SEISMIC COLLEGE

Geophysics MSc course

2017/18 2. Semester

COURSE COMMUNICATION FOLDER

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

Course datasheet

Course Title: Seismic College (Optional subject group (2)) **Instructor:** Dr. Gombár László engineer teacher	**Code:** MFGFT730006 **Responsible department/institute:** Department of Geophysics and Geodesy/ Geophysical Faculty
	Type of course: Optional
Position in curriculum (which semester): 3	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+2	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 4	**Course:** full time

Course Description:
Summarization of seismic data acquisition, data processing and interpretation methods. Applications and uses of seismic methods for raw material exploration. New seismic technologies and methods.

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

The short curriculum of the subject:
Actual, up-to-date topics connected to new results and development tendencies in the field of seismic data acquisition, data processing and interpretation.
Year to year selected special topics are offered to the students in the fields of raw materials' (especially hydrocarbon) exploration, as well as of seismic technology development.
This subject is also useful for the students to obtain deep insight in the topics of selected thesis work.

Assessment and grading:
Signature requirements: attendance on the seminars and solution of one personal task with presentation.
Exam grading scale:

% value	Grade
86 –100%	5 (excellent)
71 – 85%	4 (good)
61 – 70%	3 (satisfactory)
46 - 60 %	2 (pass)
0 – 45%	1 (failed)

Compulsory or recommended literature resources:

Dr. Ádám Oszkár, 1987: Szeizmikus kutatás I-II. Tankönyvkiadó, Budapest.
Sheriff, R. E., Geldart L. P., 1995: Exploration seismology. Cambridge University Press.
Helbig K., Treitel S. (edit.), 1987: Seismic exploration (Handbook of Geophysical Exploration). Volumes 2-20, Geophysical Press.
Articles presented in periodicals like: Magyar Geofizika, Geophysical Transactions, Geophysics, Geophysical Prospecting.
Other seismic software available at the Geophysical Faculty.

Syllabus of the semester

Week	Lecture
1	Continuum mechanical base of the seismic method, strain and stress tensors, the movement equation of the elastic continuum. Most important material models in the seismic. Solution of the elastic wave equation in case of Hook body.
2	Generation of seismic waves in the rocks and on the surface. Impulsive and vibroseis sources. Physical effects affecting the amplitude of propagating seismic waves through the inelastic layered medium.
3	Seismic data acquisition in 2D and 3D. Basic rules of source parameter selection. Elements of the seismic data channel and their features.
4	Analog and digital sensors, telemetry systems. Rules of time and space sampling of the wave fields.
5	Field techniques and methods on receiver and source side to improve signal to noise ratio during data acquisition.
6	Usual steps of seismic data (reflection) processing flow.
7	Main parameters of the most important processing steps (band-pass filtering, deconvolution, NMO correction, static correction, stacking, post stack migration).
8	Vertical seismic profiling (VSP). Types of VSP surveys. Applied basic data processing methods. Role of VSP in seismic data interpretation.
9	Interpretation of processed 2D seismic data. Correlation of reflection horizons from section to section.
10	Interpretation of processed 3D seismic data cube. Delineation of seismic horizons, correlation of reflection events.
11	Propagation velocity of different seismic waves (reflections and coherent noise waves).
12	Velocity determination in seismic technology (reflection, refraction, average, interval, RMS).
13	Direct hydrocarbon detection with seismic data. Local velocity anomalies on the seismic sections.
14	Detection of gas bearing layers – bright spots, gas chimneys. AVO analyses.

Week	Seminar
1	Most important material models in the seismic. Solution of the elastic wave equation in case of Hook body.
2	Impulsive and vibroseis source parameters. Amplitude decay of propagating seismic waves through the inelastic layered medium.
3	Seismic data acquisition in 2D and 3D. Basic rules of source parameter selection. Functions of elements of a seismic data channel.
4	Analog and digital sensors, telemetry systems. Single sensor recording. Rules of time and space sampling of the wave fields.
5	Field techniques and methods on receiver and source side to improve signal to noise ratio during data acquisition.
6	General steps of seismic data (reflection) processing flow.
7	Main parameters of the most important processing steps (band-pass filtering, deconvolution, F-K filtering, NMO correction, static correction, stacking, post stack migration).
8	Vertical seismic profiling (VSP). Types of VSP surveys. Applied basic data processing methods. Role of VSP in seismic data interpretation.
9	Interpretation of processed 2D seismic data. Correlation of reflection horizons from section to section.
10	Propagation velocity of different seismic waves (reflections and coherent noise waves).
11	Velocity determination in seismic technology (reflection, refraction, average, interval, RMS).
12	Direct hydrocarbon detection with seismic data. Local velocity anomalies on the seismic sections.
13	Detection of gas bearing layers – bright spots, gas chimneys. AVO analyses.
14	Generation of synthetic seismograms and well tie to seismic section.

Sample for the exam

1. Continuum mechanical base of the seismic method, strain and stress tensors, the movement equation of the elastic continuum. Most important material models in the seismic. Solution of the elastic wave equation in case of Hook body.

2. Generation of seismic waves in the rocks and on the surface. Impulsive and vibroseis sources.
   Basic rules of source parameter selection. Physical effects affecting the amplitude of propagating seismic waves through the inelastic layered medium.

3. Seismic data acquisition in 2D and 3D. Elements of the seismic data channel and their features. Analog and digital sensors, telemetry systems. Rules of time and space sampling of the wave fields. Methods to improve signal to noise ratio during data acquisition.

4. Basic steps of seismic data (reflection) processing flow. Main parameters of the most important processing steps (band-pass filtering, deconvolution, NMO correction, static correction, stacking, post stack migration).

5. Vertical seismic profiling (VSP). Types of VSP surveys. Applied basic data processing methods. Role of VSP in seismic data interpretation.

6. Interpretation of processed 2D and 3D seismic data. Delineation of seismic horizons, correlation of reflection events. Time maps and time slices.

7. Velocity determination in seismic technology (reflection, refraction, average, interval, RMS). Propagation velocity of different seismic waves (reflections and coherent noise waves).

8. Direct hydrocarbon detection with seismic data. Local velocity anomalies on the seismic sections. Detection of gas bearing layers – bright spots, gas chimneys. AVO analyses.