



GEOPHYSICAL EXPLORATION METHODS II

MS in Earth Science Engineering / Specialisation in Geophysical Engineering

Semester 2, 2017/18

The course was not started in the semester.

COURSE COMMUNICATION FOLDER

**University of Miskolc
Faculty of Earth Science and Engineering
Institute of Geophysics and Geoinformatics**

Course datasheet

<p>Course Title: Geophysical Exploration Methods II</p> <p>Instructors: Péter Tamás Vass Dr., associate professor, Tamás Fancsik Dr., associate professor, Endre Turai Dr., associate professor, Norbert Péter Szabó Dr., associate professor</p>	<p>Code: MFGFT720015</p> <p>Responsible department/institute: Institute of Geophysics and Geoinformatics / Department of Geophysics</p> <p>Type of course: Compulsory</p>
<p>Position in curriculum (which semester): 2</p>	<p>Pre-requisites (if any) MFGFT710004</p>
<p>No. of contact hours per week (lecture + seminar): 2+1</p>	<p>Type of Assessment (examination/ practical mark / other): examination</p>
<p>Credits: 4</p>	<p>Course: full time</p>
<p>Course Description: The main objective of the subject is to familiarize the students specialized in geophysical engineering with the details of different geophysical methods used in the fields of raw-material exploration and environmental investigations. <i>The short curriculum of the subject:</i> Gravity and magnetic methods, data processing and interpretation. Geoelectrical and electromagnetic methods. Physical basics of seismic methods. Reflexion seismic method. Refraction seismic method. Vertical seismic profile (VSP). Main features and essentials of borehole geophysics. Classification of well logging methods. Spontaneous potential (SP) logging. Resistivity logging. Natural gamma ray (GR) logging. Formation density logging. Photoelectric factor logging. Neutron logging methods. Sonic logging.</p> <p>Competencies to evolve: Knowledge: T1, T2, T3, T4, T5, T6, T7, T8, T9 Ability: K1, K2, K3, K12, K13 Attitude: A1, A2, A3, A4, A5, A7 Autonomy and responsibility: F1, F2, F3, F4, F5</p>	
<p>Assessment and grading: Condition for obtaining the signature: the presence in at least 60 % of the lessons. The determination of the examination grade is entirely based on the result of examination. Grading scale (% value → grade): 0 – 49 % → 1 (fail), 50 – 64 % → 2 (pass), 65 – 79 % → 3 (satisfactory), 80 – 89 % → 4 (good), 90 – 100 % → 5 (excellent).</p>	
<p>Compulsory or recommended literature resources: W. M. Telford, L. P. Geldart, R. E. Sheriff., 1990: Applied Geophysics. 2nd Edition. Cambridge University Press, ISBN: 0 521 32693 1 UBC Geophysical Inversion Facility – Inversion manuals (GRAV3D and MAG3D). http://gif.eos.ubc.ca/documentation P. Kearey, M. Brooks, I. Hill, 2002: An introduction to geophysical exploration, Blackwell Science Ltd., ISBN 0-632-04929-4 D. V. Ellis, J. M. Singer, 2007: Well logging for earth scientists. Springer, Dordrecht, The Netherlands, ISBN 978-1-4020-3738-2 (HB). O. Serra, L. Serra, 2004: Data Acquisition and Applications, Editions Serralog, France, ISBN: 978295156125 Other educational materials and study aids on the web page of Geophysical Department: http://www.uni-miskolc.hu/~geofiz/segedlet.html</p>	

Syllabus of the semester

Week	Lecture
1	Geophysical inversion of gravity data. Gravity forward problem of arbitrary shaped source. The problems of sensitivity and ambiguity. 3D underdetermined problems of gravity data. Geological applications.
2	Geophysical inversion of magnetic data. Magnetic forward problem of arbitrary shaped source. The problem of ambiguity. 3D underdetermined problems of magnetic data. Geological applications.
3	Physical basics of geoelectrical methods. Self-potential method. Charged-body method. Direct current resistivity methods. Induced polarization method.
4	Physical basics of electromagnetic (EM) methods. Magnetotelluric method. Frequency-domain (FD) electromagnetic methods. Transient electromagnetic method (TEM). Very-low-frequency electromagnetic method (VLF-EM).
5	Physical basics of seismic methods.
6	Reflexion seismic method.
7	Refraction seismic method. Vertical seismic profile (VSP).
8	Main features and essentials of borehole geophysics. Classification of well logging methods.
9	Spontaneous potential (SP) logging.
10	Resistivity logging.
11	Natural gamma ray (GR) logging.
12	Formation density logging. Photoelectric factor logging.
13	Neutron logging methods.
14	Sonic logging.

Week	Seminar
1	Mathematical basics of 3D gravity inverse problem. Introduction to the application of GRAV3D program package. Testing on synthetic and real data.
2	Mathematical basics of 3D magnetic inverse problem. Introduction to the application of MAG3D program package. Testing on synthetic and real data.
3	Interpretation of data coming from direct current resistivity and induced polarization measurements.
4	Interpretation of frequency sounding curves.
5	Physical basics of seismic methods.
6	Reflexion seismic method.
7	Refraction seismic method. Vertical seismic profile (VSP).
8	The phenomenon of mud filtrate invasion in porous and permeable formations. Petrophysical models and their parameters.
9	Estimation of clay volume and formation water resistivity from SP log curves.
10	Applications of resistivity logging methods.
11	Applications of natural gamma ray (GR) logging.
12	Application of formation density and photoelectric factor logging methods.
13	Application of neutron logging methods.
14	Application of sonic logging.

Exam topics

1. Geophysical inversion of gravity data. Gravity forward problem of arbitrary shaped source. The problems of sensitivity and ambiguity. 3D underdetermined problems of gravity data. Geological applications.
2. Geophysical inversion of magnetic data. Magnetic forward problem of arbitrary shaped source. The problem of ambiguity. 3D underdetermined problems of magnetic data. Geological applications.
3. Physical basics of geoelectrical methods. Self-potential method. Charged-body method.
4. Direct current resistivity methods. Induced polarization method. Interpretation of data coming from direct current resistivity and induced polarization measurements.
5. Physical basics of electromagnetic (EM) methods. Magnetotelluric method. Frequency-domain (FD) electromagnetic methods. Interpretation of frequency sounding curves. Transient electromagnetic method (TEM). Very-low-frequency electromagnetic method (VLF-EM).
6. Physical basics of seismic methods. Reflexion seismic method.
7. Refraction seismic method. Vertical seismic profile (VSP).
8. Main features and essentials of borehole geophysics. Classification of well logging methods. The phenomenon of mud filtrate invasion in porous and permeable formations. Petrophysical models and their parameters.
9. Spontaneous potential (SP) logging. Estimation of clay volume and formation water resistivity from SP log curves.
10. Natural gamma ray (GR) logging. Applications of natural gamma ray (GR) logging.
11. Resistivity logging. Applications of resistivity logging methods.
12. Formation density and photoelectric factor logging. Application of formation density and photoelectric factor logging methods.
13. Neutron logging methods and their applications
14. Sonic logging and its applications.