GEOPHYSICAL EXPLORATION METHODS II

MS in Earth Science Engineering / Specialisation in Geophysical Engineering

Semester 2, 2019/20

COURSE COMMUNICATION FOLDER

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

Course datasheet

<table>
<tr><td>Course Title: Geophysial Exploration Methods II

Instructors: Péter Tamás Vass Dr., associate professor,
László Gombár Dr., honorary associate professor,
Endre Nádasi, assistant lecturer</td><td>Code: MFGFT720015

Responsible department/institute: Institute of Geophysics and Geoinformatics / Department of Geophysics
Type of course: Compulsory</td></tr>
<tr><td>Position in curriculum (which semester): 2</td><td>Pre-requisites (if any) MFGFT710004</td></tr>
<tr><td>No. of contact hours per week (lecture + seminar): 2+1</td><td>Type of Assessment (examination/ practical mark / other): examination</td></tr>
<tr><td>Credits: 4</td><td>Course: full time</td></tr>
<tr><td colspan="2">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.
The short curriculum of the subject:
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.
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</td></tr>
<tr><td colspan="2">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).</td></tr>
<tr><td colspan="2">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</td></tr>
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Syllabus of the semester

Week	Lecture
12/02/2020	Physical basics of seismic methods.
19/02/2020	Reflexion seismic method.
26/02/2020	Refraction seismic method. Vertical seismic profile (VSP).
04/03/2020	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.
11/03/2020	Geophysical inversion of magnetic data. Magnetic forward problem of arbitrary shaped source. The problem of ambiguity. 3D underdetermined problems of magnetic data. Geological applications.
18/03/2020	Physical basics of geoelectrical methods. Self-potential method. Charged-body method. Direct current resistivity methods. Induced polarization method.
25/03/2020	Physical basics of electromagnetic (EM) methods. Magnetotelluric method. Frequency-domain (FD) electromagnetic methods. Transient electromagnetic method (TEM). Very-low-frequency electromagnetic method (VLF-EM).
01/04/2020	Main features and essentials of borehole geophysics. Classification of well logging methods.
08/04/2020	Formation density logging.
15/04/2020	Photoelectric factor logging.
22/04/2020	Day without education
29/04/2020	Neutron logging methods.
06/05/2020	Well log interpretation techniques. Quick-Look Interpretation. Crossplots and overlays.
13/05/2020	Formation evaluation in shaly sands.

Week	Seminar
12/02/2020	Physical basics of seismic methods.
19/02/2020	Reflexion seismic method.
26/02/2020	Refraction seismic method. Vertical seismic profile (VSP).
04/03/2020	Mathematical basics of 3D gravity inverse problem. Introduction to the application of GRAV3D program package. Testing on synthetic and real data.
11/03/2020	Mathematical basics of 3D magnetic inverse problem. Introduction to the application of MAG3D program package. Testing on synthetic and real data.
18/03/2020	Interpretation of data coming from direct current resistivity and induced polarization measurements.
25/03/2020	Interpretation of frequency sounding curves.
01/04/2020	Main features and essentials of borehole geophysics. Classification of well logging methods.
08/04/2020	Formation density logging.
15/04/2020	Photoelectric factor logging.
22/04/2020	Day without education
29/04/2020	Neutron logging methods.
06/05/2020	Well log interpretation techniques. Quick-Look Interpretation. Crossplots and overlays.
13/05/2020	Formation evaluation in shaly sands.

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 seismic methods. Reflexion seismic method.

6. Refraction seismic method. Vertical seismic profile (VSP).

7. Formation density logging. Photoelectric factor logging.

8. Neutron logging methods.

9. Well log interpretation techniques. Quick-Look Interpretation. Crossplots and overlays.

10. Resistivity logging. Applications of resistivity logging methods.

11 Formation evaluation in shaly sands.