

GEO 465K: Exploration Seismology

Unique IDs. 27726, 27728

GEO 384C: Seismology I

Unique IDs. 27873, 27874

Fall 2013 Syllabus

Lectures: Monday, Wednesday, and Friday, 1:00–1:50 pm; JGB 3.222

Laboratory Sections: Monday, 9:00–11:00 am; or Wednesday, 2:00–4:00 pm

Room: JGB 2.312 and (sometimes) JGB 3.218

Instructor: Kyle Spikes

University of Texas Honor Code

The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community.

Objectives: Geo 384C and Geo 465K provide an introduction to exploration seismology intended for first year graduate students with a minimal exposure to exploration geophysics, and as a key component of the undergraduate curriculum in the B.S. geophysics option. The course covers seismic methods and their applications to exploration and development of mineral resources, particularly oil and gas. Labs will consist of a mixture of practical and computer exercises, plus student presentations reviewing selected articles in the recent geophysical literature.

Prerequisites: For undergraduate students: The following courses with a grade of C or better: Math 427K, 427L, Physics 315, 115L. (Students may register for Math 427L concurrently.) For graduate students: graduate standing.

Assignments, Assessment, and Evaluation: Most weeks a homework problem set will be assigned in the laboratory section. Additional assignments may be given in lecture. These homework sets and assignments, their issue dates, and their due dates will be posted on Blackboard and specified in class or lab. Each assignment will be due at the beginning of the laboratory or lecture period on the day that it is due. For each day an assignment is late, the grade for that assignment will be dropped 10% of the assigned grade, down to a minimum of 50% of the assigned grade as long as the assignment is submitted before the graded assignments are returned. After the graded assignments are returned, no credit will be given. Short quizzes will be given at the discretion of the instructor. These quizzes cannot be retaken nor made up at a later time.

Exams: Two in-class midterm exams and a final exam will be given. A midterm may be made up at the discretion of the instructor if the student can provide valid and substantiated reasons for the absence *prior* to the exam. Midterm exams will take place during lecture. The final cannot be rescheduled.

Midterm Exam 1 Date: Monday, September 30th, in class.

Midterm Exam 2 Date: Monday, November 5th, in class.

Final Exam: Saturday, December 14th, 9 am -12 pm.

Final Exam: Cumulative exam on entire course, with additional weight on last third of the course.

Each student will make a ten minute oral presentation to the class, and class members will evaluate each presentation. Topics will be determined at a later date, and they will be selected from the recent literature of exploration geophysics.

Grades: The grading for the class is based on the following criteria.

Grade Percentage Basis

Two midterm exams at 12.5% each	25%
Final (Cumulative) exam	25%
Oral Report	10%
Lab and Homework exercises and Participation	40%

Plus and minus designations will be included in final grading.

Attendance and Classroom policies: Attendance is required for both lecture and laboratory. Active participation is expected in lecture and laboratory activities. If you must miss a laboratory session, it is your responsibility to arrange, with the teaching assistant, to attend another section covering that material. *This arrangement must be made prior to the absence.* Students with disabilities may request appropriate academic accommodations from the Service for Students with Disabilities, 471-6259.

Texts:

Required:

Kearey, P., M. Brooks, and I. Hill, 2002, An Introduction to Geophysical Exploration, Third edition: Blackwell Science Ltd., Oxford, 2002, 262 p.
Sheriff, R. E. and L. P. Geldart, 1995, Exploration Seismology: Cambridge University Press, Cambridge, England. 592 p.

Suggested:

Lillie, R. J., 1999, Whole Earth Geophysics, Prentice Hall, Upper Saddle River, N.J., 361 p.

A reading list of relevant technical papers for the technical presentations will be provided. A class website is available on BlackBoard, and will include supplemental material.

Scholastic dishonesty: Collaboration in studying, class and lab exercises is encouraged. Inappropriate collaboration on exams and individual assignments (Including lab reports) will NOT be tolerated, and will be dealt with in an appropriate manner for academic dishonesty.

Plagiarism. Plagiarism will not be tolerated. See the University of Texas guidelines for plagiarism:

http://deanofstudents.utexas.edu/sjs/scholdis_plagiarism.php

Use of E-Mail for Official Correspondence to Students

E-mail is recognized as an official mode of university correspondence; therefore, you are responsible for reading your e-mail for university and course-related information and announcements. You are responsible to keep the university informed about changes to your e-mail address. You should check your e-mail regularly and frequently—I recommend daily, but at minimum twice a week—to stay current with university-related communications, some of which may be time-critical. You can find UT Austin's policies and instructions for updating your e-mail address at <http://www.utexas.edu/its/policies/emailnotify.php>

Documented Disability Statement

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact Services for Students with Disabilities at 471-6259 (voice) or 232-2937 (video phone) or <http://www.utexas.edu/diversity/ddce/ssd>

Religious Holy Days

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, I will give you an opportunity to complete the missed work within a reasonable time after the absence.

Behavior Concerns Advice Line (BCAL)

If you are worried about someone who is acting differently, you may use the Behavior Concerns Advice Line to discuss by phone your concerns about another individual's behavior. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit <http://www.utexas.edu/safety/bcal>

Resources for Learning & Life at UT Austin. The University of Texas has numerous resources for students to provide assistance and support for your learning.

The UT Learning Center: <http://www.utexas.edu/student/utlc/>

Undergraduate Writing Center: <http://uwc.utexas.edu/>

Counseling & Mental Health Center: <http://cmhc.utexas.edu/>

Career Exploration Center: <http://www.utexas.edu/student/careercenter/>

Student Emergency Services: <http://deanofstudents.utexas.edu/emergency/>

Subject-to-change notice

Ground rules for participation in discussions or activities

A statement about plagiarism and the consequences of plagiarizing.

<http://www.lib.utexas.edu/services/instruction/faculty/plagiarism/preventing.html>

<http://www.lib.utexas.edu/services/instruction/learningmodules/plagiarism>

Assignments, Assessment, and Evaluation

Texts:

Sheriff and Geldart (S&G)

Keary, Brooks and Hill (KBH)

Robert J. Lillie (RJL)

additional *Supplemental* readings (Available on bb)

Supplemental material indicated by *italic* type.

WEEK	TOPIC	READING	LABORATORY
<hr/> Lecture # / Day, Date			

Week 1	Topic	Reading	Lab
1. W 8/28	Introduction to Exploration Seismology	S&G Ch. 1 KBH Ch. 1 RJL Ch. 1	No Lab this Week
2. F 8/30	Introduction to Elasticity Definition of Stress	S&G p. 33-38 KBH p. 21-24 RJL p. 45-49.	
Week 2	Topic	Reading	Lab
M 9/2	Labor Day Holiday – No Class		
3. W 9/4	Define Strain	S&G p. 36-38 S&G p. 33-40	No Lab this Week
4. F 9/6	Hooke's Law and Elastic Constants	<i>MM&D (18-19) 17-24, 14-16 Sheriff, Elastic Constants</i>	
Week 3	Topic	Reading	Lab
5. M 9/9	Define Wave Equations	S&G p. 33-40 KBH p. 22-26 RJL p. 49-55	Lab 1: Elastic constants and seismic velocity
6. W 9/11	Polarization, Anisotropy of Body Waves VTI, HTI, SV, SH, S1, S2	S&G p. 55-57 KBH p. 43-52 RJL Ch. 5 (p. 100-135)	
7. F 9/13	Body, surface and Interface Waves	S&G p. 49-55 KBH p. 23-26 RJL p. 45-52	
Week 4	Topic	Reading	Lab
8. M 9/16	Interfaces-Reflection, Refraction and Mode-Conversion	S&G p. 62-63, Ch. 3 (73-84) KBH 28-32 KBH p. 43-52	Lab 2: Rock velocities; Velocities and traveltimes in layered media
9. W 9/18	"THE" Seismic Experiment, Geometry of Seismic Reflections, velocity estimations	S&G Ch. 4 (85-95) RJL p. 64-66; 105-119 <i>Sheriff, Velocity Definitions</i>	
10. F 9/20	Introduction to Refraction methods: Flat layers, Single Interface, multiple interfaces	KBH 99-104 RJL 73-78	
Week 5	Topic	Reading	Lab
M 9/23	No Class		

11. W 9/25	Seismic Refractions dipping layers, Various methods of Refraction Surveying	KBH 105-108 RJL 78-85 S&G Ch. 11 (425-446)	SEG Week – No Labs
12. F 9/27	“The” Seismic Experiment Summary	Summary of all methods discussed in class	
Week 6	Topic	Reading	Lab
14. M 9/30	First Midterm Exam		
15. W 10/2	Acquisition—Layout for 2D and 3D acquisition Various gather types	S&G Ch. 8 (239-253) KBH 43-52 RJL 102-113	Lab 3: Field Data Analysis
16. F 10/4	Seismic Field Methods and Equipment: Sources, Receivers and Arrays	KBH 33-42 72-81, 53-57 RJL 102-106 120-122 S&G 191-236 239-375 S&G 241-260 KBH 72-92	
Week 7	Topic	Reading	Lab
17. M 10/7	Seismic Field Methods: Acquisition Geometry 1D, 2D, 3D and 4D, 1C, 2C, 3C, 4C, and 9C data	S&G Ch. 8 (239-275) 243-245 KBH 72-81	Lab 4: Seismic Acquisition Lab. (Reflection acquisition Geometry, CMPs, and Stacking Charts)
18. W 10/9	Convolution Model and Synthetic Seismograms Properties	KBH 48-49 S&G 146-150 RJL 122-127 Neidel & Poggiogliomi, 1977,	
19. F 10/11	Thin Bed Effects and Vertical Resolution	p. 409-411 S&G 172-180 RJL 130-134	
Week 8	Topic	Reading	Lab
20. M 10/14	Horizontal Resolution	Neidel & Poggiogliomi, 1977, p. 396-397	Lab 5: Seismic Acquisition Field Lab I (Outdoors)

			S&G 152-155	
			KBH 52-53	
21.	W10/16	Seismic Velocity from Rock Properties	S&G Ch. 5 (107-143)	
22.	F 10/18	Velocity ratios	S&G Ch. 5 (107-143)	
	Week 9	Topic	Reading	Lab
23.	M 10/21	Seismic Data Processing	S&G Ch. 9	Lab 6: Refraction Analysis of Field Experiment
24.	W 10/23	Seismic Data Processing	S&G Ch. 9	
25.	F 10/25	Seismic Data Processing	S&G Ch. 9	
	Week 10	Topic	Reading	Lab
26.	M 10/28	Review of Processing Corrections for Land Data	<i>Processing Overview</i> S&G 261—266 RJL 108-113	Lab 7: Data Processing I
27.	W 10/30	Inversion of Reflection Data: Part I	S&G 135-139 <i>Lindseth (1979)</i>	
28.	F 11/1	Inversion of Reflection Data: Part II	S&G 135-139 <i>Lindseth (1979)</i>	
	Week 11	Topic	Reading	Lab
29.	M 11/4	Second Midterm Exam		
30.	W 11/6	Fluid Substitution	S&G 121-125; 110-113 S&G 77-81	Lab 7 continued: Data Processing II
31.	F 11/8	AVO (Amplitude vs. Offset), Class I, II and III Gas Sands	<i>Rutherford & Williams 1989</i> <i>Ostrander 1986</i> <i>Foster et al., 2010</i>	
	Week 12	Topic	Reading	Lab
32.	M 11/11	Displays of Seismic Data	S&G 459-467, Color Plates between 465-465 KBH Color plates between 70-71	
33.	W 11/13	Direct Hydrocarbon Indicators, Bright Spots, AVO and others. Seismic Attributes	S&G 415-418 KBH 84-85 Brown, Ch. 5, AAPG Memoir 42 S&G 326-335 KBH 67-76)	Lab 8: Synthetic seismograms and thin-bed effects
34.	F 11/15	Migration	RJL 137-158 Problems 6.1, 6.2, 6.3	

Week 13	Topic	Reading	Lab
35. M 11/18	Migration (Continued)	S&G 326-335 KBH 67-76 RJL 137-158 Probs 6.1, 6.2, 6.3	Lab 9: Interpretation /Migration
36. W 11/20	Interpretation	S&G Ch. 10	
37. F 11/22	Interpretation	S&G Ch. 10	
Week 14	Topic	Reading	Lab
38. M 11/25	Interpretation	S&G Ch. 10	
39. W 11/27	Review and Students' Evaluation of class		No Lab
F 11/29	No Class. Thanksgiving Holiday		
Week 15		Reading	Lab
40. M 12/2	Class Presentations		Use lab time for Presentations, if necessary
41. W 12/4	Class Presentations		
42. F 12/6	Class Presentations		
Final Exam	Saturday, December 14, 9:00 am–12:00 PM		Location: TBD