PTYS 512: Planetary Global Tectonics
Fall 2024
Kuiper room 312, Tuesday/Thursday, 9:30-10:45

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.

Instructor Information
> Dr. Jeff Andrews-Hanna
> Kuiper 438
> jcahanna@arizona.edu (preferred mode of contact)
> preferred name: "Jeff"
> preferred pronouns: he, him, his
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> Office hours: Tuesday, 11:00 AM -12:00 PM (in-person or remote)
> *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.*
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> Web information: This course will use a D2L page:
> > https://d2l.arizona.edu/d2l/home/1507419

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, 2nd edition)
Available for free in pdf 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
See course schedule at end of syllabus

Assessments
The different components of the course will be weighted as follows:
> Homework: 40%
> Exams: 15%, 15%, 30%

Exams: This course will have two mid-term exams and a final exam. Exams will be in-person. You may prepare and use a single-sided 8x10 page of handwritten notes to use during the exams.

The university final exam schedule can be found at:
https://registrar.arizona.edu/faculty-staff-resources/room-course-scheduling/schedule-classes/final-exams/final-exams-fall-2024
The final exam is currently scheduled for Tuesday 12/17 8:00 AM – 10:00 AM

Homework: Regular problem sets will be assigned approximately every other week. Assignments will require quantitative problem solving. You are encouraged to use *Matlab* or another programming language for some parts of these assignments (and some assignments will require *Matlab*-based functions), so that we have a uniform programming language for ease of grading and assistance by the professor, but any programming language is acceptable. A *Matlab* tutorial will be provided. 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).

You are permitted to consult with your fellow students or the professor for assistance in completing homework assignments (unless instructed otherwise), but your work must be your own. 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.*

In the alternate weeks, students will work in pairs to conduct "itty-bitty research projects" (IRPs). Students will apply a concept learned in the previous unit to a real problem in planetary science of their choosing, write up the results, and present in class. These are intended to be fun, practical exercises of limited duration (<3 hours).

Equipment and software requirements: For this class you will need access to a computer with *Matlab* or equivalent program for homework assignments. *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

Grading Scale and Policies
Numerical grades will be curved. Letter grades will nominally be assigned based on the following distribution:
    A: 90% and higher
    B: 80-89%
    C: 70-79%

D: 60-69%
F: <60%

Meeting times: The class will meet Tuesdays and Thursdays from 9:30-10:45 AM MST in Kuiper room 312.

Academic advising: If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the Advising Resource Center can guide you toward university resources to help you succeed.

Life challenges: If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at 520-621-2057 or DOS-deanofstudents@email.arizona.edu.

Physical and mental-health challenges: If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520)-621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

University policies
All university policies related to a syllabus are available at:
https://academicaffairs.arizona.edu/syllabus-policies
Policies pertain to absence and class participation, threatening behavior, accessibility and accommodations, the code of academic integrity, and the non-discrimination and anti-harassment policy.

Land acknowledgement
The University of Arizona resides on ancestral lands of the Tohono O'odham and Pascua Yaqui nations, where many today continuously reside in their ancestral land. I acknowledge the privilege it is to teach and learn in this region and I express my gratitude to these nations. I also acknowledge the historical and present-day injustices that many indigenous peoples have suffered at the hands of those in power, including the loss of their ancestral lands, and the grave inequities that persist today as a result.

Preferred pronouns
This course affirms people of all gender expressions and gender identities. If you prefer to be called a different name than what is on the class roster, please let me know. Feel free to correct instructors on your preferred gender pronoun. You may also change your preferred name and/or pronouns on the UAccess system. If you have any questions or concerns, please do not hesitate to contact me directly in class or via email.

Classroom community
My goal is to establish this class as a community of mutual respect. I believe that diversity is a critical part of science – diversity of ideas, diversity of perspectives, and diversity of

individuals. I appreciate the fact that each student brings their own history and perspective to the class. I recognize that many in our campus community have faced discrimination and bias throughout their educations and their lives, particularly people of color, other under-represented minorities, and immigrants. I expect that each person in this class will treat everyone else with respect at all times. If at any time you feel that I have failed to treat you with respect, I ask you to speak with me to help me to understand my failing or to clear up any misunderstanding.

Accessibility and Accommodations: At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations.

Code of Academic Integrity: Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are permitted and encouraged to discuss problems with their peers, but must do their own work to be turned in.

Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See https://deanofstudents.arizona.edu/policies/code-academic-integrity

The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy:
The University is committed to creating and maintaining an environment free of discrimination; see: http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students
UA Academic policies and procedures are available at http://catalog.arizona.edu/policies

Student Assistance and Advocacy information is available at http://deanofstudents.arizona.edu/student-assistance/students/student-

Confidentiality of Student Records: http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa

Subject to Change Statement
Work and course requirements are subject to change at the discretion of the instructor with proper notice to the students.

Provisional lecture schedule: (*subject to change*)

Lecture	date	day	Lecture topic	Assignments
1	8/27/24	T	Intro and overview	
2	8/29/24	R	Heat flow - static	
3	9/3/24	T	Heat flow - static	
4	9/5/24	R	Heat flow - dynamic	
5	9/10/24	T	Heat flow - dynamic	
6	9/12/24	R	Heat flow - dynamic	Hwk 1 (static heat flow) due
7	9/17/24	T	Heat flow - finite differences	
8	9/19/24	R	Heat flow - planetary applications	IRP 1 - static heat flow
9	9/24/24	T	Stress, strain and elasticity	
10	9/26/24	R	Elasticity and flexure	Hwk 2 (dynamic heat flow)
11	10/1/24	T	Flexure	
12	10/3/24	R	Applications of flexure	IRP 2 - dynamic heat flow
13	10/8/24	T	Applications of flexure	
14	10/10/24	R	Exam 1	Exam 1: heatflow, stress
15	10/15/24	T	Fourier series and flexure	
16	10/17/24	R	Gravity basics	Hwk 3 - elasticity and flexure
17	10/22/24	T	Gravity analyses	
18	10/24/24	R	Gravity - spherical harmonics	IRP 3 - elasticity and flexure
19	10/29/24	T	Gravity - spherical harmonics	
20	10/31/24	R	Gravity - planetary applications	Hwk 4 - gravity
21	11/5/24	T	Gravity - planetary applications	
22	11/7/24	R	EXAM 2	EXAM 2 - flexure, gravity
23	11/12/24	T	Gravity - planetary applications	
24	11/14/24	R	Tectonics	IRP 4 - gravity
25	11/19/24	T	Rheology	
26	11/21/24	R	Fluid mechanics	IRP 5 - tectonics
	11/26/24	T	Thanksgiving - no class	
	11/28/24	R	Thanksgiving - no class	(Thanksgiving)
27	12/3/24	T	Fluid mechanics	
28	12/5/24	R	Mantle convection, cores	Hwk 5 - fluid mech., mantle conv.
29	12/10/24	T	wrap-up	