PTYS 512 Planetary Global Tectonics
Fall 2026
TR 9:30-10:45 Kuiper 312

Instructor Information
Dr. Jeff Andrews-Hanna
Kuiper 438
jcahanna@arizona.edu (preferred mode of contact)
preferred name: "Jeff"
preferred pronouns: he, him, his
Office hours: Tuesday 10:45 AM – 11:45 AM
I am also available to meet at other times – please e-mail to set up a meeting either during office hours or at another time.

Web information: This course will use a Brightspace page:
https://d2l.arizona.edu/d2l/home/1818729

Course Description
This course will provide an overview of planetary geodynamics. The lectures will focus on developing a theoretical understanding of the physical processes that govern planetary evolution, including the generation of heat, conductive and convective heat transfer, elasticity, stress and strain, flexure of the lithosphere, analysis and interpretation of gravity data, seismology, and fluid dynamics. The theory will be applied to problems related to the evolution and structure of the solid planets and moons in the solar system.

Course Prerequisites or Co-requisites
None. College-level proficiency in calculus, differential equations, and physics is expected.

Course Format and Teaching Methods
Course Modality – Live in person.

Course Objectives
This course will cover:
- Heat flow in planetary interiors
- Elasticity, stress, strain and deformation
- Flexure and deformation of the lithosphere
- Gravity and the compensation of topography
- Rheology, fluid mechanics, and mantle convection
- Applications of all of the above physical processes toward understanding planetary evolution

Expected Learning Outcomes
Students will demonstrate a quantitative understanding of the physical processes governing planetary evolution.
Students will be able to solve quantitative problems in planetary geodynamics using analytic and numerical methods.

Required Texts and Materials

Geodynamics (Turcotte and Schubert, 3rd edition)
Available for free in digital form from the UA library (but it is a good book to have on your shelf):
https://www-cambridge-org.ezproxy4.library.arizona.edu/core/books/geodynamics/D20BD7359E157591F75CF3BCFEDF88A8

Schedule of Topics and Activities

Lecture	date	day	Lecture topic	Assignments
1	8/25/26	T	Intro and overview	
2	8/27/26	R	Planetary energy sources	
3	9/1/26	T	Heat flow - static	
4	9/3/26	R	Heat flow - dynamic	
5	9/8/26	T	Heat flow - dynamic	
6	9/10/26	R	Heat flow - dynamic	Hwk 1 (static heat flow) due
7	9/15/26	T	Heat flow - finite differences	
8	9/17/26	R	Heat flow - planetary applications	
9	9/22/26	T	Stress, strain and elasticity	
10	9/24/26	R	Elasticity and flexure	
11	9/29/26	T	Flexure	Hwk 2 (dynamic heat flow)
12	10/1/26	R	Applications of flexure	
13	10/6/26	T	Applications of flexure (remote)	
14	10/8/26	R	Applications of flexure (remote)	mid-term project
15	10/13/26	T	project presentations	
16	10/15/26	R	Fourier series and flexure	
17	10/20/26	T	Gravity and compensation	
18	10/22/26	R	Gravity analyses	Hwk 3 - elasticity and flexure due
19	10/27/26	T	Gravity analyses	
20	10/29/26	R	Gravity - spherical harmonics	
21	11/3/26	T	Gravity - planetary applications	
22	11/5/26	R	Tectonics	Hwk 4 - gravity due
23	11/10/26	T	Tectonics	
24	11/12/26	R	Rheology	
25	11/17/26	T	Fluid mechanics	
26	11/19/26	R	Fluid mechanics	Hwk 4 - gravity due
	11/24/26	T	Thanksgiving - no class	(Thanksgiving)
	11/26/26	R	Thanksgiving - no class	(Thanksgiving)
27	12/1/26	T	Mantle convection	
28	12/3/26	R	Mantle convection	Hwk 5 - fluid mech., mantle conv.
29	12/8/26	T	wrap-up	

Assessments

The different components of the course will be weighted as follows:

Homework: 50%
Midterm Project: 15%
Final Project: 35%

Homework: Regular problem sets will be assigned approximately every other week. Assignments will require quantitative problem solving. You are encouraged to use *Matlab, Python* or another programming language for some parts of these assignments (and some assignments may require *Matlab*-based functions). While many questions could be answered using a spreadsheet-based program such as *Excel*, these programs are not effective for answering most questions and are particularly prone to errors in setting up complex equations. For all problems, show all work, including written-out versions of equations used with explicit statements of the values and associated units used for each variable in the equation. Submit any code used in your solution (though the written non-code answers must be complete and stand on their own).

Policy on group or collaborative work: The goal of this course is for you to build a quantitative and qualitative understanding of how planets work. This understanding comes through solving problems in which you apply the course content to real planetary science problems. Consulting with your peers on assignments is permitted, but you must first attempt each problem on your own. Your turned in assignment should include your first independent attempt as well as your final solution, and clearly delineate between your own individual work and work that was done in consultation with your peers. You will only be graded on your final work, but I want to see your thought process. *Exchanging code is not permitted. Obtaining and using homework, answer keys, or exams from previous years is not permitted and will be considered a violation of the University of Arizona code of Academic Integrity.*

Equipment and software requirements: For this class you will need access to a computer with *Matlab* or equivalent program for some homework problems. *Matlab* is available to University of Arizona students free of charge.

https://softwarelicense.arizona.edu/mathworks-matlab

https://www.mathworks.com/academia/tah-portal/university-of-arizona-30356115.html

If you experience any technology issues that may impede your participation in the course, please let me know as early in the semester as possible

Use of Artificial Intelligence

You are not permitted to use AI or related tools for any assignments unless instructed to do so. Any use of AI must be disclosed.

Final Examination or Project

This course does not have exams.

Details on the mid-term and final projects will be provided when they are assigned.

Mid-term project: A mid-term research project will be conducted on material from the first half of the class. Theoretical concepts will be applied to a real research problem in the field of planetary science and described in a short write-up.

Final project: A final research project will be conducted using material from any part or parts of the class and written up in the form of a scientific paper.

Grading Scale and Policies

Numerical grades will be curved. Letter grades will nominally be assigned based on the following distribution of curved grades:

A: 90% and higher
B: 80-89%
C: 70-79%

D: 60-69%
F: <60%

Safety on Campus and in the Classroom

For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): https://cirt.arizona.edu/case-emergency/overview

Also watch the video available at https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/common/learningeventdetail/crtfy000000000003560

Nondiscrimination and Anti-harassment Policy

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please see: http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

University Policies

All university policies related to a syllabus are available at: https://catalog.arizona.edu/syllabus-policies. By placing this link in your syllabus, you no longer need to have each individual policy included in your syllabus.

Subject to Change Notice

Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor of this course.

Life challenges

If you are experiencing unexpected barriers to your success in this course, or need assistance and/or accommodation, please speak to me. Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor of this course. In addition, the Dean of Students Office is a central support resource for all students, and can be reached at 520-621-2057 or at DOS-deanofstudents@e-mail.arizona.edu

Graduate Student Resources

Link to the University of Arizona's Basic Needs Resources page: http://basicneeds.arizona.edu/index.html