

GLY 4450/5455: Intro Geophysics - Spring 2025

Time: F, Periods 4-6 (10:40 am -1:40 pm)

Place: 214 Williamson Hall

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Office Hours: By appointment

Course Description: On short time scales, the Earth is a hard solid(kick it and see), but we know that on the scale of geologic time, the Earth flows like a viscous fluid. How can this be? We will examine some aspects of the answer to this paradox in this course by outlining solid Earth geophysics in some detail, including: elasticity and flexure of the lithosphere; heat production, heat transfer, and the Earth's thermal budget; fluid mechanics and flow of the Earth's mantle; rock rheology; chemical geodynamics.

Prerequisites 1 year of calculus and 1 year of college physics or consent of instructor.

Grading Method Homework (70%) and term paper (30%).

Grading Policies Grades for this course will be determined based on student attendance at lectures, participation in discussions, homework assignments, and the term paper, as described during the first week of class. For detailed information on UF grading policies, please visit: [UF Grading Policies](#).

Textbook *Geodynamics*, 3rd Ed., by Turcotte & Schubert, Cambridge University Press.

Course Goals

- Become conversant with the basic physical processes that determine Earth's dynamics.
- Learn, through in-depth homework problems, how to approach problems in Earth physics and produce quantitative results relevant to clear scientific conclusions about the solid Earth and its evolution.
- Establish a broad quantitative knowledge base for all interested in pursuing a career in any field related to solid Earth geophysics.

Course Objectives

- Develop an understanding of the solid Earth through the study of basic Earth.
- Learn how to apply basic physics to classic problems in Earth's tectonics and geodynamics.
- Internalize basic concepts of Earth physics

Weekly Course Schedule of Topics and Assignments

Week 1 - Elasticity and flexure, Turcotte & Schubert Chapter 3-1 to 3-9: linear elasticity, uniaxial stress and strain, plane stress and strain, pure and simple shear.

Week 2 - Elasticity and flexure, Turcotte & Schubert Chapter 3-10 to 3-14: 2-d plate bending, plate buckling, the earth's lithosphere under various types of loads.

Week 3 - Elasticity and flexure, Turcotte & Schubert Chapter 3-15 to 3-18: periodic loads on the lithosphere, island chains, and subduction zones.

Week 4 - Heat transfer, Turcotte & Schubert Chapter 4-10 to 4-14: heat conduction in a sphere or spherical shell, 2-d and 3-d steady-state heat conduction.

Week 5 - Heat transfer, Turcotte & Schubert Chapter 4-15 to 4-19: 1-d time-dependent heat conduction, half spaces, cooling of the lithosphere, dikes and sills.

Week 6 - Heat transfer, Turcotte & Schubert Chapter 4-20 to 4-30: heat conduction in a moving medium, thermal stresses, 1-d unsteady heating of an infinite region, thermal stresses, ocean bathymetry, mantle geotherms and adiabats, thermal structure of the lithosphere.

Week 7 - Fluid mechanics, Turcotte & Schubert Chapter 6-1 to 6-9: 1-d channel flow, asthenospheric counterflow, 2-d mass conservation and force balance equations, stream functions.

Week 8 - Fluid mechanics, Turcotte & Schubert Chapter 6-10 to 6-15: postglacial rebound, subduction angle, diapirism, folding, stokes flow, mantle plumes.

Week 9 - Fluid mechanics, Turcotte & Schubert Chapter 6-16 to 6-21: thermal convection, stability analysis for convection, boundary layers.

Week 10 - Fluid mechanics, Turcotte & Schubert Chapter 6-22 to 6-30: plate driving forces, viscous heating, mantle mixing.

Week 11 - Rock rheology, Turcotte & Schubert Chapter 7-1 to 7-5: elasticity, diffusion creep, dislocation creep, shear flow.

Week 12 - Rock rheology, Turcotte & Schubert Chapter 7-6 to 7-5: mantle rheology and convection, secular cooling of the Earth, crustal rheology, viscoelasticity, elastic\perfectly plastic behavior.

Week 13 - Chemical geodynamics, Turcotte & Schubert Chapter 10-1 to 10-4: radioactivity and geochronology, geochemical reservoirs, 2-reservoir model for crustal formation.

Week 14 - Chemical geodynamics, Turcotte & Schubert Chapter 10-5 to 10-6: noble gas radioactive systems, isotope systematics of ocean island basalts.

Course Evaluation Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at [GatorEvals for Students](#). Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via [UF Blue Evaluations](#). Summaries of course evaluation results are available to students at [GatorEvals Public Results](#).

Materials and Supplies Fees There are no additional materials or supplies fees for this course. If this changes, students will be notified in advance.

Honor Pledge

We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Student Honor Code. On all work submitted for credit by Students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

Students with Disabilities

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting our [Get Started page](#). It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Wellness and Mental Health

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. The UF Counseling & Wellness Center (CWC) is available to provide support, and participation in services does work. You can learn more about confidential mental health services available on campus at: counseling.ufl.edu Support is available (24/7) from the CWC who can be reached at: 352-392-1575 for brief consultation or support for urgent/emergent concerns. You can access the Wellness Center using this QR code:

