GEOPHYSICAL DATA PROCESSING

Earth Science Engineering MSc course, Geophysical Engineering Specialization

2018/19 1st Semester

COURSE COMMUNICATION FOLDER

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

Course datasheet

Course Title: Geophysical data processing **Instructor:** Dr. Endre Turai, associate professor, CSc, PhD.	**Code:** MFGFT730026 **Responsible department/institute:** Department of Geophysics / Institute of Geophysics and Geoinformatics
	Type of course: obligatory
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:
Introduce to the spectral geophysical data processing methods for MSc academic specialization in geophysical engineering.
Competencies to evolve:
Knowledge: T1, T2, T3, T4, T5, T6, T7, T9.
Ability: K1, K2, K3, K6, K7, K12, K13.
Attitude: A1, A2, A3, A4, A5, A7.
Autonomy and responsibility: F1, F2, F3, F4, F5.

The short curriculum of the subject:
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.

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. Turai Endre: Spectral data- and information processing. lecture notes, Miskolci Egyetem, 2005.
P. F. Panter: Modulation, Noise, and Spectral Analysis, McGraw-Hill Book Co, 1965.
Meskó A.: Digital filtering. Akadémiai Kiadó, Budapest, 1984.
E. O. Brigham: The Fast Fourier Transform, Prentice-Hall Inc., 1974.

M. Bath: Spectral Analysis in Geophysics, Elsevier Scientific Publishing Co., 1974.
R. N. Bracewell: The Fourier Transform and its Applications, McGraw-Hill Book Company, 1978.
J. V. Candy: Signal Processing, McGraw-Hill Book Company, 1986.
N. Hesselmann: Digital signal processing, Műszaki Könyvkiadó, 1985.

Syllabus of the semester

(Megjegyzés: a tárgy kurzusa a 2018/2019 tanév 1. félévében jelentkezés hiányában nem indult.)

Week	Lecture and seminar
1	Classification of signals. The deterministic and stochastic signals.
2	The dynamic probability density functions. The errors of the discretization.
3	The effect of the discretization on signal spectrums. D/A conversion, interpolation, reduction.
4	Relationship between correlation functions and power density spectra.
5	Stochastic Systems. Analysis of Stochastic Systems.
6	Synthesis of Stochastic Systems.
7	Convolutional Non Real Time (NRT) and Real Time (RT) filtering. Convolutional low-pass filter.
8	Convolutional high-pass, band-pass and band-cut filter. Recursive RT filtering.
9	Recursive hole filters planning using complex-conjugate pole-zero technique.
10	Deterministic deconvolution filtering. Optimum filter.
11	Correlation filtering. Stochastic deconvolution filtering.
12	Polarization filtering.
13	Generalized spectral analysis. Bartlett window, MEM and MLM methods.
14	Multidimensional filtering. Presentation of Individual Tasks. Semester closing.

Exam items:

1. Classification of signals, the deterministic signals.
2. Classification of signals, the stochastic signals.
3. The dynamic probability density functions.
4. The errors of the discretization.
5. The effect of the discretization on signal spectrums.
6. D/A conversion, interpolation, reduction.
7. Relationship between correlation functions and power density spectra.
8. Stochastic Systems.
9. Synthesis of Stochastic Systems. (The note can be used on the exam.)
10. Analysis of Stochastic Systems.
11. Convolutional Non Real Time (NRT) and Real Time (RT) filtering.
12. Convolutional low-pass filter.
13. Convolutional high-pass, band-pass and band-cut filter.
14. Recursive RT filtering.
15. Recursive hole filters planning using complex-conjugate pole-zero technique. (The note can be used on the exam.)
16. Deterministic deconvolution filtering.
17. Optimum filter.
18. Correlation filtering.
19. Stochastic deconvolution filtering.
20. Polarization filtering.
21. Generalized spectral analysis.
22. Bartlett window, MEM and MLM methods.
23. Multidimensional filtering.