

GEOL 460 Course Syllabus
Solid Earth Geophysics
(3 Units)

Humboldt State University
Department of Geology
Arcata, CA 95521

Spring 2016

Lecture: CRN 25313 Section 10 T 5 PM – 6:50 PM

Founders Hall 179

Lab: CRN 25328 Section 11 R 5 PM – 7:50 PM

Van Matre 109

Instructor: Jason Robert Patton

Email: Jason.Patton@humboldt.edu

Office: Founders Hall 136

Phone: 707.826.3923

Course Website: http://www.science.earthjay.com/?page_id=3519

Office Hours: Tuesday 3:00 PM – 5:00 PM

Prerequisites: MATH 110, PHYX 107 or 110

Field Trips: One 3 day and Two 1 day Weekend Field Trips (these will replace some in-class labs)

Required Reading:

Fowler, C.M.R. *The Solid Earth, An Introduction to Global Geophysics*. Cambridge Press University, 2nd ed., 685 pp., 2005.

Required Supplies: three ring binder for class handouts including blank paper for drawing illustrations and notes during class; colored pencils for making illustrations, field notebooks for taking notes during our field trips

Contact: Please don't hesitate to email me with any questions, comments, or concerns. I welcome any feedback or suggestions. The best way to contact me for any reason is by sending an email directly to my HSU email jason.patton@humboldt.edu

Fulfills the following requirements: the upper division geology area of specialization for the Bachelor of Science degree with a major in Geology

Course Description:

Principles of seismology, gravity, geodesy, terrestrial heat flow, geomagnetism, and paleomagnetism. Emphasis on earth as a whole: its internal constitution and evolution.

Course Student Learning Outcomes:

1. Students can demonstrate an understanding of the scientific method and the consequences of human activities on the environment and earth resources.
2. Demonstrate critical thinking to communicate the basic elements of plate tectonic theory and apply these concepts in describing how earthquakes, or other geologic hazards, impact both humanity and the natural environment.

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3. Apply physical science principles to describe how energy is transmitted through geologic systems.
4. Students can effectively communicate scientific ideas and results verbally and orally, and demonstrate competence in the manipulation of electronic data.

Humboldt State University Student Learning Outcomes:

HSU graduates will have demonstrated:

- Effective communication through written and oral modes.
- Critical and creative thinking skills in acquiring a broad base of knowledge and applying it to complex issues
- Competence in a major area of study.
- Appreciation for and understanding of an expanded world perspective by engaging respectfully with a diverse range of individuals, communities and viewpoints.

HSU graduates will be prepared to:

- Succeed in their chosen careers.
- Take responsibility for identifying personal goals and practicing lifelong learning.
- Pursue social justice, promote environmental responsibility, and improve economic conditions in their workplaces and communities.

Grading

Late Assignments are NOT ACCEPTED.

There are NO EXTRA CREDIT opportunities.

Your final grade will be comprised of:

<u>Summary</u>	<u>Points</u>
Participation	100
Course Notes and Illustrations	100
Labs	300
Field Trip Report	50
Research Paper / Presentation	150
Earthquake Reports & Summary	100
Mid Term	100
<u>Final Exam</u>	<u>100</u>
Total	1000

There are 1000 points available and grades are assigned by the percentage of total points as follows:

1000-940=A	939-900=A-	899-870=B+	869-830=B	829-800=B-
799-770=C+	769-700=C	699-670=D+	669-600=D	<599=F

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Communication

The instructor will send announcements via email to the student's humboldt.edu email addresses. Please contact the instructor only via the email listed above. The instructor will respond at their earliest convenience. Students will exchange contact information with their peers on the first day of classes. This is important so that if anyone misses a class, they can contact more than one of their peers to go over the notes and lab materials. Also, students will need to interact during the online portion of this course and having other student's email addresses will facilitate this.

Classroom Conduct

Side conversations among classmates are disrespectful and disruptive to the instructor and your fellow students. Questions or comments about the course material are welcome at all times but should be approached in a respectful manner.

The use of cell phones, iPods, or other items that may distract you, your instructor, or your classmates are not permitted during class. All such devices must be turned off.

You may not leave the room during an exam or quiz unless you are ready to turn in your finished exam.

Academic Honesty

You are encouraged to work together to review notes from lectures, to work on problems from the text, and to formulate ideas for any take-home assignments. However, all work you turn in must be your own independent, original work.

In the event that any work is copied from another student, zero credit will be given to all students involved (regardless of who copied from whom).

Any sources of information used in your written work must be referenced (regardless of whether the material was copied word-for-word). This includes your text book and all internet sources (reference these by including the name and URL). Any work including un-referenced material from another source (regardless of whether it was copied word-for-word) will be given zero credit.

More information is available at:

http://www.humboldt.edu/studentrights/academic_honesty.php

Academic Misconduct: Cheating, plagiarism, collusion, abuse of resource materials, computer misuse, fabrication or falsification, multiple submissions, complicity in academic misconduct, and/ or bearing false witness will not be tolerated. Violations will be dealt with according to the procedures and sanctions proscribed by Humboldt State University. Students caught plagiarizing or cheating on exams will receive an "F" in the course.

University Policies

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Students with Disabilities: Persons who wish to request disability-related accommodations should contact the Student Disability Resource Center in the Learning Commons, Lower Library, 826-4678 (voice) or 826-5392 (TDD). Some accommodations may take up to several weeks to arrange. <http://www.humboldt.edu/disability/>

Add/Drop policy: Students are responsible for knowing the University policy, procedures, and schedule for dropping or adding classes. <http://www.humboldt.edu/~reg/regulations/schedadjust.html>

Emergency evacuation: Please review the evacuation plan for the classroom (posted on the orange signs), and review http://www.humboldt.edu/emergencymgmtprogram/evacuation_procedures.php for information on campus Emergency Procedures. During an emergency, information can be found campus conditions at: **826-INFO** or www.humboldt.edu/emergency

Academic honesty: Students are responsible for knowing policy regarding academic honesty: http://www.humboldt.edu/studentrights/academic_honesty.php

Academic dishonesty is willful and intentional fraud and deception to improve a grade or obtain course credit. It includes all student behavior intended to gain unearned academic advantage by fraudulent and/or deceptive means.

Attendance and disruptive behavior: Students are responsible for knowing policy regarding attendance and disruptive behavior: http://www.humboldt.edu/studentrights/attendance_behavior.php

*** Please note that this document is informational and subject to change.**

Week	Lecture		Lab		Reading
	Date	Subject Material	Date	# Lab Subject	
1	T 1/19/2016	Introduction to Class; 2015 Earthquakes in Review; Tectonics on a Sphere	R 1/21/2016	1 Spherical Tectonics Problem Set	ch. 1 & 2
2	T 1/26/2016	Plate Tectonics and Magnetism	R 1/28/2016	2 Plate Motion Rates Problem Set	ch. 3
3	T 2/2/2016	Earthquake Seismology, Literature Review 1	R 2/4/2016	3 Seismology I Problem Set	ch. 4.1-4.2
4	T 2/9/2016	Seismic Refraction	R 2/11/2016	4 <u>No Lab (in exchange for Cache Creek)</u>	ch. 4.3
5	T 2/16/2016	Seismic Reflection	R 2/18/2016	5 Seismology III	ch 4.4
6	T 2/23/2016	Gravity I: Isostasy	R 2/25/2016	6 Magnetometer Survey (training in lab, weekend self schedule)	ch. 5.1-5.5.2
7	T 3/1/2016	Gravity II: Gravity Anomalies; Research Paper Outline Due	R 3/3/2016	7 Isostasy Problem Set	ch. 5.5.3-5.7.2
8	T 3/8/2016	Geochronology, Mid Term	R 3/10/2016	8 Geochronology Problem Set	ch. 6
9	T 3/15/2016	Heat Flow	R 3/17/2016	9 Heat Flow Problem Set	ch. 7
10	T 3/22/2016	Structure of the Earth	R 3/24/2016	10 Earth's Structure Problem Set	ch. 8
11	T 3/29/2016	Oceans I; First Draft Research Paper Due	R 3/31/2016	- Cesar Chavez Holiday	ch. 9
	T 4/5/2016	Spring Break	R 4/7/2016	- Spring Break	
12	T 4/12/2016	Oceans II	R 4/14/2016	11 Oceans Problem Set	ch. 9
13	T 4/19/2016	Continents I	R 4/21/2016	- <u>No Lab (in exchange for Cache Creek)</u>	ch. 10
14	T 4/26/2016	Earthquake Summary Report Due and Final Presentation	R 4/28/2016	12 Continents Problem Set	ch. 10
15	T 5/3/2016	Research Paper Due; Presentations	R 5/5/2016	Review of Class and Labs	
	T 5/10/2016	FINAL			
			March	6 Self Schedule: Magnetometry	
			April	4 Cache Creek Seismic Survey	
			April/May	13 GPS Survey	

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Class will start on time at 5:00 PM. You are responsible to be present for and be attentive to all the material covered in class. If you need to leave the class early, please let me know before the class starts.

This is a college-level science class, and will require a commitment of your time outside of class. This at-home time will enable you to digest the material we cover in class and help when you are asked on the exams to apply these concepts to different problems and applications.

You will spend 10 to 15 hours per week on course material outside of class, on average. You are encouraged to set aside a specific time each week outside of class devoted solely to each course:

- Reviewing lecture notes and in-class exercises each week
- Reading the textbook
- Studying for the exam

Note that 10 hours per week at home is the average minimum to pass. Some students may require more time at home just to pass; for some in this course that may be enough to get an A. A student who is very attentive in class, asks questions, and takes careful notes will need less at-home time.

Absences: It is extremely difficult to do well in this class without attending all the lectures. I understand there will be an occasional absence due to illness or emergency, however I consider more than two absences per semester excessive. If you do miss a class:

1. Obtain the course material online (PowerPoint slides, extra reading, and handouts). The slides will include information about any homework or in-class exercises that were assigned. Most assignments and handouts referenced by the slides will be in your handouts.
2. Next, try to obtain a copy of lecture notes from a classmate since there are many things we cover that are not spelled out directly on the slides or handouts. This is the most important step.
3. Read the required reading covering the material you missed.
4. After this, feel free to contact me by email with any questions.

Final grade active attendance boost: If your final course grade after rounding to the nearest whole number is within 1 point of a grade transition (C to C+, D to C, A- to A, etc.) I will give you the boost needed to obtain the higher grade if you have actively attended most classes and succeeded in many of the in-class pop quiz questions. More than 2 unexcused absences is

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considered excessive and will disqualify you from this opportunity. Conduct not in accordance with that outlined below will also prevent you from receiving this bonus.

Computer skills: This class will require computer use outside of class. Activities involving the 4 skills listed below will be included throughout the semester. In addition, you will be expected to check Moodle and your email regularly for announcements.

1. Send and receive email from your Humboldt State University email account.
2. Open a web browser and access a web page if you are given the web address.
3. Access the course material online (handouts, slides, announcements, etc.).
4. Create, edit, and export Microsoft word (.doc or .docx), Microsoft Excel (.xls or .xlsx) and Adobe .pdf documents. We will also be using specialized software to create, edit, and export files of other formats.

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Participation: Students will be given up to 100 points for participating in class. Full credit will be given if students attend regularly, ask and answer questions in class, and participate in class discussion. When students conduct in behavior that is not respectful (as outlined in the syllabus), they jeopardize their participation grade.

Lectures: Lectures will consist of presentations and discussions led by the professor and weekly earthquake report discussions led by the students.

Reading: The reading is essential to your comprehension of the material in this course and will be a key to your success. The student is expected to read the assignment before class/lab.

Labs: Each week there will be a lab that will incorporate either problem sets from the text or field trips for applied geophysics. The labs are due by the beginning of lab the following week, except when otherwise noted. Late assignments will be accepted with a grade reduction of 25% per day past the due date.

Missing an exam: All make-up exams should be arranged for in advance. In the event of an emergency or sudden illness that prevents you from attending the exam, you must contact me as soon as possible and arrange a time for the exam to be completed before our next regular class time. If you miss an exam (and do not contact me to make it up) or if you arrange a make-up that you do not take, you will receive a zero for that exam.

Course Notes and Illustrations: Each lecture may include handouts and several on-board illustrations that relate to the specific topic being discussed for that day. You will use your notebook to copy and label any illustrations. You are **required** to have a **three-ring binder** containing these handouts and your notes taken during every class. The notebooks will also contain all of your course materials (labs, syllabus, exams, etc.). You will turn in your notebooks along with your labs and homework that has been completed through the semester. Your material must be well organized within the notebook. These will be evaluated during the final. Credit of 100 points is given for careful reproduction of the illustrations including any notes, labels, and graphs.

Earthquake Reports: Each week, people will present earthquake reports for their selected region. These reports will be comprised of a summary of the earthquakes in a certain region since the last report and will be 2-5 minutes long. At the end of the term, students will make a 5-10 minute presentation summarizing the seismicity in a certain region since the beginning of the term. Students should make at least one digital presentation slide for their weekly reports

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and provide it to the professor via email at least an hour before class begins. The end of the term summary should have several digital presentation slides, with at least one map and one figure explaining the regional tectonics for their region. This final presentation should be provided to the professor at least an hour before class. The weekly reports are worth 50 points and the summary report is worth 50 points.

Library Research: There is one library research assignment that is worth 100 points, with an associated presentation that is worth 50 points. The report will be typed in font size 12, double spaced, margins between 0.75 and 1 inch, and turned in electronically by 5 PM, May 3, 2016. The report will be five to ten pages long. The paper will include between 1 and 3 figures and 1 and 3 data plots or tables. Each table, plot, or figure needs to have a caption describing the table, plot, or figure. The filename needs to include the course number, the subject, and your last name, in the following format: GEOL_460_CSZ_lastname.docx (or *.pdf). There is a writing example posted on the website (albeit a different length). The presentation will be 10 minutes long with time for 2-3 minutes of discussion. Presentations will be made on 5/3/16.

The purpose of this assignment is:

- a. To become familiar with the tectonics of the north coast area - one of the most active regions of the western United States.
- b. To look at examples of the application and limitation of geophysical techniques in the study of real problems.
- c. To read and critically review scientific literature.
- d. To gain experience in writing (and rewriting) a scientific paper.
- e. To share what you have learned with the rest of the class.

During the course of the term I expect you to work closely with me in order to produce a satisfactory final product. This will include meeting with me early in the term to discuss general ideas for the paper, preparing an outline of the paper and meeting with me again to discuss the outline, preparing a complete draft of the paper which I will critique, and responding to my comments in a final draft.

Content: The Mendocino Deformation Zone and its boundaries define one of the most seismically active regions in California. A number of studies of this area have been reported in the literature. The Cascadia subduction zone which includes the convergent boundary between the Gorda-Juan de Fuca-Explorer plates and North American plate has been recognized as capable of producing very large earthquakes. The number of published papers on this region has increased yearly. They vary as to the type(s) of data used, in the interpretation of those

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data, and in the tectonic models that they propose. Your assignment is to choose a problem and critically review three papers which use geophysical evidence to study this problem. At least one of these papers must include seismic evidence.

Some examples of previous paper topics:

Is the Cascadia subduction zone locked?

Is the Gorda plate really a plate?

The dynamics of the Mendocino triple junction

The state of stress in the Gorda plate

The nature of the Mendocino fault

Was the 1992 Cape Mendocino earthquake on the Cascadia subduction zone?

Evidence for segmented rupture of the Cascadia subduction zone

Your review should make clear the type of data each study uses, how the authors have interpreted those data, and the model(s) proposed to explain their interpretation. You should comment on any limitations of their data or analysis (i.e. sparse seismic station coverage, ambiguities in fault plane solutions, etc.). You should also point out any areas of conflict or controversy among the different papers and explain whether the controversy is due to different types of data gathered, different interpretations of the same data, and/or different proposed models. Finally you should add your own comments as to which studies (or parts of studies) you think are most accurate, which are the weakest, and why. I expect you to have at least looked at recent papers using the type of data your paper covers.

Requirements: You are to turn in a short outline (1 page or less) and two drafts of this paper.

1. Outline: This should include a brief statement of the problem your paper will focus on (for example - what earthquakes tell us about the stress state in the Gorda plate, the seismicity of the southern portion of the Cascadia subduction zone, etc.), the three main papers you intend to work with, and the points you plan to discuss.

2. First draft: This should be written as a final copy (in other words, do your best job!). The paper must include an abstract and a bibliography (these don't count in your 5 - 10 pages). Unless the figures are your own original work, you must cite the source. It is all right to copy figures from a published paper; however please write your own figure caption and include the citation in it. I will return these drafts with comments by April 12 or earlier if you get your draft to me before the deadline.

3. Final draft: Your final draft should address any comments/criticisms I've raised on your first draft. Attach the copy of your first draft with my comments on it!

NO LATE PAPERS WILL BE ACCEPTED!!! I will be glad to receive papers early and return them to you early.

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Grading: Grading is based on content and quality of writing. It is impossible to separate these two since it is very difficult to decipher the content of a poorly written paper! Utilize the campus writing center! They require you to make an assignment and I suggest that you plan on meeting with them several times during the writing process. As to content, I am particularly interested in how well you understood what the authors were trying to do and what assumptions they made in their respective studies. You may find that the authors of your papers disagree on some or many points. That's fine – just point out their areas of disagreement and what data supports them. I don't expect you to become a supporter of one point of view or another – it is fine to point out weaknesses and strengths in the papers and, if you wish, include how you feel about these arguments in the discussion section, but try to be objective in your treatment. As to writing, there is no excuse for misspelled words, run-on sentences, or blatantly poor grammar! I will also consider how well your paper is structured and whether you've cited references appropriately. Usually the rewritten version will get a better grade than the first version if you've addressed all the comments I have made. However, occasionally papers don't improve much and rarely have they gotten worse. If you are unclear as to how to proceed, please see me.

Field Trips: We will have three weekend field trips. One will be self-scheduled (magnetometer). One will be a group field trip on a Saturday (GPS). One will be a 3-day field trip (seismic reflection). The magnetometer field trip will be a group lab. The group will turn in a group report. For the GPS and 3-day field trip, each student will turn in a field trip report.

The reports will be typed in font size 12, double spaced, and turned in electronically within a week of the field trip. The reports will be three to five pages. The filename needs to include the course number, the subject, and your last name (e.g. GEOL_460_field_trip_X_lastname.docx). The one-day field trip reports are turned in as regular labs. The 3-day field trip report is worth 50 points. People who cannot make the field trip will write a research paper based on a single peer review journal. This paper will be the same length.

Electronic Presentations: All electronic presentations will be posted to the website for this course. Please use these presentations to review course material and to prepare for your exams and reports.

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