Syllabuses

MS in Petroleum Engineering

Subject	Code
Numerical Methods and Optimization	GEMAK712MA
Applied Geology	MFFTT710003
Fluid Mechanics	MFKGT710005
Applied Geophysics	MFFGT710005
Drilling Engineering I	MFKOT710002
Reservoir Engineering Fundamentals	MFKOT710004
Production Engineering Fundamentals	MFKOT710005
Transport of Hydrocarbons	MFKOT710006
Reservoir Lab	MFKOT710007
Production Technology Lab I	MFKOT710008
Drilling Design I	MFKOT710009
Computer Applications I	MFKOT720009
Oilfield Chemistry	MFKOT720011
Graduate Research Seminar	MFFAT720006
Petroleum Economics	MFKOT720012
Drilling Engineering II	MFKOT720013
Well Completion Design	MFKOT720014
Flow in Porous Media	MFKOT720015
Material Balance	MFKOT720016
Artificial Lifting I	MFKOT720017
Production Technology Lab II	MFKOT720010
Drilling Design II	MFKOT720018
Compulsory Electives 1. Groundwater Modeling.	MFKHT720015
Computer Applications II	MFKOT730010
Artificial Lifting II	MFKOT730011
EOR Methods	MFKOT730013
Well Control Lab	MFKOT730014
Reservoir Management, Simulation Lab	MFKOT730015
NODAL Analysis Applications	MFKOT730016
Compulsory Electives 2. Hydrogeology	MFKHT730017
Free Electives Geothermal Well Drilling	MFKOT730025
Geothermal Energy	MFKGT740001
HSE in Petroleum Engineering	MFKOT740003

Course Title: Numerical Methods and Optimization **Instructor:** Dr. Józsefné Mészáros	**Code:** GEMAK712MA **Responsible department/institute: GEMAN**
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

Course Description:

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. Multiaided and multicriteria decision problems (Pareto efficient solutions). Linear programming. About Soft Computing (SC) methods: fuzzy systems, genetic algorithms, neural network. Numerical solutions of ordinary differential equations and system of equations: Runge-Kutta, predictor-corrector, finite differences.

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:

- Égertné, M. É., Kálovics, F., Mészáros, G.: Numerical Analysis I.-II. (Lecture notes), 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.
- *Galántai Aurél-Jeney András*: Numerikus Módszerek; Miskolci Egyetemi Kiadó, 1997.
- *Galántai Aurél*: Optimalizálási módszerek; Miskolci Egyetemi Kiadó, 2004.

Course Title: Applied Geology **Instructor:** Dr. Éva Hartai	**Code:** MFFTT710003 **Responsible department/institute: MFFTT**
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 inner structure of Earth. Plate tectonics and hydrocarbon generation. Hydrocarbon-geological aspects of magmatic, sedimentary and metamorphic rocks. Generation of hydrocarbons. Primary and secondary migration. Characteristics of reservoirs. Porosity, permeability, the effects of grain size and sorting. Trapping mechanisms trap types. Carbon-dioxide storage in geological reservoirs.

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:

- Stoneley, R.: Introduction to Petroleum Exploration for Non-geologists. Oxford University Press, 1995, ISBN 0 19 854856 7
- Landes, K. K.: Petroleum Geology. John Wiley & Sons, 1959
- Pápay, J.: Development of Petroleum Reservoirs. Akadémiai Kiadó, 2003, ISBN 963 05 7927 8

Course Title: Fluid Mechanics **Instructor:** Dr. Elemér Bobok	**Code: MFKGT710005** **Responsible department/institute: GMTSZ/KFGI**
Position in curriculum (which semester): 1	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 3+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 3	**Course:** full time

Course Description:

Kinematics. Conservation of mass. Balance Equations of momentum. Perfect Fluid Flow. Euler's equation. Bernoulli equation. Elements of gas dynamics. Bernoulli equation with friction. Laminar and turbulent flow in pipes. Determination of pressure losses. Moody's diagram. Pressure losses in gas transporting pipe-lines.

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:

- E. Bobok: Fluid Mechanics for Petroleum Engineers. Elsevier, Amsterdam, London, New York, Tokyo, 1993. ISBN: 10: 0-444-98668-5
- V. L. Streeter, E. B. Wylie, K. W. Bedford: Fluid Mechanics. WCB/McGraw-Hill 1998, ISBN 0-07-062537-9
- R. Bird, W. Stewart, E. Lightfoot: Transport Phenomena. John Wiley and Sons, New York, 2007. ISBN: 978-0-470-11539-8
- Bobok E.: Fluid Mechanics. 2013.
- Streeter W. et. al: Fluid Mechanics, Auckland: McGraw-Hill, 1983.

Course Title: Applied Geophysics **Instructor:** Dr. Gábor Pethő	**Code:** MFFGT710005 **Responsible department/institute: MFGFT**
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 most important geophysical parameters used in HC exploration. Geophysical exploration methods and their resolutions. Geophysical methods detecting HC in direct or indirect way. Time-lapse (including 4D) geophysical measurements. Physical bases and instrumentation of bore-hole geophysical measurements. The main features of wire line logging, logging while drilling and production well logging. The determination of porosity, permeability, water and HC saturation. Log indicators of overpressured zones. Technical measurements and their applications. Information gained by logging in cased holes. Detecting well problems. Application of logging in injection, production and monitoring wells. Geophysical case histories including exploration and production.

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:

- Sheriff R.E., Geldart L.P. : Exploration Seismology 2nd Edition, Cambridge University Press, New York, ISBN-10 0-521-46826-4, 1995.
- Bacon M., Simm R., Redshaw T.: 3-D Seismic Interpretation, Cambridge University Press, Cambridge, ISBN 978 0 521 71066, 2003.
- Serra O.: Well Logging and Reservoir Evaluation, Technip, Paris, ISBN 978-2-7108-0881-7, 2007
- Schlumberger: Cased Hole Log Interpretation Principles/Applications, Schlumberger Educational Services, Houston, 1989

Course Title: Drilling Engineering I. **Instructor:** Dr. Tibor Szabó	**Code:** MFKOT710002 **Responsible department/institute:** **OMTSZ/KFGI**
Position in curriculum (which semester): 1	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 3+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 3	**Course:** full time

Course Description:

The main subjects of the curriculum: tubing string design, recommended torque for threaded coupling, tubing elongation, tubing movements, introduction of packer types, calculation of packer forces, connection between tubing and packer, well completion tools selection, perforating techniques, control the formation damage, well completion fluids, gravel pack techniques, formation stimulation, hydraulic fracturing, matrix acidizing, coiled tubing operations, wireline operations, nitrogen operations, well completion quality control.

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:

- H. Rabia: Oilwell Drilling Engineering. Principles and Practice. Graham Tratman Ltd. London 1995. 322 p.
- Howard B. Bradley: Petroleum Engineering Handbook, Third Printing, Society of Petroleum Engineers, Richardson, TX, U.S.A. 1992.
- Drilling Data Handbook, Edition Technip, Paris ISBN 2-2108-0756-4, 1999. 542 p.
- Erik B. Nelson: Well Cementing. Schlumberger Educational Services. Second Edition, Houston Texas, 2006
- H. Dale Beggs: Gas production operation. OGCI Publications, Tulsa, 1984.
- Arthur Lubinski (Edited by Stefan Miska): Development of Petroleum Engineering I-II. Gulf Publishing Company, Houston, 1987.

Course Title: Reservoir Engineering Fundamentals **Instructor:** Dr. Tibor Bódi	**Code:** MFKOT710004 **Responsible department/institute: AFKI**
Position in curriculum (which semester): 1	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 3+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 3	**Course:** full time

Course Description:

Basic terms of porous media filtration. Continuity law. Governing equations of slightly compressible flow. Multiphase flow. Steady-state flow. Complex potential. Conformal mapping. Superposition. Non steady-state, transient flow. Immiscible, two phase flow, frontal oil displacement.

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:

- Craft and Hawkins: Applied Petroleum Reservoir Engineering, Prentice Hall, 1991, ISBN 0-13-039884-5
- Towler: Fundamental Principles of Reservoir Engineering, SPE Textbook Series, Vol.8., 2002, ISBN 1-55563-092-8
- T. Ahmed: Advanced Reservoir Engineering, Gulf Publishing Co. 2005, ISBN-13: 978-0-7506-7733-2
- T. Ahmed: Reservoir Engineering Handbook, Gulf Publishing Co., 2001, ISBN 0-88415-770-9
- L. P. Dake: Fundamentals of Reservoir Engineering, Elsevier, 1978, ISBN 0-444-41830-X
- János Török, Lipót Fürcht, Tibor Bódi: PVT Properties of Reservoir Fluids. (Book). University of Miskolc Miskolc, Hungary 2012. ISBN 978-963-661-988-5 p. 1-192

Course Title: Production Engineering Fundamentals **Instructor:** Dr. Gábor Takács	**Code:** MFKOT710005 **Responsible department/institute: OMTSZ/KFGI**
Position in curriculum (which semester): 1	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 3+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 3	**Course:** full time

Course Description:

Introduction to artificial lifting: history, main features, comparison. Components of the sucker-rod pumping system: downhole pumps, sucker-rod string. Mechanical design of the sucker-rod string, failure modes. Surface equipment, pumping units, unit geometries, kinematics of pumping units. Gearboxes, prime movers.

Calculation of operational parameters of rod pumping: approximate models. Dynamics of rod strings. The API RP 11L model: calculation accuracy, application ranges. Simulation of the sucker-rod string's behavior. Forms of the one-dimensional wave equation, solution methods, calculation of downhole cards. Torsional analysis of pumping units, optimum counterbalancing. Design of the pumping system, selection of the optimum pumping mode. Intermittent pumping. Analysis of the pumping system's operation: well testing, the use of dynamometers, evaluation of dynamometer cards.

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:

- A.P. Szilas: Production and Transport of Oil and Gas. Part A., Akadémiai Kiadó, Budapest, 1986.
- Takács G.: Fundamentals of Production Engineering. okt. segédlet, Miskolci Egyetem, 2005, 161p.
- G. Takács: Gas Lift Manual., PennWell Corporation, Tulsa, USA. 2005. 478p, ISBN 0-87814-805-1.
- G. Takács: Fundamentals of Production Engineering., oktatási segédlet, Miskolci Egyetem, 2005.
- George V.Chilingarian et.al.: Surface Operations in Petroleum Production II, Elsevier, 1989
- Larry W. Lace: General Engineering, Petroleum Engineering Handbook Vol 1, SPE, 2006

Course Title: Transport of Hydrocarbons **Instructor:** Dr. Zoltán Turzó	**Code:** MFKOT710006 **Responsible department/institute:** **OMTSZ/KFGI**
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):** practical mark
Credits: 3	**Course:** full time

Course Description:

Hydraulics: Pressure drop in liquid and gas carrying pipelines. Thermodynamics: Temperature of oil in buried pipeline. Pressure loss calculation. Pipeline engineering: Determination of pipe diameters and thickness. Parallel lines, booster pumps. Pipeline construction. Centrifugal pumps and gas compressors: Series and parallel pumps, characteristic curves, control. Instrumentation: Pipeline and metering station instrumentation. Maintenance: Pipeline inspection and repairs, limits of imperfection. MAOP calculation.

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:

- Szilas, A.P.: Production and Transport of Oil and Gas. Part A., Akadémiai Kiadó, Budapest, 1986., ISBN 963-05-3363-4
- Szilas, A.P.: Production and Transport of Oil and Gas. Part B., Akadémiai Kiadó, Budapest, 1986., ISBN 963-05-3938-1
- Kennedy, J. L.: Oil and Gas Pipeline Fundamentals, 1993. Penn Well Books. ISBN 0-87814-390-4
- J. N. H. Tiratsoo: Pipeline Pigging Technology, 1998. Gulf Professional Publishing ISBN 0-87201-426-6
- E. L. Upp: Fluid Flow Measurement, 1993. Gulf Professional Publishing ISBN 0-88415-017-8

Course Title: Reservoir Lab **Instructor:** Dr. Tibor Bódi	**Code:** MFKOT710007 **Responsible department/institute: AFKI**
Position in curriculum (which semester): 1	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 0+3	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 3	**Course:** full time

Course Description:

Practical measurements and calculations of petro physical and fluid parameters for optimal exploration of oil and gas reservoirs. Determination of initial hydrocarbons in place via volumetric and statistical methods. Objective of the course is to show laboratory equipment that are able to determine those petro physical properties which influence production and fluid bearing capabilities of fluid bearing formations, along with calculation methods and their practical application. The course contains practical application of correlation methods which are able to calculate fluid phase behavior and pressure and temperature dependent properties like formation volume factor, density, viscosity, solution gas, etc.

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:

- J. Pápay: Development of Petroleum Reservoirs, Akadémiai Kiadó, Budapest 2003. ISBN 963 05 7927 8
- János Török, Lipót Fürcht, Tibor Bódi: PVT Properties of Reservoir Fluids. (Book). University of Miskolc Miskolc, Hungary 2012. ISBN 978-963-661-988-5 p. 1-192.
- C. H Whitson, M. R. Brule: Phase Behavior. SPE Monograph Volume 20. Richardon, Texas, 2000. ISBN:978-1-55563-087-4.
- H. C. “Slip” Slider: Worldwide Practical Petroleum Reservoir Engineering Methods, 1983. PennWellBooks, ISBN 0-87814-234-7
- L. P. Dake: Fundamentals of Reservoir Engineering, 1978. Elsevier, ISBN 0-444-41830-X

Course Title: Production Technology Lab I. **Instructor:** Dr. Zoltán Turzó	**Code:** MFKOT710008 **Responsible department/institute: OMTSZ/KFGI**
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):** practical mark
Credits: 2	**Course:** full time

Course Description:

Calculations for the following topics: Properties of oilfield fluids and gases. Inflow performance of oil wells. Single-phase flow. Multiphase flow in oil wells: empirical correlations, mechanistic models, gradient curves. Horizontal and inclined flow of multiphase mixtures. Multiphase flow through chokes. Temperature conditions in hydrocarbon producing wells.

Continuous flow and intermittent gas lifting. Unloading of continuous flow gas lift wells, unloading valve string design.

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:

- Szilas, A.P.: Production and Transport of Oil and Gas. Part A., Akadémiai Kiadó, Budapest, 1986., ISBN 963-05-3363-4
- Takács, G.: Fundamentals of Production Engineering. okt. segédlet, Miskolci Egyetem, 2005, 161p.
- Takács, G.: Gas Lift Manual., PennWell Corporation, Tulsa, USA. 2005. 478p, ISBN 0-87814-805-1.
- George V.Chilingarian et.al.: Surface Operations in Petroleum Production II, Elsevier, 1989
- Larry W. Lace: General Engineering, Petroleum Engineering Handbook Vol 1, SPE, 2006
- W. D. McCain, Jr.: The Properties of Petroleum Fluids, 1990. PennWell Books, ISBN 0-87814-335-1

Course Title: Drilling Design I. **Instructor:** Dr. Tibor Szabó	**Code:** MFKOT710009 **Responsible department/institute: OMTSZ/KFGI**
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):** practical mark
Credits: 2	**Course:** full time

Course Description:

The basic calculations related to the drilling rig components, the drilling process, Unit systems, the drill string design: drill string elements and their functions, typical BHA configurations, drill string design calculation. Hoisting: hoisting elements and their functions, drilling line design, ton miles calculation. Drill bits: design and classification of roller and diamond bits, dull bit evaluation, drill bit selection (drilling cost calculation). Vertical and directional drilling and related calculations. Casing design.

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:

- H. Rabia: Oilwell Drilling Engineering. Principles and Practice. Graham Tratman Ltd. London 1995.
- Howard B. Bradley: Petroleum Engineering Handbook, Third Printing, Society of Petroleum Engineers, Richardson, TX, U.S.A. 1992.
- Drilling Data Handbook, Edition Technip, Paris ISBN 2-2108-0756-4, 1999.
- Erik B. Nelson: Well Cementing. Schlumberger Educational Services. Second Edition, Houston Texas, 2006
- Arthur Lubinski (Edited by Stefan Miska): Development of Petroleum Engineering I-II. Gulf Publishing Company, Houston, 1987.

Course Title: Computer Applications I. **Instructor:** Dr. Zoltán Turzó	**Code:** MFKOT720009 **Responsible department/institute: OMTSZ/KFGI**
Position in curriculum (which semester): 2	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 2	**Course:** full time

Course Description:

Hardware components of personal computers. Operating systems: General introduction of operating systems; Windows operating system: Usage of graphical user interface (GUI). Important system components. Hard disk maintenance. Installing new software and hardware components. Maintenance of software system.

Computer networks: Local Area Networks, Wide Area Networks. Networking with Windows.

Internet and intranets. Protocols: TCP/IP, FTP, HTTP.

Electronic mail, mailing programs, WWW, Searching on the Web.

General description of word-processing. Microsoft Word: creating and formatting simple documents. Writing and managing of longer documents (i.e. thesis). Useful tools of Word: spelling, thesaurus etc.

Creation of presentations slides using Microsoft PowerPoint.

General descriptions of spreadsheet programs. Microsoft Excel: creating and formatting tables and diagrams. Using equations: operators and built-in engineering functions. Writing user functions in Visual Basic programming language of Excel. Database management inside Excel: sorting, filtering and maintenance.

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:

User manuals of the given computer programs.

Course Title: Oilfield Chemistry **Instructor:** Dr. István Lakatos	**Code:** MFKOT720011 **Responsible department/institute: AFKI**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** Reservoir Engineering Fundamentals
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:

Fundamentals of physical chemistry and colloid chemistry: behavior of real gases, equilibria, reaction kinetics, sorption phenomena, rheology, diffusion, colloid systems, surface and interfacial tension, capillary forces, wettability, properties of suspensions and emulsions. Chemistry of drilling muds and well completion fluids. Chemical well stimulation methods including hydraulic fracturing, acidization, profile control in water injection wells, chemical methods providing selective fluid flow in oil and gas producing wells (water shutoff treatments and GOR improving techniques). Fundamentals of intensive flooding technologies addressing the whole reservoir space. Chemical aspects of improved and enhanced oil and gas productions methods (IOR/EOR and IGR/EGR), including the thermal, gas injection and chemical (alkaline, surfactant and polymer) technologies. Mitigation of formation damage by chemicals, bottomhole clean-up for paraffin, asphaltene deposits, and chemical sand control in wells. Basics of water technology: composition of formation waters, mechanism of scale formation, their inhibition and removal of inorganic scales by chemicals. Surface and underground corrosion of metallic structures, types and origin of corrosion, corrosion inhibitors. Hydrocarbon hydrates and inhibition of hydrate formation at well site and transport pipelines.

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:

- Laider, K. J., Meiser, J. H.: "Physical Chemistry" Houghton Miffin Co., ISBN 0-395-91848-0, Boston (USA), 1999
- Atkins, P. W.: "Physical Chemistry", Oxford Univ. Press, ISBN 0-19-850102-1, Oxford (UK), 1998
- Green, D. W., Willhite, G. P.: "Enhanced Oil Recovery", SPE Inc., ISBN 1-55563-077-4, Richardson (USA), 1998
- Schechter, R. S.: "Oil Well Stimulation", Prentice Hall International, ISBN 0-13-949934-2, Englewood Cliffs (USA), 1992
- Jones, L. W.: "Corrosion and Water Technology for Petroleum Producers", Oil and Gas Consultants International Inc., ISBN 0-930972-09-0, Tulsa (USA), 1990

Course Title: Graduate Research Seminar **Instructor:** Dr. Ferenc Mádai	**Code:** MFFAT720006 **Responsible department/institute: MFFAT**
Position in curriculum (which semester): 2	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 2	**Course:** full time

Course Description:

The purpose of the course – as in many different universities in the world – is to introduce the methods of information gathering and evaluation, formal and ethic requirements of scientific communication, rules for preparation of oral and poster presentations. During the course these general requirements are actualized to the field of earth science and engineering. Examples and exercises will use English publications and text materials.

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:

- L. C. Perelman, J. Paradis, and E. Barrett: The Mayfield Handbook of Technical and Scientific Writing (McGraw-Hill, 2001)
- G. J. Alred, C. T. Brusaw, and W. E. Oliu: Handbook of Technical Writing, (St. Martin's, New York, 2003)
- Hagan P., Mort P. 2014: Report writing giude for mining engineers. Mining Education Australia.
- Day R.A., Gastel B.: How to write and publish a scientific paper. Greenwood, 2011.
- ISO 690-2: Information and documentation - Bibliographic references.
- Taylor G. A Student's Writing Guide. How to Plan and Write Successful Essays. Cambridge University Press, 2009
- Chen Ch., Härdle W., Unwin A. (Editors): Handbook of Data Visualization. Springer, 2008

Course Title: Petroleum Economics **Instructor:** Dr. Zsolt Komlósi	**Code:** MFKOT720012 **Responsible department/institute: OMTSZ/KFGI**
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:

Brief summary of some general economic issues in macro-economics, micro-economics, company management (Porter's model) and decision theory. Basis of economic approach including cash flow modeling, time preference (concept of compound interest and present value). Forecast of key factors determining E&P business in the future. Methods determining key economic indicators. Features of appraisal individual projects applying economic indicators and their constraints in risk-free case. Basic geological, technical and economical features of petroleum industry investment in case of exploration, field development, production and abandonment (risks, resources, reserves, venture capital). Crude oil and natural gas price history and price forecasting models. Risks "measurements" and their impact on project value (expected value concept, Monte Carlo simulation). Evaluation uncertainty and risk of various parameter estimates and their impact on (economic) indicators calculated. Non-quantifiable (risk) factors and their impact on project evaluation. Assessment of project groups (portfolio evaluation). The place and role of oil companies worldwide: typical contracts and tax systems in various countries ranked in terms of hydrocarbon availability, profitability and risk.

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:

- Seba, R.D. (1998): Economics of Worldwide Petroleum Production. OGCI Publications Tulsa, p.582
- Megill, R.E. (1984): An Introduction to Risk Analysis. 2. Ed., PennWell Books Tulsa, p.274.
- Brealey/Mayers (2003): Principles of Corporate Finance, McGraw-Hill ISBN: 0072467665
- D. Johnston (1992): Oil Company Financial Analysis in Nontechnical Language (Pennwell Nontechnical Series)
- SPE (2007): Petroleum Resources Management System http://www.spe.org/industry/reserves/docs/Petroleum_Resources_Management_System_2007.pdf

Course Title: Drilling Engineering II. **Instructor:** Dr. Tibor Szabó	**Code:** MFKOT720013 **Responsible department/institute:** **OMTSZ/KFGI**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** Drilling Engineering I.
No. of contact hours per week (lecture + seminar): 3+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 3	**Course:** full time

Course Description:

The main subjects of the curriculum: wellbore stability, determination of rock properties, stress distribution around the wellbore, preventing borehole instability, primary cementing design, selection of cement and additives, cement slurry lab test, cementing calculations, effective mud removal, surface equipment and subsurface tools of cementing operation, two stage cementing operation, liner cementing, squeeze cement operation, cement job evaluation, foam cement applications, managed pressure drilling technology and surface equipment, mud logging, elements of well costing and affecting for well costing, drilling time estimate, drilling risk estimates, contracting strategies.

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:

- H. Rabia: Oilwell Drilling Engineering. Principles and Practice. Graham Tratman Ltd. London 1995. 322 p.
- Howard B. Bradley: Petroleum Engineering Handbook, Third Printing, Society of Petroleum Engineers, Richardson, TX, U.S.A. 1992.
- Drilling Data Handbook, Edítion Technip, Paris ISBN 2-2108-0756-4, 1999. 542 p.
- Erik B. Nelson: Well Cementing. Schlumberger Educational Services. Second Edition, Houston Texas, 2006.
- Arthur Lubinski (Edited by Stefan Miska): Development of Petroleum Engineering I-II. Gulf Publishing Company, Houston, 1987.

Course Title: Well Completion Design **Instructor:** Dr. Tibor Szabó	**Code:** MFKOT720014 **Responsible department/institute:** **OMTSZ/KFGI**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** Drilling engineering I.
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 main subjects of the curriculum: tubing string design, recommended torque for threaded coupling, tubing elongation, tubing movements, introduction of packer types, calculation of packer forces, connection between tubing and packer, well completion tools selection, perforating techniques, control the formation damage, well completion fluids, gravel pack techniques, formation stimulation, hydraulic fracturing, matrix acidizing, coiled tubing operations, wireline operations, nitrogen operations, well completion quality control.

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:

- H. Rabia: Oilwell Drilling Engineering. Principles and Practice. Graham Tratman Ltd. London 1995. 322 p.
- Howard B. Bradley: Petroleum Engineering Handbook, Third Printing, Society of Petroleum Engineers, Richardson, TX, U.S.A. 1992.
- Drilling Data Handbook, Edítion Technip, Paris ISBN 2-2108-0756-4, 1999. 542 p.
- Erik B. Nelson: Well Cementing. Schlumberger Educational Services. Second Edition, Houston Texas, 2006.
- Arthur Lubinski (Edited by Stefan Miska): Development of Petroleum Engineering I-II. Gulf Publishing Company, Houston, 1987.

Course Title: Flow in Porous Media **Instructor:** Dr. Tibor Bódi	**Code:** MFKOT720015 **Responsible department/institute: AFKI**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** Reservoir Engineering Fundamentals
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 2	**Course:** full time

Course Description:

Basic terms of porous media filtration. Continuity law. Governing equations of slightly compressible flow. Multiphase flow. Steady-state flow. Complex potential. Conformal mapping. Superposition. Non steady-state, transient flow. Immiscible, two phase flow, frontal oil displacement.

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:

- Craft and Hawkins: Applied Petroleum Reservoir Engineering, Prentice Hall, 1991, ISBN 0-13-039884-5
- Towler: Fundamental Principles of Reservoir Engineering, SPE Textbook Series, Vol.8., 2002, ISBN 1-55563-092-8
- T. Ahmed: Advanced Reservoir Engineering, Gulf Publishing Co. 2005, ISBN-13: 978-0-7506-7733-2
- T. Ahmed: Reservoir Engineering Handbook, Gulf Publishing Co., 2001, ISBN 0-88415-770-9
- L. P. Dake: Fundamentals of Reservoir Engineering, Elsevier, 1978, ISBN 0-444-41830-X

Course Title: Material Balance **Instructor:** Dr. Tibor Bódi	**Code:** MFKOT720016 **Responsible department/institute: AFKI**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** Reservoir Engineering Fundamentals
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:

Basic terms, conditions. Different forms of the material balance equation. Material Balance of the saturated oil reservoir. Average pressure. Drive mechanics, drive indices. Material balance equation of a gas reservoir. Water influx. Volumetric and open reservoirs. Cole and Campbell plots for gas and oil reservoirs. Hydrocarbon in Place Estimation with material balance. Havlena-Odeh, Tehrani, Sills methods. Prediction with material balance.

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:

- J. Pápay: Development of Petroleum Reservoirs, Akadémiai Kiadó, Budapest 2003. ISBN 963 05 7927 8
- Craft and Hawkins: Applied Petroleum Reservoir Engineering, Prentice Hall, 1991, ISBN 0-13-039884-5
- Towler: Fundamental Principles of Reservoir Engineering, SPE Textbook Series, Vol.8., 2002, ISBN 1-55563-092-8
- T. Ahmed: Advanced Reservoir Engineering, Gulf Publishing Co. 2005, ISBN-13: 978-0-7506-7733-2
- T. Ahmed: Reservoir Engineering Handbook, Gulf Publishing Co., 2001, ISBN 0-88415-770-9
- L.P.Dake: Fundamentals of Reservoir Engineering, Elsevier, 1978, ISBN 0-444-41830-X

Course Title: Artificial Lifting I. **Instructor:** Dr. Gábor Takács	**Code:** MFKOT720017 **Responsible department/institute:** **OMTSZ/KFGI**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** Production engineering fundamentals
No. of contact hours per week (lecture + seminar): 3+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 3	**Course:** full time

Course description:

Introduction to artificial lifting: history, main features, comparison. Components of the sucker-rod pumping system: downhole pumps, sucker-rod string. Mechanical design of the sucker-rod string, failure modes. Surface equipment, pumping units, unit geometries, kinematics of pumping units. Gearboxes, prime movers.

Calculation of operational parameters of rod pumping: approximate models. Dynamics of rod strings. The API RP 11L model: calculation accuracy, application ranges. Simulation of the sucker-rod string's behavior. Forms of the one-dimensional wave equation, solution methods, calculation of downhole cards. Torsional analysis of pumping units, optimum counterbalancing. Design of the pumping system, selection of the optimum pumping mode. Intermittent pumping. Analysis of the pumping system's operation: well testing, the use of dynamometers, evaluation of dynamometer cards.

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:

- Takács G.: Basic sucker rod pumping. Miskolc, ME, 1992. 321 p.
- Takács G.: Sucker-rod pumping manual. Tulsa : PennWell, 2003. 395 p. ISBN 0 87814 899 2
- G. Takács: Modern sucker-rod pumping. Tulsa : PennWell, 1993. 230 p. ISBN 0 87814 383 1
- Production Operations Engineering, Petroleum Engineering Handbook Vol 4, SPE, 2006
- George V.Chilingarian et.al.: Surface Operations in Petroleum Production II, Elsevier, 1989.
- Szilas, A.P.: Production and Transport of Oil and Gas. Part B., Akadémiai Kiadó, Budapest, 1986., ISBN 963-05-3363-4

Course Title: Production Technology Lab II. **Instructor:** Dr. Zoltán Turzó	**Code:** MFKOT720010 **Responsible department/institute: OMTSZ/KFGI**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** Production Technology Lab I.
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 2	**Course:** full time

Course Description:

Calculations for the following topics: Mechanical design of the sucker-rod string. Calculation of operational parameters of rod pumping: approximate models, the API RP 11L model, downhole cards. Torsional analysis of pumping units, optimum counterbalancing. Design of the pumping system, selection of the optimum pumping mode. Analysis of the pumping system's operation: well testing, the use of dynamometers, evaluation of dynamometer cards.

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:

- Cholet, H.: Progressing cavity pumps. Editions Technip, Paris. 1997. 112p. ISBN 2-7108-0724-6.
- G Takacs.: Sucker-rod pumping manual. Tulsa : PennWell, 2003. 395 p. ISBN 0 87814 899 2
- G. Takács: Modern sucker-rod pumping. Tulsa : PennWell, 1993. 230 p. ISBN 0 87814 383 1
- Production Operations Engineering, Petroleum Engineering Handbook Vol 4, SPE, 2006
- George V.Chilingarian et.al.: Surface Operations in Petroleum Production II, Elsevier, 1989.
- Szilas, A.P.: Production and Transport of Oil and Gas. Part B., Akadémiai Kiadó, Budapest, 1986., ISBN 963-05-3363-4

Course Title: Drilling Design II. **Instructor:** Dr. Tibor Szabó	**Code:** MFKOT720018 **Responsible department/institute:** **OMTSZ/KFGI**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** Drilling design I.
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 2	**Course:** full time

Course Description:

The basics of fluids flow: flow regimes, fluid types, rheological parameters of fluids and measurement. Drilling mud: functions, types, drilling mud properties and additives, drilling mud calculations, solids control equipment. Rig hydraulics: pressure losses calculations, optimization of rig hydraulic, bit nozzle selection, determination of optimal flow regime. Fracturing gradient, Cementing: functions of cement slurry, cement types, cement classification, cement and cement additives, cement properties, cement design and calculations.

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:

- H. Rabia: Oilwell Drilling Engineering. Principles and Practice. Graham Tratman Ltd. London 1995. 322 p.
- Howard B. Bradley: Petroleum Engineering Handbook, Third Printing, Society of Petroleum Engineers, Richardson, TX, U.S.A. 1992.
- Drilling Data Handbook, Edítion Technip, Paris ISBN 2-2108-0756-4, 1999. 542 p.
- Erik B. Nelson: Well Cementing. Schlumberger Educational Services. Second Edition, Houston Texas, 2006.
- Arthur Lubinski (Edited by Stefan Miska): Development of Petroleum Engineering I-II. Gulf Publishing Company, Houston, 1987.

Course Title: Compulsory Electives 1. Groundwater modeling **Instructor:** Dr. Balázs Kovács	**Code:** MFKHT720015 **Responsible department/institute:** KGI
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:

The course on groundwater modeling gives an overview on the possibilities of numerical simulation of groundwater in different reservoirs. The course is dominantly practice oriented that uses a freeware code called Processing MODFLOW to understand groundwater motion. All students may use either their own notebook or the computers of the computer lab of the Oil and Gas Institute to perform the jobs during the course. The course starts with a short introduction to modeling principles and the theory of groundwater motion. After the short theoretical introduction the "getting started" part of the software usage will be completed. Using simple examples the most important modeling techniques are presented to the students. During the rest of the semester a common work on computers is done to solve tasks of step-by-step increasing complexity. The students must complete several stand-alone simulation tasks at home during the semester that makes a relevant part of the course grading (home-work). After closing each course section a stand-alone model building task is required to be successfully completed in the class-room as part of the final course grading (major exam).

Assessment and grading:

Students will be assessed with using the following elements.

Attendance:	10 %
Homework	40 %
Midterm exam	50 %
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:

- Kinzelbach (1986): Groundwater modeling, with sample program sin BASIC, Elsevier
- Kresic (1997) : Quantitative solutions in Hydrogeology and Groundwater Modeling, CRC Lewis Press
- Chiang, W-Hs (2005): 3D-Groundwater Modeling with PMWIN: A Simulation System for Modeling Groundwater Flow and Transport Processes, Springer Verlag
- Simcore Software (2012) Processing Modflow An Integrated Modeling Environment for the Simulation of Groundwater Flow, Transport and Reactive Processes, Users Guide

Course Title: Computer Applications II. **Instructor:** Dr. Zoltán Turzó	**Code:** MFKOT730010 **Responsible department/institute: OMTSZ/KFGI**
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):**practical mark
Credits: 3	**Course:** full time

Course Description:

Database management using Microsoft Access: user interface, elements of databases, relational databases. Creation of queries and reports. Database maintenance.

General descriptions of CAD programs. Creation of simple engineering drawings using AutoCAD: user interface, drawing elements. Three-dimensional drawings.

General descriptions of mathematical programs, Usage of MathCAD program: simple calculations, graphics, matrix operations, processing and analyzing measured data, programming, integral and differential calculations.

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:

User manuals of the given computer programs.

Course Title: Artificial Lifting II **Instructor:** Dr. Gábor Takács	**Code:** MFKOT730011 **Responsible department/institute:** OMTSZ/KFGI
Position in curriculum (which semester): 3	**Pre-requisites (if any):** Artificial Lifting I
No. of contact hours per week (lecture + seminar): 3+0	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 3	**Course:** full time

Introduction to ESP operations: history, main features. Hydraulic, electrical backgrounds. Components and their operation: centrifugal pump, performance curves. Construction of the electric motor, operational features, starting. Temperature conditions of ESP motors. Functions and main parts of protectors. Construction and operation of gas separators. The downhole cable: construction, materials, operational features. Ancillary downhole equipment.
Application of ESP units in special conditions. Producing high viscosity fluids. Production of gassy fluids: pump performance deterioration. Possible solutions: use of natural gas separation, gas separators, others. Abrasive, high-temperature fluid pumping. Variable speed drives: construction and operation of VSD drives. Design of ESP installations for low and high gas contents. Analysis of ESP system operation: NODAL Analysis. Energy conditions of ESP operation. Monitoring of system operation, typical failures, their elimination.
Main features of PCP systems. System components: PCP pump, rod string, surface drives. Basics of PCP installation design.

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:

- Cholet, H.: Progressing cavity pumps. Editions Technip, Paris. 1997. 112p. ISBN 2-7108-0724-6.
- G Takacs.: Sucker-rod pumping manual. Tulsa : PennWell, 2003. 395 p. ISBN 0 87814 899 2
- Production Operations Engineering, Petroleum Engineering Handbook Vol 4, SPE, 2006
- George V. Chilingarian et.al.: Surface Operations in Petroleum Production II, Elsevier, 1989.
- Szilas, A.P.: Production and Transport of Oil and Gas. Part B., Akadémiai Kiadó, Budapest, 1986., ISBN 963-05-3363-4
- Takács G.: Production technology 2. Univ. of Miskolc, 1991. 216p.

Course Title: EOR Methods **Instructor:** Dr. Tibor Bódi	**Code:** MFKOT730013 **Responsible department/institute: AFKI**
Position in curriculum (which semester): 3	**Pre-requisites (if any):** Reservoir Engineering Fundamentals
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:

To teach students production procedures, methods producing hydrocarbon reservoirs with higher recovery factor (EOR, IOR). To prepare students for inter disciplinary sciences and how to apply them to oil reservoirs. Hydrodynamic principles of oil displacement with miscible and immiscible fluids. Areal and edge flooding methods: well systems, displacement, areal and vertical displacement and volumetric efficiencies, and how they can be influenced. Enhanced Oil Recovery methods (EOR). Oil displacement by CO2 injection. Oil displacement by polymer flooding. Oil displacement with tensides, with polymer-tensides, with foam. Thermal methods like in-situ combustion (wet combustion), hot water injection, steam injection.

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:

- Craft and Hawkins: Applied Petroleum Reservoir Engineering, Prentice Hall, 1991, ISBN 0-13-039884-5
- Towler: Fundamental Principles of Reservoir Engineering, SPE Textbook Series, Vol.8., 2002, ISBN 1-55563-092-8
- T. Ahmed: Advanced Reservoir Engineering, Gulf Publishing Co. 2005, ISBN-13: 978-0-7506-7733-2
- T. Ahmed: Reservoir Engineering Handbook, Gulf Publishing Co., 2001, ISBN 0-88415-770-9
- L. P. Dake: Fundamentals of Reservoir Engineering, Elsevier, 1978, ISBN 0-444-41830-X

Course Title: Well Control Lab **Instructor:** Dr. Tibor Szabó	**Code:** MFKOT730014 **Responsible department/institute: OMTSZ/KFGI**
Position in curriculum (which semester): 3	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 0+3	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 3	**Course:** full time

Course Description:

Causes of kicks, warning signs of kicks, shutting-in procedures, the risk of shallow gas, stripping operation, pressure balance in the hole, behavior of gas in the well, well control methods, well control equipment, BOP stack arrangements, manifolds and valves systems, other devices, the functions and capacity of the accumulator unit, pressure testing of well control equipment, regulations and standards.

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:

- T. Bell, D. Eby, J. Larrison, B. Ranka: Blowout Prevention, 4th Ed. ISBN 0-88698-242-1. 2009.
- R. Baker: Practical Well Control, 4th Ed. ISBN 0-88698-183-2. 1998.
- R. Grace: Blowout and Well Control Handbook, Gulf Publishing Company, ISBN: 0750677082.
- R. D. Grace: Advanced Blowout & Well Control, Gulf Publishing Company, 1994, ISBN 0-88415-260-X.

Course Title: Reservoir Management, Simulation Lab **Instructor:** Dr. Tibor Bódi	**Code:** MFKOT730015 **Responsible department/institute: AFKI**
Position in curriculum (which semester): 3	**Pre-requisites (if any):** Reservoir Engineering Fundamentals
No. of contact hours per week (lecture + seminar): 0+3	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 3	**Course:** full time

Course Description:

Definition of reservoir management. Short history. Basics of reservoir management. Goals. Realization. Monitoring. Evaluation. Case studies. Data acquisition and analysis. Material Balance calculations. Numerical simulation. Economic considerations. Risk analysis. EOR methods. Case studies.

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:

- Fanci: Principles of Applied Reservoir Simulation, Gulf Publishing Co. 2001, ISBN 0-88415-372-X
- Ertekin – AbouKassem - King: Basic Applied Reservoir Simulation, SPE Textbook Series, 2001, ISBN 1-55563-089-8
- T. Ahmed: Advanced Reservoir Engineering, Gulf Publishing Co. 2005, ISBN-13: 978-0-7506-7733-2
- A. Satter: Integrated Petroleum Reservoir management: A Team Approach. Pennwell Books, 1994, ISBN 0-87814-408-0
- A. Satter: Computer Assisted Reservoir Management Pennwell Books, ISBN**:** 978-0-87814-777-9

Course Title: NODAL Analysis Applications **Instructor:** Dr. Zoltán Turzó	**Code:** MFKOT730016 **Responsible department/institute: OMTSZ/KFGI**
Position in curriculum (which semester): 3	**Pre-requisites (if any):** Production Technology Lab II.
No. of contact hours per week (lecture + seminar): 0+2	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 2	**Course:** full time

Course Description:

General introduction of NODAL Analysis programs. Building of the NODAL Analysis model. Testing of the model using field data. Using of the model for inspection, optimization and design. Connection to other simulators. Nodal Analysis of: flowing, gas lifted, sucker rod, electrical submersible or PCP pumped wells. Simulation and optimization of networks and gathering systems.

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:

- Beggs, H. D.: Production Optimization Using NODAL Analysis, OGCI Publications, 2003. ISBN: 0-930972-14-7
- Takács, G.: Gas Lift Manual., PennWell Corporation, Tulsa, USA. 2005. 478p, ISBN 0-87814-805-1.
- Takács, G.: Sucker-rod pumping manual. Tulsa : PennWell, 2003. 395 p. ISBN 0 87814 899 2
- Takács, G.: Electrical submersible pumps manual. Elsevier, 2009. 425 p. ISBN 978 1 85617 557 9.
- Cholet, H.: Progressing cavity pumps. Editions Technip, Paris. 1997. 112p. ISBN 2-7108-0724-6.

Course Title: Compulsory electives 2. Hydrogeology **Instructor:** Dr. Péter Szűcs	**Code:** MFKHT730017 **Responsible department/institute: KGI**
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):** examination
Credits: 2	**Course:** full time

Course Description: This course covers fundamentals of subsurface flow and transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater.

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:

- Freeze, R. Allan, Cherry, John A.: Groundwater, Practice Hall Inc. 1979. 604 p. ISBN 0-13-365312-9
- Fetter, C. W.: Applied Hydrogeology, Practice Hall Inc., 2000. 597 p. ISBN 0-13-088239-9
- József Tóth: Gravitational Systems of Groundwater Flow. Cambridge University Press, 2009. 297 p. ISBN-13 978-0-521-88638-3
- Poehls, D.J. Smith, Gregory J.: Encyclopedic Dictionary of Hydrogeology. Elsevier Inc. 2009. 517 p. ISBN: 978-0-12-558690-0

Course Title: Free electives: Geothermal Well Drilling **Instructor:** Dr. Tibor Szabó	**Code:** MFKOT730025 **Responsible department/institute: KFGI**
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):** examination
Credits: 2	**Course:** full time

Course Description:

The Geothermal drilling process, the special drill string elements and drill string design, drill string loadings, drill bit selection for Geothermal Well Drilling, specialties in drilling mud engineering, and rig hydraulics, determination of fracturing gradient, casing shoe selection, casing design, factors affecting casing, biaxial forces determination in casing design, bending forces, running casing operations, unscheduled event during drilling operation, wellbore stability, determination of rock properties, stress distribution around the wellbore, preventing borehole instability, primary cementing design, selection of cement and additives, cement slurry lab test, cementing calculations, effective mud removal, elements of well costing and affecting for well costing, drilling time estimate, drilling risk estimates, contracting strategies.

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:

- H. Rabia: Oilwell Drilling Engineering. Principles and Practice. Graham Tratman Ltd. London 1995. 322 p.
- Howard B. Bradley: Petroleum Engineering Handbook, Third Printing, Society of Petroleum Engineers, Richardson, TX, U.S.A. 1992.
- Drilling Data Handbook, Edítion Technip, Paris ISBN 2-2108-0756-4, 1999. 542 p.
- Erik B. Nelson: Well Cementing. Schlumberger Educational Services. Second Edition, Houston Texas, 2006.

Course Title: Geothermal energy **Instructor:** Dr. Anikó Nóra Tóth	**Code:** MFKGT740001 **Responsible department/institute: MFKGT**
Position in curriculum (which semester): 4	**Pre-requisites (if any): -**
No. of contact hours per week (lecture + seminar): 2+1	**Type of Assessment (examination / practical mark / other):** practical mark
Credits: 3	**Course:** full time

Course Description:

Geothermal energy phenomena. Geothermal reservoirs. Geothermal heat flow. Simple analytical reservoir models. Geothermal drilling practice. Well test analysis. Heat transfer in geothermal wells. Production from a geothermal well. Steam and hot water transmission by pipe-line. Direct application. EGS system. Sustainability and depletion. Geothermal heat pump. Environmental effects.

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:

- R. Horne: Modern Well Test Analysis: A Computer-Aided Approach. Petroway, Inc., 1995, ISBN 0-9626992-1-7.
- J.W. Lund: Geothermal Direct-Use Engineering and Design Guidebook. Geo-Heat Center, Oregon Institute of Technology, 1998, ISBN 1-880228-00-9.
- E. Huenges: Geothermal Energy Systems: Exploration, Development, and Utilization. Wiley-VCH Verlag GmbH & Co. 2010. ISBN: 978-3-527-40831-3.
- D. Chnadrasekharam, J. Bundschuh: Geothermal Energy Resources. Sweet & Zeitlinger B.V. Lisse, Netherlands, 2002 ISBN 90-5809522-3

Course Title: HSE in petroleum engineering **Instructor:** Dr. Tibor Szabó	**Code:** MFKOT740003 **Responsible department/institute: OMTSZ/KFGI**
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:

Basics of fire and explosion protection. Fundamentals of combustion theories, burnings of different materials, auto ignitions. 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 labors 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.

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:

- Design of plant, equipment and workplaces. Dangerous Substances and Explosives Regulations, 2003. ISBN 978 0 7176 2199 6
- Storage of dangerous substances./ Dangerous Substances and Explosive Regulations, 2003. ISBN 978 0 7176 2200 9.
- Dangerous Substances and Explosive Atmospheres Dangerous Substances and Explosive Atmospheres Regulations, 2003. ISBN 978 0 7176 2203 0
- Manufacture and storage of explosives Manufacture and Storage of Explosives Regulations, 2005. ISBN 978 0 7176 2816 2