Introduction to Global Geophysics
LECTURE: Thursday 17:00 – 19:50, Science Hall 231

INSTRUCTOR: Dr. Gordana Garapic, Assistant Professor
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OFFICE: Room SH 108

OFFICE HOURS: Tuesdays 15:30 – 17:00, Wednesdays 15:30 – 17:00, Thursdays 15.00 – 16.00, or email for appointment

CREDITS: 3

GENERAL COURSE OVERVIEW: Geophysics is the study of physical processes of the solid Earth. Geophysics is an extensive subject that encompasses physics of space, atmosphere, oceans and physics of the Earth's interior. Our focus will be on the physics of the solid Earth. We will start the course with discussing plate tectonics – a model that provides a framework for the dynamics of the Earth's interior and its interaction with the surface environment. We will then look at the dynamics of the Earth's interior, and how to image it. Finally, we will discuss the methods for absolute age determination of rocks, and look at Earth's different geochemical reservoirs and their connection to geodynamic processes.

Many problems in geophysics can be expressed and visualized by relatively simple equations. MATLAB is a convenient way to do this in practice.

The class meetings will generally start with a lecture and will continue in the computer lab. We will set up MATLAB codes together to solve problems discussed in the lectures. The time in the lab will probably not be sufficient to complete the assignments (i.e. obtain solution and visualize results); they should be completed as part of the homework.

STUDENT LEARNING OUTCOMES:
Students who successfully complete this course will,

- Gain an integrated knowledge of the three-dimensional structure of the Earth and how this structure is determined.
- Understand the geodynamic processes that operate in the Earth's interior.
- Understand the concept of geochemical reservoirs in the Earth and relate them to geodynamic processes.
- Understand principles of measuring absolute geologic time.
- Demonstrate the ability to use principles of mathematics, chemistry and physics to solve Earth Science problems.
- Demonstrate the ability to solve numerical problems utilizing MATLAB.

TEXTBOOK: C.M.R. Fowler: The Solid Earth, An Introduction to Global Geophysics, Cambridge University Press, 2004, Second Edition.

ADDITIONAL READING:
D. Turcotte and G. Schubert: Geodynamics, Cambridge University Press, 2014, Third Edition

HOMEWORK and LAB WORK: Lab work and homework problems are usually related. At times homework will be separately assigned after the class. For the most part, homework will be a continuation of the lab work.

EXAMS: There will be three exams – two midterm exams and final exam. The midterm exams will 75 minutes long. Exams are mandatory.

GRADES: The final exam will be cumulative. I do not scale grades. Your final course grade will be determined as follows:

Midterm Exam 1:	*15%*
Midterm Exam 2:	*15%*
Homework and Lab Work:	*35%*
Final Exam:	*30%*
Subjective Evaluation of Performance	5%
Total:	*100%*

Grade guidelines:

A	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+/D/D-**	**F**
>92	89-91	86-88	83-85	80-82	77-79	73-76	69-72	57-68	<56

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SUNY NEW PALTZ POLICY STATEMENTS:

- **Academic integrity:** Students are expected to maintain the highest standards of honesty in their college work. Cheating, forgery, and plagiarism are serious offenses, and students found guilty of any form of academic dishonesty are subject to disciplinary action. Also see: http://www.newpaltz.edu/advising/policies_integrity.html
- **Reasonable accommodations of individuals with disabilities statement:** Students with documented physical, learning, psychological and other disabilities are entitled to receive reasonable accommodations. If you need classroom or testing accommodations, please contact the Disability Resource Center (HAB 205), in advance of the tests. The DRC will provide forms verifying the need for accommodation. As soon as the instructor receives the form, you will be provided with the appropriate accommodations. Students are encouraged to request accommodations as close to the beginning of the semester as possible.

STUDENT EVALUATION OF INSTRUCTION:
You are responsible for completing the Student Evaluation of Instruction (SEI) for this course and for all your courses with an enrollment of three or more students. I value your feedback and use it to improve my teaching and planning. Please complete the form during the open period on-line [April 23 through May 07, 2019].

FINAL NOTES: Lecture topics and order may be modified if required as the class progresses, and the coverage of topics may be increased or decreased.

CLASS SCHEDULE:

	Topics to be covered
01.24.2019. **L1**	Introduction: course overview; structure of the Earth; Lab 1: getting started with MATLAB
01.31.2019. **L2**	Plate Tectonics: Introduction; plate boundaries; lithosphere; asthenosphere; Lab 2: getting started with MATLAB - arrays
02.07.2019. **L3**	Plate Tectonics: Mid-ocean ridges and subduction zones; motions on a sphere; Lab 3: distance on a sphere (MATLAB)
02.14.2019. **L4**	Plate Tectonics: Whole mantle convection ("hot spots" and "mantle plumes"); Lab 4: age of Hawaiian islands (MATLAB)
02.21.2019. **L5**	Heat Transfer: Introduction; basic governing equation for heat conduction (Fourier's Law); structure of oceanic plates (ocean depth, thickness of lithosphere as function of age as indicators of conductive cooling). Lab 5: Heat Flow (MATLAB)
02.28.2019.	Exam 1
03.07.2019. **L6**	Earth's Rheology: Stress and strain in solids; description of elastic, viscous and visco-elastic behavior; dependence on time scale; Lab 6: Rheology (MATLAB); Lab7: Viscosity dependence on temperature (MATLAB)
03.14.2019. **L7**	Seismology Pt.1: earthquake processes, focal mechanisms, seismic wave propagation; exploration methods: reflection and refraction seismology Lab 8: Gravity (MATLAB)
03.21.2019.	**Spring break**
03.28.2019. **L8**	Seismology Pt2: earthquake processes, focal mechanisms, seismic wave propagation; exploration methods: reflection and refraction seismology Lab 8: Seismic tomography
04.04.2019. **L9**	Lab 9: Seismic refraction demo
04.11.2019.	**Exam 2 (or on April 18)**
04.18.2019. **L10**	Mantle convection: Phase transitions; Clapeyron slopes; conservation laws (mass, momentum and energy);
04.25.2019. **L11**	Flow in Porous Media: Darcy's Law; permeability models; porous flow model for magma migration Lab 10: Advection-Diffusion (MATLAB)
05.02.2019. **L12**	Chemical geodynamics: Radioactivity and geochronology; Lab 11: Radioactive Decay; Geochronology (MATLAB)