vols: 2-20. Geophysical Press 1987.

Journals:
Papers from Magyar Geofizika, Geophysical Transactions, Geophysics, Geophysical Prospecting.

Work-help tutorials from Department of Geophysics and seismic softwares.

Operating systems

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical Engineer	2	e	2	1 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Gábor Bartha	professor	Institute of Geophysics and Geoinformatics

Main objectives of the course:

Introduction into the important operating systems for the students of course Geoinformation Engineering.

Short curriculum of the course:

Operating Systems (concept, definition, history, types, role , interfaces). Architecture of Operating Systems (structure and operation; development of UNIX,Windows systems and their struture). User Interface of Operating Systems (interface types; UNIX user interface - user ID, login, remote login, shell, commands, file-management, piping, programs; Windows NT user interface - user ID, login, change user, messages,graphical interface, programs,services, cmd; X Window System). Processes in Operating Systems (process and thread, their models in operating systems, parallel processes and threads, process management in UNIX and NT systems). CPU timing (concept and strategies, timing in UNIX and NT systems). Storage ad File Management (central storage management, allocation methods, paging, segment management, virtual storage management, memory management in UNIX and NT systems, file management in UNIX and NT systems). Security of Operating Systems (inside security – secure domains, access attributes and authorisations; outside security – frequent problems and security methods; security operation in NT and UNIX systems). Distributed System (concept, distributed services, distributed file systems – NFS system)

Recommended bibliography:

Tannenbaum: Modern Operating Systems, Prentice Hall, 1992.
Haralick, RM.: „Computer Vision I-II”. Addison Wesley, 1992
Tzafestas, S.G.: ”Intelligent robotic systems”. Dekker Inc., 1991.

G. C. Barney: Intelligent Instrumentation. Prentice Hall 1985.

Geoinformatics I

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical Engineer	2	e	3	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Endre Turai	associate professor	Department of Geophysics

Main objectives of the course:

Introduce to the basis of geoinformatics and areas of science included geoinformatical subsystems for MSc academic specialization in geoinformatical engineering.

Short curriculum of the course:

Basis of the information theory. Relation between informatics, spatial informatics and geoinformatics. Elements of geoinformatics. Information and open GIS based geoinformation systems. The importance of geoinformation in the research and exploration. Development of Artificial Intelligence Systems. Data acquisition process and its general characteristics. Flow of the data- and information processing and its principal methods.

Recommended bibliography:

M. Bath: Spectral Analysis in Geophysics, Elsevier Scien. Publ. Co., Amsterdam - Oxford - New York, 1974.
A. Meskó: Digital Filtering, Akadémiai Kiadó, Budapest, 1984.

R. N. Bracewell: The Fourier Transform and its Applications, McGraw - Hill Book C., 1978.

Software engineering

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical Engineer	2	e	3	1 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Tamás Ormos Dr. Norbert Péter Szabó	Associate professor Junior lecturer	Geophysical

Main objectives of the course:

Practical training of algorithmizing and solving programming exercises, coming up in technical sciences and engineering applications, with up-to-date softwer development systems.

Short curriculum of the course:

Base concepts of computing technique, algorithmizing. Steps of program development, the program architecture and the main elements of it. Data stuctures, procedures, functions and cicles. Units. The principles of structured programming. Programming operations with matrix-based data structure. Developing scripts and program modules in MATLAB software development system. Planning and developing numerical algorithms. Solving special geo-engineering, data processing and applied mathematical exercises. Using the built-in functions and toolboxes of the development system in programming.

Recommended bibliography:

Stoyan Gisbert: Matlab, Typotex 2005., ISBN 963 9548 499

Database systems

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical engineer	2	p	2	1 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Gábor Bartha	professor	Institute of Geophysics and Geoinformatics

Main objectives of the course:

Introduction into the important dbase systems for the students of course Geoinformation Engineering.

Short curriculum of the course:

Basic Concepts of dBase Management (informationand data; information systems; filesystem; record, field, key, index; dBase, DBS and DBMS; dBase types; hashing; dBase technologies). Data modelling (data models, components, types; object; E/R model; conversion of E/R model into hierahic model). Relation algebra, calculus és datamodel (operations: selection, projection, join, extension, grouping; operators; datahandling operation; first, second,third normal form; dekomposition; RDBMS-types; structural elements: field, domain, relation, table,scheme; relations; key and foreign key; conversion E/R modell into relation model: 1:N és N:M relations). SQL language (SQL in dBase management, SQL history, SQL86, SQL89 and SQL92 SQL components; a selection, projection, join, grouping withSELECT; HAVING, ORDER BY option; security commands; special operators; alias names; recursive query; structure modifications)

Recommended bibliography:

J. D. Ullmann, J. Widom: Adatbázis-rendszerek (Alapvetés). Paem-Prentice-Hall, 1998.
C.Batini - S.Ceri -S.B.Navathe: Conceptual Database Design, An Entity-Relationship Approach
H.F. Korth - A. Silberschatz: Database systems concepts.

J. D Ullman: Principles of Database and Knowledge-Base Systems

Geoinformation processing I

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical engineer	2	e	4	2 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Mihály Dobróka	Professor	Geophysical

Main objectives of the course:

Introduction geoinformatical students to inversion methods used for the processing of geoinformation.

Short curriculum of the course:

Parameters of data and information processing by inversion. One and multi-dimensional inversion reconstruction. Local inversion methods: gradient method, Newton-Gauss method, damped least squares method. Global inversion methods: Monte Carlo method, SA method, Genetic Algorithms, methods based on Fuzzy logic, method of neural networks.

Recommended bibliography:

W. Menke: Geophysical Data Analysis: Discrete Inverse Theory. Academix Press, Inc. ISBN 0.12.480820.5

Hardware knowledge

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical engineer	3	p	2	0 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Károly Jónap	Senior research fellow	Universit of Miskolc, Research Institute of Applied Chemistry

Main objectives of the course:

Familiarizing parts of the hardver system of a computer for students in Engineering in Geoinformatics MSc.

Short curriculum of the course:

The different microprocessor's structures and architectures, selecting aspects. General purpose CISC – Complex Instruction Set for Computer, RISC – Reduced Instruction Set for Computer, DSP – Digital Signal Processors and Embedded controller's structures and application. Communication systems for computer (serial and parallel). How to connect the equipments to the computer systems; stand-alone controllers; information system. Devices of the data acquisition and control systems. Intelligent sensor's architecture. Vision systems – features and application. Data input and output equipments for computers – structures and features. Distributed system application in oil, gas, energy and chemical industries.

Recommended bibliography:

Haralick, RM.: „Computer Vision I-II". Addison Wesley, 1992
Tzafestas, S.G.: "Intelligent robotic systems". Dekker Inc., 1991.
G. C. Barney: Intelligent Instrumentation. Prentice Hall 1985.
Issues by Intel, AMD, Analog Devices, etc.

Geoinformatics II

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical engineer	3	e	2	1 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Endre Turai	associate professor	Department of Geophysics

Main objectives of the course:

Introduce to geological-geophysical and self-governing systems for MSc academic specialization in geoinformatical engineering.

Short curriculum of the course:

State constitutional system of geological exploration and its formation. The geological official data acquisition, presentational and exploration tasks of state. Database of the Hungarian State Geological, Geophysical and Mining Storage and its availability. GIS applications in geology. Information collection in the phase of geological exploration. Information systems in the geological survey of highly developed countries. International data service and the possibility of data availability in the World. The fundamental conceptions of mineral estate record and economical estimation. Mineral estate of Hungary. Geoinformatical systems of county- and city development.

Recommended bibliography:

W. Tang, J. Selwood: Connecting Our World GIS Web Services, ESRI Press, Redlands - California, 2003.
Working with GeoMedia Professional, Intergraph, 1999.

Selected chapters of technical books and professional articles

Geoinformation processing II

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical engineer	3	e	2	2 l+0 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Endre Turai Dr. Mihály Dobróka	Associate professor Professor	Geophysical

Main objectives of the course:

Introduction geoinformatical students to spectral methods used for the processing of geoinformation.

Short curriculum of the course:

Digital data acquisition systems. Windowing, functions. Analysis and synthesis of deterministic convolution systems. Analysis and synthesis of stochastic systems. Designing filters and filtering in the time-domain. Designing filters and filtering in the frequency-domain. Convolution RT and NRT filtering. Recursive filtering. Stochastic filtering: optimum filtering, correlation filtering, deconvolution filtering, polarization filtering. Methods for determination of power-density spectrum: Bartlett windowing, MLM and MEM methods.

Recommended bibliography:

M. Bath: Spectral Analysis in Geophysics, Elsevier Scien. Publ. Co., Amsterdam - Oxford - New York, 1974.
A. Meskó: Digital Filtering, Akadémiai Kiadó, Budapest, 1984.
R. N. Bracewell: The Fourier Transform and its Applications, McGraw - Hill Book C., 1978.

Computer networks

Branch	Semester	Requirements	Credit	Weekly hours	Language
Geoinformatical engineer	3	p	2	1 l+1 p	Hungarian, English

Subject leader and lecturer:

Name	Position	Department
Dr. Károly Jónap	Senior research fellow	University of Miskolc, Research Institute of Applied Chemistry

Main objectives of the course:

Familiarizing computer network systems for students of Engineering in Geoinformatics MSc..

Short curriculum of the course:

Computer network's structures – LAN, MAN and WAN. The ISO-OSI Model using, networking standards. The different computer network's features and application. Computer protocols and application in network systems, multiprotocol architectures. Local and remote systems application in the computer network. Wireless technologies. Global Position System architectures. Standard communication system for computer networks. Internet, intranet and remote system: configuration, installation and services. Geoinformatic system features. Hardware and software structures of the field communication networks. Industrial measurement and control system's network architectures.

Recommended bibliography:

F. Zhao, L. Guibas: Wireless Sensor Networks. Elsevier , 2004.
F. Zhao, L. Guibas: Information Processing in Sensor Networks. Palo Alto. 2003.
Issues by: 3Com, Cisco, etc.