GLOBAL ENVIRONMENTAL GEOPHYSICS

Geophysics MSc course

2020/21 1. Semester

COURSE COMMUNICATION FOLDER

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

Course datasheet

Course Title: Global environmental Geophysics (Optional subject group (3)) **Instructor:** Dr. Gábor Pethő private university professor	**Code:** MFGFT730027 **Responsible department/institute:** Institute of Geophysics and Space Informatics/ Geophysical Dept. **Type of course:** Optional
Position in curriculum (which semester): 3	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** examination
Credits: 2	**Course:** full time

Course Description:
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

Main objectives of the course:

There are two goals: training global environmental geophysics to a level that graduated engineers can begin to work in the field of general geophysics and maintain communication with colleagues working as experts in the field of global environmental geophysics.

Short curriculum of the course:

Main physical and chemical processes and physical parameters of the Sun. Classification of planets in the Solar System. Gravitational and magnetic field of the planets. Relationship between the potential of the Earth's gravity field and pressure field at surfaces with constant values in the state of equilibrium. Conclusion for the zonal composition of the Earth. Isostatic anomalies and interpretations for the ascending and descending trends for the investigated area, relationships with plate tectonics. The approximation of the Earth's magnetic field with magnetic dipole and its characterization. Timely variations in the magnetic field. The paleomagnetic method and its application. Determining the age of rocks by means of radiological methods. Heat produced by radioactivity. Heat flux measurements, areas with great heat flow in the Earth. The macro seismic characterization of earthquakes, determining focal depth. Seismic zones of the Earth, plate tectonical relations. Records of seismological observatories and conclusions: elastic wave velocity and density distributions related to depth. The measuring activity of CTBTO to detect and locate nuclear explosion.

Assessment and grading:

Signature requirements: attendance on the lectures and seminars and the 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)

Frank Stacey & Paul Davis: Physics of the Earth. Cambridge Univ. Press, 4. edition 2008. ISBN-10: 0521873622
William Lowrie: Fundamentals of Geophysics 2nd edition, Cambridge Univ. Press. 2007. ISBN- 13 978-0-521-85902-8
http://www.uni-miskolc.hu/~geofiz/PG_GlobenvGeophysics.pdf
https://www.ctbto.org/verification-regime/monitoring-technologies-how-they-work/

Syllabus of the semester

Datum 2020	**Lecture**
Sept.10	Solar System. Zonal interior of the Sun, radiochemical transformation in it, differential rotation of the Sun, its atmosphere with processes acting on the Earth. Physical and geometrical parameters of the Sun, solar cycles.
Sept.17	The classification of the planets of the Solar System. The main physical, chemical and geometrical parameters of the planets. The gravitational and magnetic field of the planets.
Sept.24	The satellite geoid, isostasy, post-glacial rebound.
Oct.1	The main features of the magnetosphere of the Earth, characterization of ionosphere.The magnetic field of the Earth, magnetic field's reversal. Different types of remanent magnetization.
Oct.8	Composition of the Earth' interior based on seismic tomography, the most significant boundaries (1).
Oct.15	The zonal composition of the Earth(2), characterization of the zones, putting emphasis on mantle convection, liquid and solid core
Oct.22	Radioactivity, isotopes and the most important radiometric dating methods (1).
Oct.29	Radiometric dating methods (2), their reliability.
Nov.5	Radioactive heat production. Heat flux map of the Earth.
Nov.12	Viscosity, temperature, elastic waves velocity and density in the function of depth.
Nov.19	Focal depth determination. Magnitude definitions, energy released, intensity. Focal mechanism based on first motion studies using focal spheres.
Nov.26	Areal distribution of earthquakes, correlation with plate tectonics.
Dec.3	Applied monitoring technologies by CTBTO for detecting nuclear explosion.
Dec.10	Relation between global environmental and applied geophysics.

Datum 2020	Seminar
Sept.10	Activity of geophysical and astronomical observatories.
Sept.17	Visiting an astronomical observatory.
Sept.24	Overview of topics suggested for individual student presentation.
Oct.1	Visiting Kövesligethy Radó Seismological Observatory.
Oct.8	Physical quantities and units used on global maps.
Oct.15	Comparison of heat gained by conduction and convection based on examples.
Oct.22	Calculation of magnitudes, released energy in the course of an earthquake.
Oct.29	Determination of focal depth and epicentre.
Nov.5	Completing the two observatory notes, submission.
Nov.12	Calculation for radioactive heat production. Radiometric dating assignments.
Nov.19	Preparation for the individual presentation, overview corresponding literature.
Nov.26	Preparation for the individual presentation
Dec.3	Student’s presentations, questions, evaluation.
Dec.10	Discussion on CTBTO case histories.

Sample questions for the exam

1. Characterize the radiochemical transformations in the Sun.
2. What do you know about the differential rotation of the Sun?
3. What can the satellite magnetic and gravity measurements used for?
4. What are the role of K-Ar dating method and remanent magnetizations observations in the theory of plate tectonics?
5. What do you know about the factors influencing the heat produced by radioactivity. Does it depend on the type of the crust?
6. Define the general formalism of radiometric dating if the concentration of the non-radiogenic daughter isotopes cannot be neglected.
7. What is the essence of Rb-Sr dating method?
8. What technologies are applied by CTBTO for nuclear explosion test detection?

All answers for these questions can be found in http://www.uni-miskolc.hu/~geofiz/PG_GlobenvGeophysics.pdf