EESB26

Introduction to Global Geophysics

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COURSE DESCRIPTION:

The course will explore topics such as the Earth's interior structure, magnetic field history, global seismology, properties of the mantle and core, sources of internal energy and manifestations of the loss of that energy.

Specific topics will include:

- review of observations of the ocean floors

- a description of the current day magnetic field, paleomagnetism, past plate motion

- probing the Earth's interior with seismology, wave types and properties, earthquakes, the density of the interior, the temperature of the interior.

- Sources of heat, how the Earth cools and how the heat is replenished (to some degree).

- Mathematical models of the oceanfloor, its temperature, rate of heat loss and rate of subsidence.

The lecture material will be supported by the textbook The Solid Earth, by Dr. Mary Fowler. However, additional material will supplement the material from the text.

Prerequisite:

Completion of both parts of the first year physics program, calculus and a general positive attitude towards mathematical descriptions, computing, and investigation of Earth Science. Some previous knowledge of Earth Science is required but this is not a geology course and will not assume a great deal about geology background. However, if you have forgotten the age of the Earth you had better look it up! Any aspiring geophysicist should have an understanding of the time and length scales pertaining to planetary processes.

There will be an emphasis on solving some of the assignment problems using short computer programs. Many students find this is one of the most enjoyable parts of the course and like the development of transferable skills that they develop. Students are encouraged to obtain a copy of an application that creates

an environment for running Python code in order to work on these problems (Jupyter notebooks is popular but there are other options too). You can find various open source software packages online that will be perfectly adequate for running Python code. If you have expertise with other languages that you prefer to use, you may implement these but I will not be able to provide any trouble-shooting support.

LECTURES:

For 2022, 24 lectures will be given in person. Tutorials will be held weekly from the second week of the course. Students are expected to attend all tutorials.

ASSESSMENT:

- A final exam worth 40% of the final mark.

- Four problem sets. Each problem set will be worth 8% of the final mark.

- A 45-min. term test worth 12% of the final mark.

- A (rehearsed) ten minute powerpoint presentation summarizing a research paper you will read after consultation with and approval by the instructor (16%). The presentation of the slides will be done in class (on a tutorial day) and students will verbally describe their slides to their classmates. The presentation will be a summary of the paper read, pitched at a level classmates will understand. Questions will be taken for 2-3 minutes after the presentation.

REFERENCES:

Besides Fowler's book, the following are useful reading.

Fundamentals of Geophysics, 2nd edition (Lowrie)

Mantle Convection in the Earth and Planets (Schubert, Turcotte & Olson, 2001).

Geodynamics, 2nd or 3rd edition (Turcotte & Schubert, 2001).

Physics of the Earth, 4th edition (Stacey and Davis, 2008)

LECTURE NOTES:

Slides will be made available online.

OFFICE HOURS:

Please arrange required appointments by e-mail.

Due dates and times will appear on the assignment handouts. Late assignments will be penalized by 25% per day (weekends included). Assignments must be submitted on the day they are due no later than 6pm EST.