

# **Course Syllabus: Solid Earth and Exploration Geophysics McCoy College of Science, Mathematics, and Engineering**

GEOS 3533

Fall 2019

## **Contact Information**

Instructor: Dr. Andrew Katumwehe

Office: Bolin 307H

Lecture: TR 3-4:20 PM RM 105

Lab: T 4:30-5:20 PM RM 105

Office hours: Mon-Wed and Friday; 9:00 – 1:00PM and by appointment

Office phone: (940) 397-4031

E-mail: [andrew.katumwehe@msutexas.edu](mailto:andrew.katumwehe@msutexas.edu)

## **Course Description**

This is a lecture-based overview of solid Earth, its properties and how we use those properties to understand geological processes using geophysical tools. This course is focused on methods and approaches that are appropriate for the shallow targets. Lectures will cover only the most essential aspects of the 26 topics that comprise this course. The course introduces each geophysical method by presenting the basic theory as well as its practical applications in exploring a given target. We will cover the various fundamental principles of experimental designs to support the theory and brief discussions on how data is processed and interpreted.

We will examine the different shallow subsurface geophysical methods such as gravity which is based on the density contrast between different geological Units. One of the applications for gravity methods is mapping bedrock depth. Just like gravity method, magnetic methods are based on a magnetic field caused primarily by sources at the boundary between the inner and outer core. Many rocks and minerals are magnetized by induction in the Earth's field, and cause spatial perturbations or "anomalies" in the Earth's main field. Man-made objects containing iron or steel are often highly magnetized and can locally cause large anomalies up to several thousands of nT.

The electrical methods of prospecting depend on the marked differences in the resistivity that exist between adjacent geological formations. These differences are produced by either variation in the porosity of the rocks or the nature of the saline solutions present. The electrical methods depend on whether current is injected in the ground and a potential difference is measured (active) or measuring the voltage of naturally occurring field (passive).

During this course we shall also look at seismic wave propagation using both refraction and reflection methods. The theory of wave propagation will be tested using the ground penetrating radar. In addition to the PowerPoint-based lectures, you are expected to read the appropriate chapters in the required course textbook. This course outline/syllabus contains a detailed schedule including a list of specific topics and corresponding textbook readings. You are expected to attend lectures and come prepared by reading the textbook and assigned readings in advance.

Lecture and final exams will cover lecture materials and textbook-only topics. Only the final exam will be cumulative; all prior material, topics, and text and assigned readings will be included on the final exam. Graduate students will be given extra assignments on top of what is given to the rest of the class.

The Lab portion of the course has hands-on projects ranging from introducing you to geophysical instruments, teach you the art of data acquisition, processing, interpretation and report writing. Where possible we will use the equipment in-kind from a different University. At the end of this course, you will be familiar with using geophysical tools, acquiring geophysical data, processing and interpreting and integrating different geophysical data sets to solve a geological problem. Active participation in all required lab sessions is expected. Completion of all lab assignments on time is expected. If you are going to miss a lab you must let Dr. Andrew know in advance. You must make up any missed lab by making suitable arrangement with Dr. Andrew. Labs must be made up within one week or a grade/completion penalty will be imposed. After two weeks, a missed lab may not be made up and will receive a completion grade of zero. Note that some labs will consist of take home problem sets only whereas other labs will require use of software available on computers in Bolin 105 or Bolin 308.

### **Required Textbook & Instructional Materials**

1- Introduction to Applied Geophysics by Burger, Sheehan, and Jones Norton 2006

### **Student Handbook**

Refer to: [Student Handbook 2017-18](#)

### **Academic Misconduct Policy & Procedures**

Academic Dishonesty: Cheating, collusion, and plagiarism (the act of using source material of other persons, either published or unpublished, without following the accepted norm of crediting, or the submission for credit of work not the individual's to whom credit is given). Additional guidelines on procedures in these matters may be found in the Office of Student Conduct.

### **Grading**

Lecture Portion of course = 60% of final grade. Lecture Exam 1 = 10% of final grade; Lecture Exam 2 = 20% of final grade; Final Exam = 20% of final grade; Assignments=10% of final grade. Lab assignments =20%, while a research paper contributes 20% of the total grade. If you miss any of the classes make up is possible only if (1) you have a written excuse as to why you missed the exam and (2) you notified Dr. Andrew Katumwehe in advance that you would miss the exam. A missed exam or quiz must be made up within one week or you may receive a grade of zero. Obviously, there may be extreme circumstances as to why prior notice was not given. These will be evaluated on a case-by-case basis. Note that oversleeping is not an acceptable reason! The final exam will be cumulative and may include material from the lab assignments and exercises. Lab attendance and

participation, lab exercise completion and homework assignments (usually one per week) will determine your overall Lab Completion grade. All lab assignments must be turned in within one week of original due date. After two weeks, a grade of zero may be given for a late assignment. The Research Paper grade is 20% of final grade. The research paper grade will be derived as follows - 50% derived from submitted text and 50% derived from presentation. Presentation is limited to 15 minutes and will be followed by 5-10 minutes for questions from peers, lab TAs, instructor, and/or guests. Presentations may be PowerPoint or poster-based. Research papers must be between 2250 and 3250 words (about 4-6 pages of text based on 11-pt or 12-pt font; word count per MSWord's word count tool) and be no longer than ten total pages including illustrations and title page. Papers must contain an abstract no more than 250 words (not included in word count) and highlights of the paper. At least three primary, peer reviewed references, and be structured as follows: (1) Title page with title and author; (2) Abstract and highlights; (3) Introduction (background and rationale for paper topic choice); (4) Discussion (basically what you learned and want to share with your colleagues as a result of your research); (5) Conclusion (highlight or restatement of most important learning's from your perspective and why you chose the particular topic); and (6) references (minimum of five primary references). Figures and/or tables (with captions and references) may be included within the text or at end of paper. Format – MS Word; paper copy and electronic copy to be submitted per the course schedule/syllabus. Papers are due as per the syllabus schedule. Papers submitted one week late will be docked one letter grade (e.g. 10 points; thus a paper that would have received an 85% grade if submitted on time will receive a final grade of 75% if submitted one week late). Research papers submitted more than two weeks late may be given a grade of zero. Papers must be submitted in both printed and electronic form (MS Word). The latter should be submitted via Dr. Andrew Katumwehe's University email at [andrew.katumwehe@msutexas.edu](mailto:andrew.katumwehe@msutexas.edu) with the words "GEOS 3533 Paper Fall 2019" along with your paper title on the email subject line. The research paper grade is determined based on format compliance (up to 60% of paper grade; see previous paragraph for details) and logical reasoning (up to 40% of paper grade). Note that the Lecture exams, lab quizzes, and lab completion grades are typically normalized ("curved") by simple arithmetic adjustment so that the class grade average is between 76-80%. However, this is only curved for students who have consistently attended and handed in their assignments, quizzes, research paper and exams. All components of your final grade must be submitted/completed by December 6. The homework assignments will be posted on D2L. The homework assignments will include questions to answer that focus on lecture and lab content. Homework due dates are listed in the syllabus. Note: No homework, lab assignments, or research papers may be submitted after 12/06/2019. The Table below (next page) summarizes the grading policy for this course.

**Table 1: Points allocated to graded item or group of items discussed in the Grading Section above.**

<b>Graded Items</b>	<b>Contribution to Final Course Grade</b>
Exam 1	10%
Exam 2	20%
Final Exam	20%
Lecture Assignments	10%
Lab Grade (includes lab quizzes, lab participation and attendance, homework assignments)	20%
Research Paper	20%

**Table 2: Final grade determination** (grades are rounded up to the nearest integer before assigning the final course letter grade. This means, for example, that a final calculated course grade of 89.8% will be rounded up to a final course grade of 90.)

<b>Grade</b>	<b>Points</b>
A	90 and above
B	80-89
C	70-79
D	60-69
F	Less than 60

### **Homework**

See Grading Section for details – All Homework to be submitted to my office in your regular lab section

### **Lab Assignments**

See Grading Section for details – All Lab Assignments to be submitted to me during your regular lab section meeting.

### **Lab Attendance Policy – Important!**

Students who miss three or more lab section meetings may be dropped from the course by the instructor. Students must notify Dr. Andrew Katumwehe by email in advance of missing a lab section. Students who leave lab sections early may be marked absent.

### **Exams**

See Grading Section for details – Three lecture exams are included in your course grade; see Grades section for details. All exams will have a time limit of 50 minutes for the two “midterm” exams and 110 minutes for the final exam.

## **Research Paper**

See Grading Section for details about content and format. All Research Papers must be submitted in Microsoft Word or PDF format to [andrew.katumwehe@msutexas.edu](mailto:andrew.katumwehe@msutexas.edu) and paper copy to my physical mailbox in Bolin 307H.

## **Lecture (Attendance) Extra Credit**

Limited extra credit opportunities will be available on an irregular and random basis during the lecture portion of the course. Each individual extra credit opportunity will be worth up to one (1.0) extra credit point. Generally, these opportunities will involve a short written response to a question or problem posed during the lecture or more often than not, simply your signature on attendance sheet (Therefore, bring paper and pen/pencil to lectures and printouts for the presentations).

## **Late Work**

Late work will be accepted. However, the following penalties will apply in all cases of late submittals: 10% for one day past due; 20% for two days past due; 30% for one weeks past due; after one week a grade of zero may be recorded. No course assignments will be accepted after 12/06/2019.

## **Important Dates**

The last Day to drop this course is found in the University 2019 Falls calendar under [Drops, Withdrawals & Void](#)

## **Desire-to-Learn (D2L)**

The MSU D2L program is a part of this course. Lectures, review materials, and course information are available through D2L. You can log into [D2L](#) through the MSU Homepage. If you experience difficulties, please contact the technicians listed for the program or contact your instructor.

## **Change of Schedule**

A student dropping a course (but not withdrawing from the University) within the first 12 class days of a regular semester or the first four class days of a summer semester is eligible for a 100% refund of applicable tuition and fees. Dates are published in the Schedule of Classes each semester.

## **Refund and Repayment Policy**

A student who withdraws or is administratively withdrawn from Midwestern State University (MSU) may be eligible to receive a refund for all or a portion of the tuition, fees and room/board charges that were paid to MSU for the semester. HOWEVER, if the student received financial aid (federal/state/institutional grants, loans and/or scholarships), all or a portion of the refund may be returned to the financial aid programs. As described below, two formulas (federal and state) exists in determining the amount of the refund. (Examples of each refund calculation will be made available upon request).

## **Services for Students with Disabilities**

In accordance with Section 504 of the Federal Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, Midwestern State University endeavors to make reasonable accommodations to ensure equal opportunity for qualified persons with disabilities to participate in all educational, social, and recreational programs and activities. After notification of acceptance, students requiring accommodations should make application for such assistance through Disability Support Services, located in the Clark Student Center, Room 168, (940) 397-4140. Current documentation of a disability will be required in order to provide appropriate services, and each request will be individually reviewed. For more details, please go to [Disability Support Services](#).

## **College Policies**

Campus Carry Rules/Policies are given here: [Campus Carry Rules and Policies](#)

### **Smoking/Tobacco Policy**

College policy strictly prohibits the use of tobacco products in any building owned or operated by WATC. Adult students may smoke only in the outside designated-smoking areas at each location.

### **Alcohol and Drug Policy**

To comply with the Drug Free Schools and Communities Act of 1989 and subsequent amendments, students and employees of Midwestern State are informed that strictly enforced policies are in place, which prohibits the unlawful possession, use or distribution of any illicit drugs, including alcohol, on university property or as part of any university-sponsored activity. Students and employees are also subject to all applicable legal sanctions under local, state and federal law for any offenses involving illicit drugs on University property or at University-sponsored activities.

### **Grade Appeal Process**

Students who wish to appeal a grade should consult the Midwestern State University [Undergraduate Catalog](#)

### **Notice**

Changes in the course syllabus, procedure, assignments, and schedule may be made at the discretion of the instructor. These changes will be communicated to all students through [D2L](#). Please check the course news on a regular basis for schedule updates.

The course schedule detail is given on the next five pages. The first table lists lecture topics, textbook readings, and the three lecture exams. The second table lists the dates for the lab topics, three lab quizzes, research paper due date, homework assignment due dates, and self-assessment assignments.

## Course Schedule – Lecture Topics and Exams, Text Reading (Page 1 of 3)

Date	Topic and Topic Number	Textbook Pages
27-Aug	Course overview, techniques and targets	Pages 1-349
29-Aug	Potential Field: Methods-Gravity methods	Pages 349-427
02-Sep	Labor Day - No Classes	None
3-Sep	Potential Field: Methods-Gravity methods	Pages 349-427
05-Sep	Potential Field: Methods-Gravity methods <b>Assignment 1-Gravity methods</b>	Pages 349-427
10-Sep	Gravity methods-Lab	
12-Sep	Potential Field: Magnetic Methods	Pages 429-497
17-Sep	Potential Field: Magnetic Methods	Pages 429-497
19-Sep	Potential Field: Magnetic Methods <b>Assignment 2- Magnetic Methods</b>	Pages 429-497
24-Sep	Magnetic methods-Lab	
26-Sep	<b>Exam 1: Gravity and Magnetics</b>	
01-Oct	Electrical methods: Resistivity Method	Pages 265-335
03-Oct	Electrical methods: Resistivity Method	Pages 265-335
08-Oct	Electrical methods: Resistivity Method <b>Assignment 3- Resistivity Method</b>	Pages 265-335
10-Oct	Resistivity Method Lab	
15-Oct	Seismic Methods – Refraction Seismology	Pages 7-263
17-Oct	Seismic Methods – Refraction Seismology	Pages 7-263
22-Oct	Seismic Methods – Reflection Seismology	Pages 7-263
24-Oct	Seismic Methods – Reflection Seismology <b>Assignment 4- Seismic Methods</b>	Pages 7-263
29-Oct	<b>Exam 2: Resistivity &amp; Seismic Methods</b>	
31-Oct	Electrical and Electromagnetic methods- Induced Polarization (IP)	Pages 499-553
05-Nov	Induced Polarization (IP)	Pages 499-553
07-Nov	Electromagnetic methods (EM)	Pages 499-553
12-Nov	Electromagnetic methods (EM)	Pages 499-553
14-Nov	Ground Penetrating Radar	Pages 499-553
19-Nov	<b>Assignment 5- EM, IP and GPR</b>	
21-Nov	<b>Thanksgiving Break - No Class</b>	
26-Nov	<b>Final Research Presentation</b>	Assignment 5 submitted
06-Dec	<b>Final Review</b>	
<b>10-Dec</b>	<b>Final Exam 3.30-5:30PM</b>	