Syllabus for Seismic Methods (GEOL 5336)  

Fall, 2021  
SFASU  

INSTRUCTOR: Dr. Wesley A. Brown  
PHONE: (936) 468-2422  
OFFICE: Miller Science, Room# 301B  
EMAIL: brownwal1@sfasu.edu  
OFFICE HOURS: M-F 8-9 AM & 2-3 PM or by appointment  
TEXTBOOK: None required. Recommended readings provided by instructor.  
LECTURES: Miller Sci. RM #330 (T 9:30-11:10 AM; R Lab 9:30–12:00 PM)  

Tentative Course Schedule (GEOL 5336)  

Weeks 1 - 4  
Stress, Strain, Elastic Constants  
Identification of Seismic Wavefields Spreading,  
Absorption, Snell's Law Reflection and Transmission Coefficients  
Zoeppritz Equations, AVO  
Lecture Exam #1 (Week of Sept 20th)  
Project Assignments (Sept. 6th)  

Weeks 5-9  
Geometry of Seismic Waves  
Reflection/Refraction Data acquisition  
Refraction/Reflection Data interpretation  
Lecture Exam #2 (Week of Oct. 16th)  

Weeks 10-13  
Fourier Transforms, Bandpass Filtering, Seismic Resolution Velocity and Depth Estimation, NMO, Stacking Deconvolution, Migration, Statics  
Lecture Exam #3 (Week of Dec. 6th)  

Weeks 14-16  
3-D Seismic Data, Structural interpretation of Reflection Data, Stratigraphic interpretation of Reflection Data  
Final Presentation (Week of Nov. 29th)  

Course Description:  
This course is a survey of the application of seismic methods to hydrocarbon exploration, investigations of the lithosphere and environmental investigations of the shallow subsurface. Topics include physical principles of seismic wave propagation, and acquisition, processing, and interpretation of seismic reflection and refraction data. Weekly labs are designed to stress the applied aspects of these seismic methods.
Tentative Laboratory Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Wk #1</th>
<th>Lecture Topics</th>
<th>Lab Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>23-Aug</td>
<td>1</td>
<td>Introduction To Geophysics</td>
<td>Geophysical Data Presentation</td>
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<tr>
<td>30-Aug</td>
<td>2</td>
<td>Elastic Properties of Rocks</td>
<td>Elastic Properties of Rocks</td>
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<tr>
<td>6-Sep</td>
<td>3</td>
<td>Snell's Law Zoeppritz Equation</td>
<td>Snell's Law Zoeppritz Equation</td>
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<tr>
<td>13-Sep</td>
<td>4</td>
<td>Earthquake Seismology</td>
<td>Earthquake Seismology</td>
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<tr>
<td>20-Sep</td>
<td>5</td>
<td>Review</td>
<td>Exam #1</td>
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<tr>
<td>27-Sep</td>
<td>6</td>
<td>Seismic Refraction</td>
<td>Seismic Refraction</td>
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<tr>
<td>4-Oct</td>
<td>7</td>
<td>Seismic Reflection</td>
<td>Seismic Reflection</td>
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<tr>
<td>11-Oct</td>
<td>8</td>
<td>Seismic Reflection/Refraction</td>
<td>Seismic Reflection/Refraction</td>
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<tr>
<td>18-Oct</td>
<td>9</td>
<td>Review</td>
<td>Exam #2</td>
</tr>
<tr>
<td>25-Oct</td>
<td>10</td>
<td>Seismic Data Acquisition</td>
<td>Seismic Software Intro</td>
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<tr>
<td>1-Nov</td>
<td>11</td>
<td>Seismic Data Processing</td>
<td>Seismic Data Acquisition</td>
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<tr>
<td>8-Nov</td>
<td>12</td>
<td>Seismic Data Processing</td>
<td>Seismic Data Processing</td>
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<tr>
<td>15-Nov</td>
<td>13</td>
<td>No Lecture - Thanksgiving Week</td>
<td>No Lab - Thanksgiving Week</td>
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<tr>
<td>22-Nov</td>
<td>14</td>
<td>Seismic Data Interpretation</td>
<td>Final Project Preparation</td>
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<tr>
<td>29-Nov</td>
<td>15</td>
<td>Seismic Data Interp./Emerging Topics</td>
<td>Final Project Presentation</td>
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<tr>
<td>6-Dec</td>
<td>16</td>
<td>Finals Week No Lecture/Lab</td>
<td>Exam #3 Final</td>
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COURSE OBJECTIVES:
Upon completion of this course, the students will acquire an understanding of the following topics:


4. Refraction Seismology: Correction to a datum. Interpretation of refraction data by graphical and analytical techniques

5. 3D seismic exploration: An introduction to 3D survey design and acquisition. 3D processing & migration.
GRADING:
Lecture Exam #1 15%
Lecture Exam #2 15%
Lecture Exam #3 15%
Class Presentations 10%
Final Paper/Presentations 20%
Lab: 20%
Quizzes 5%
Total: 100%
Overall grading: >90% = A, 80-89.9% = B, 70-79.9% = C, 60-69.9% = D, <60% = F.

Program Learning Outcomes:
1. Demonstrate knowledge of the fundamental core geologic concepts (Mineralogy, Petrology, Structural Geology, Stratigraphy, Geophysics and Geochemistry). (Concepts)
2. Execute geologic procedures and methods accurately, appropriately and efficiently. (Skills)
3. Apply principles of logic and reasoning to develop and analyze geologic problems. (Logical Reasoning)
4. Demonstrate competence in using various geologic tools, including technology, to formulate, represent, and solve problems. (Critical thinking - Problem Solving)
5. Demonstrate proficiency in communicating geologic information in an appropriate form to the expected audience. (Communication)

Student Learning Outcomes:
The student is expected to understand and apply the follow concepts:

1. Generalized Snell’s and its application to reflection and refraction studies.
2. Reflection survey design, data collection, data processing, and analysis.
3. Refraction survey design, data collection, data processing, and analysis.
5. Structural interpretation of seismic data

Topics Covered:
Stress, Strain, Elastic Constants 1 Week
Identification of Seismic Wavefields Spreading, 1 Week
Absorption, Snell's Law Reflection and Transmission Coefficients 1 Week
Zoeppritz Equations, AVO 1 Week
Geometry of Seismic Waves 1 Week
Reflection/Refraction Data acquisition 1 Week
Refraction/Reflection Data interpretation 1 Week
Fourier Transforms, Bandpass Filtering, 1 Week
Seismic Resolution Velocity and Depth Estimation 1 Week
NMO, Stacking Deconvolution, Migration, Statics 2 Weeks
3-D Seismic Data, Structural interpretation of Reflection Data 2 Weeks
Stratigraphic interpretation of Reflection Data 2 Weeks
CLASSROOM POLICIES

Exams
Exam may include a multiple-choice section. However, you will not be required to take a scantron to the exam room. Other sections may include matching; true/false questions; short answers; fill in the blanks; and/or short essay questions. The final exam will be comprehensive. However, most of its content will be related to material covered over the final third of the lecture series. All exams will take place in room 330 unless otherwise stated. The use of cell phones and programmable calculators will not be permitted during exams. A review sheet for the upcoming exam may be issued prior to the date of the exam.

If you have a scheduling conflict with an exam for an officially sanctioned University reason, you may take the exam at a different time or date. However, you must inform me at least a week before the exam. Make-up exams will only be given in documented the cases of illnesses, official university activities, or deaths in the family. Bear in mind that this is a “relatively small” upper level class and if there is going to be a scheduling conflict I will be able to discuss it with you on a one to one basis. If the final exam is missed for a legitimate excuse, an "Incomplete" will be given and the final can be taken next semester. Make-up exams may be in essay format.

Lecture:
You are expected to be prepared for each lecture period by reading the material to be covered in lecture prior to attending class. This will help you to better comprehend the material given during the lecture.

Electronic Devices: Please turn off all cell phones and audio pagers before class.

Office Hours:
I have listed my scheduled office hours at the top of this syllabus. Please feel free to drop by or call to raise questions or concerns regarding this course. If you need to speak to me but cannot come to my office during the posted hours, I will make an appointment to meet with you at another time. You can also email me at any time.

HELPFUL HINTS:
• Attend classes regularly and punctually
• Review both lecture and laboratory material regularly (Don’t cram).
• Complete assigned readings
• Form a study groups.
• Participate fully in lab exercises.
• Develop and practice good note taking skills.
• Ask questions in class.
UNIVERSITY POLICIES

Add/Drop Policy

Students may add courses through the 2nd class day during the summer semesters and through the 4th class day during the fall or spring semesters. Academic Department Chairs may reconcile class schedules through the official reporting date. Students may drop classes through five working days past mid-semester or mid-session as applicable. A student will not be allowed to drop a course after these dates, unless he or she withdraws from the University. For information please visit: (http://www.sfasu.edu/upp/pap/academic_affairs/add_drop.html)

Academic Integrity

Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty

Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

In the hopes of deterring incidents of cheating and/or plagiarism this class employs a "zero tolerance" policy meaning that if a student commits cheating or plagiarism they receive a grade of F for the class.

Please read the complete policy at http://www.sfasu.edu/policies/student-academic-dishonesty-4.1.pdf

Withheld Grades Semester Grades Policy (5.5)

Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.
**Students with Disabilities**
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

**Mental Health and Wellness**
SFA values students’ mental health and the role it plays in academic and overall student success. SFA provides a variety of resources to support students' mental health and wellness. Many of these resources are free, and all of them are confidential.

**On-campus Resources:**
SFA Counseling Services [www.sfasu.edu/counselingservices](http://www.sfasu.edu/counselingservices)  Rusk Building, 3rd Floor 936.468.2401

*SFA Human Services Counseling Clinic*
[www.sfasu.edu/humanservices/139.asp](http://www.sfasu.edu/humanservices/139.asp)  Human Services, Room 202 936.468.1041

**Crisis Resources:**
Burke 24-hour crisis line: 1.800.392.8343
Suicide Prevention Lifeline: 1.800.273.TALK (8255)
Crisis Text Line: Text HELLO to 741-741