

Geophysical Fields

GEOS 602

Spring 2010

Tu-Th 1:30-3:00, GI Auditorium

Instructor: Jeff Freymueller

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Last Updated: January 20, 2010

Course Topics

- Gravity, gravitational field of earth, gravity measurement and interpretation
- Magnetics, magnetic field of earth, paleomagnetism, magnetic measurement and interpretation
- Heat in the earth, heat flow, conduction and convection

Grading Scheme

- 60% Homework
- 40% Final Project

Grades will be based on your percentage of the total possible score. The breaks between A, B, C, etc are NOT at 90%, 80%, etc, but at lower percentages to account for the difficulty level of the homework. The breakpoints are based on the history of past classes in addition to this year's students.

Homework

- 10 Problem Sets, roughly weekly

Final Project

- Numerical or computational project.

Detailed Schedule

Each lecture title is a link to the powerpoint file for that lecture.

Day	Date	Lecture Topic
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Thu	Jan 21	Gravity 1: What is a field?, Mathematical properties of scalar and vector fields, Potential and field, Newtonian Attraction; <i>Homework: PROBLEM SET 1 assigned, due Tue February 2.</i>
Thu	Jan 26	NO CLASS
Thu	Jan 28	Gravity 2: Measurements of gravity, Potential of an arbitrary 3D body, Potential of a sphere
Tue	Feb 2	Gravity 3: MacCullough's formula, Earth's gravity field; <i>Homework: PROBLEM SET 2 assigned, due Tue February 9.</i>
Thu	Feb 4	Gravity 4: The Geoid, Shape of the Earth, Introduction to orthogonal functions
Tue	Feb 9	Gravity 5: Spherical Harmonics, Application to the global gravity field; <i>Homework: PROBLEM SET 3 assigned, due Tue February 16.</i>
Thu	Feb 11	Gravity 6: Satellite Measurements of the Gravity Field and gravity change
Tue	Feb 16	Gravity 7: More gravity change and spherical harmonics, Tides; <i>Homework: PROBLEM SET 4 assigned, due Tue February 23.</i>
Thu	Feb 18	Gravity 8: Gravity surveys, Gravity Anomalies, Examples of gravity anomalies from the real world.
Tue	Feb 23	Gravity 9: Modeling gravity anomalies, Attraction of special mass distributions, Excess mass, Green's equivalent layer, Sinusoidally-varying topography; <i>Homework: PROBLEM SET 5 assigned, due Thu March 4.</i>
Thu	Feb 25	NO CLASS
Tue	Mar 2	Gravity 10: Compensation, Isostasy, Isostatic Anomalies, Gravity and lithospheric flexure <i>Homework: PROBLEM SET 6 assigned, due Tue March 23.</i>

Thu	Mar 4	Gravity 11: Fourier methods, Upward and downward continuation.
Tue	Mar 9	<i>SPRING BREAK!!</i>
Thu	Mar 11	<i>SPRING BREAK!!</i>
Tue	Mar 16	Gravity 12: Fourier methods, Application of Fourier methods to compensation
Thu	Mar 18	Magnetics 1: Electricity and magnetism, Electric and magnetic fields, Magnetic field of the Earth, IGRF
Tue	Mar 23	Magnetics 2: The dipole and non-dipole fields, Magnetization, Magnetic anomalies <i>Homework: PROBLEM SET 7 assigned, due Tue March 30.</i>
Thu	Mar 25	Magnetics 3: Magnetization, Modeling magnetic anomalies, Total field anomaly
Tue	Mar 30	Magnetics 4: Reduction to the pole, Examples of magnetic anomaly maps, How rocks get their magnetization, Paleomagnetism, Magnetic reversals and history of Earth's magnetic field <i>Homework: PROBLEM SET 8 assigned, due Thu April 8.</i>
Thu	Apr 1	Magnetics 5: Paleoinclination and declination, Spherical trig and statistics of directions, Paleomagnetism and plate tectonics
Tue	Apr 6	Initial Presentation of Final Project Topics
Thu	Apr 8	Heat Flow 1: Heat transfer, Fourier's Law, Heat flow in the Earth <i>Homework: PROBLEM SET 9 assigned, due Thu April 15.</i>
Tue	Apr 13	Heat Flow 2: Heat sources within the Earth and the geothermal gradient, Conduction
Thu	Apr 15	Heat Flow 3: Conduction on a sphere, 1D time-dependent conduction <i>Homework: PROBLEM SET 10 assigned, due Thu April 22. It's the last one!</i>

Tue	Apr 20	Heat Flow 4: Heating or cooling of a semi-infinite half-space, Cooling of oceanic crust
Thu	Apr 22	Heat Flow 5: Advection
Tue	Apr 27	Progress Reports on Final Projects
Thu	Apr 29	Heat Flow 6: The Stefan problem and phase changes
Tue	Apr 27	Heat Flow 7: Thermal stresses, mantle adiabats
Thu	Apr 29	Heat Flow 8: Convection

END OF CLASSES (but final Project due Fri May 14)

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