



**Course Syllabus: Solid Earth and Exploration Geophysics
McCoy College of Science, Mathematics, and Engineering
GEOS 3533-101
Fall 2024**

Contact Information

Instructor: Dr. Andrew Katumwehe

Office: Pierce 206

Lecture: TR 11:30 am-12:50 pm RM 105

Lab: T 1:00–2:50 pm RM 105

Office hours: F: 1:00 – 4:00 pm, T R 10–11 am and by appointment

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Course Description

This course is a lecture-based overview of solid Earth, its properties, and how we use them to understand geological processes using geophysical tools. It focuses on methods and approaches 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 basic theory and its practical applications in exploring a target. We will cover the fundamental principles of experimental designs to support the theory and briefly discuss data acquisition and how data is processed and interpreted.

We will examine the different shallow subsurface geophysical methods, such as gravity, based on the density contrast between different geological Units. One of the applications of gravity methods is mapping bedrock depth. Like gravity, 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 significant anomalies up to several thousands of nT.

Electrical Resistivity Imaging (ERI) depends on the marked resistivity contrast between adjacent geological formations. Either variation in the porosity of the rocks or the nature of the saline solutions present produces these differences. The electrical methods depend on whether current is injected in the ground and a potential difference is measured (active) or the voltage of a naturally occurring field (passive).

We will study seismic wave propagation using both refraction and reflection methods. The theory of wave propagation will be tested using ground-penetrating

radar (GPR). In addition to the lectures, you are expected to read the relevant chapters in the required course textbook. The course schedule includes specific topics and corresponding textbook readings. Lecture assignments are designed to reinforce your understanding of the lecture materials, and final exams, which will test your comprehension, will cover lecture materials and textbook-only topics. The final exam will not be cumulative; it will include all prior material, topics, and assigned readings. Graduate students will have additional 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 to the art of data acquisition, processing, interpretation, and report writing. At the end of this course, you will be familiar with using geophysical tools, acquiring field data, processing and interpreting, and integrating different geophysical data sets to solve a geological problem.

Active participation and completion of all lab sessions are a must. If you are going to miss a lab, you must let Dr. Katumwehe know in advance. It is impossible to redo a lab since it requires more than 3 people to run it. A missed lab will receive a completion grade of zero. Note that some labs will consist of take-home problem sets, whereas others will require software available on computers in Bolin 105.

Required Textbook & Instructional Materials

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

Student Handbook

Refer to: [Student Handbook 2021-22](#)

Academic Misconduct Policy & Procedures

Academic dishonesty includes cheating, collusion, and plagiarism. Plagiarism is using another person's published or unpublished work without giving them credit. It also involves submitting work for credit that is not your own without proper attribution. While I encourage you to discuss the lab problems and answers to some of the extra credit assignments with each other, your answers should be written only by you. For example, discussing the concepts or strategies to approach a problem is acceptable, but sharing or copying specific answers is not. Turning in any work that is not your own is unacceptable. Remember, cooperation is good, but plagiarism is not. Additional guidelines on procedures in these matters may be found in the Office of Student Conduct. The expectation for all students in this course is that complete integrity will consistently be demonstrated. Violations may subject you to disciplinary action, including the following: receiving a failing grade (0%) on an assignment, examination, or course, receiving a notation of a violation of academic integrity on your transcript, and being suspended from the University. Violations of academic integrity will be reported for administrative action, and the penalties for such infractions will be as listed in the [MSU policy on Academic Integrity](#).

Artificial Intelligence (AI).

Chat GPT and University Policy: AI programs assist writers. AI programs do not replace human creativity, originality, and critical thinking. Writing is a craft you must develop over time to develop your writing voice. This course assumes that the students will write all work submitted by students. All coursework without proper citation or attribution is a form of academic dishonesty. AI writing detection complements Turnitin's similarity-checking workflow and is integrated with D2L. The detection component provides a percentage score for AI-written text.

Grading

The lecture portion of this course = 60% of the final grade. Lecture Exam 1 = 10% of final grade; Lecture Exam 2 = 10% of final grade; Final Exam = 20% of final grade; Assignments=20% of final grade. Lab assignments =30%, while a research paper contributes 10% of the total grade. If you miss any classes, makeup is possible only if (1) you have a written excuse for missing the exam and (2) you notified Dr. Andrew Katumwehe beforehand that you would miss the exam. A missed exam or quiz must be made up within one week, or you will receive a grade of zero. 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! Lab attendance, 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 the original due date. After two weeks, a grade of zero will be given for a late assignment. The research Paper grade is 20% of the final grade, which will be derived as follows - 50% from the submitted text and 50% from the presentation. Presentation is limited to 15 minutes and will be followed by 5-10 minutes for questions from peers, lab TAs, instructors, and guests. 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 MS Word's word count tool) and be no longer than ten pages, including illustrations and title page. Papers will contain an abstract of 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 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 the end of the paper—format – MS Word; paper copy and electronic copy to be submitted per the course 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 printed and electronic form (MS Word). The latter should be submitted via Dr. Andrew Katumwehe's University email at andrew.katumwehe@msutexas.edu with the words "GEOS

3533 Paper Fall 2024" and your paper title in the email subject line. Note that the exams, lab quizzes, and lab completion grades are typically normalized ("curved") by simple arithmetic adjustment so that the class average averages 76-80%. However, this is only for students who have consistently attended and handed in their assignments, quizzes, research papers, and exams. All components of your final grade must be submitted by December 04. The homework assignments will be posted on D2L. The homework assignments will include questions 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 12/07/2024. The Table below (on the next page) summarizes the grading policy for this course.

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

Graded Items	Contribution to Final Course Grade
Exam 1	10%
Exam 2	10%
Final Exam	20%
Lecture Assignments	20%
Lab Grade (includes lab quizzes, lab participation, and attendance, homework assignments)	30%
Research Paper	10%

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.)

Grade	Points
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 are responsible for working with their lab section TA to make up any missed material promptly. Students must email their lab TA and Dr. Katumwehe in advance if they miss a lab section. Students **who leave lab sections and class early may be marked absent, and geophysical labs are labor intensive in putting them up and down.** However, any proximal interaction, including supervision or collegial interaction in the class, lab, and outside during demonstration, requires individual protection.

Exams

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 and paper copy to my physical mailbox in Bolin 102A.

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 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 with the following penalties; 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 12/04/2024.

Important Dates

The Last Day to drop this course with a W is October 09, 2024, at 4 pm and is found in the University 2022 fall 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 get in touch with the technicians listed for the program or contact your instructor.

Computer Requirements

Geophysics requires considerable use of Excel and other computer programs. You are responsible for having (or having access to) a working computer in this class. Assignments and tests are due by the due date, and personal computer technical difficulties may not be considered a reason for the instructor to allow students extra time to submit assignments, tests, or discussion postings. Computers are available on campus in various areas of the buildings and the Academic Success Center. Your computer being down is not an excuse for missing a deadline or an exam! Contact your instructor immediately upon having personal computer trouble. If you have technical difficulties in the course, a student helpdesk is available to you. The college cannot work directly on student computers due to liability and resource limitations.

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 paid to MSU for the semester. However, if the student receives financial aid (federal/state/institutional grants, loans, and scholarships), all or a portion of the refund may be returned to the financial aid programs. As described below, two formulas (federal and state) exist to determine the refund amount. (Examples of each refund calculation will be made available upon request).

Services for Students with Disabilities

Under Section 504 of the Federal Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, MSU makes 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 apply for such assistance through Disability Support Services 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](#).

Campus Carry and Active Shooter

Campus Carry

Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. The new Constitutional Carry law does not change this process. Concealed carry still requires a License to carry permit, and openly carrying handguns is not allowed on college campuses. For more information, [visit Campus Carry](#).

Active Shooter

The safety and security of our campus are the responsibility of everyone in our community. Each of us must be prepared to appropriately respond to threats to our campus, such as an active aggressor. Please review the information provided by the MSU Police Department regarding the options and strategies we can all use to stay safe during difficult situations. For more information, visit [Safety / Emergency Procedures](#). Students are encouraged to watch the "Run. Hide. Fight" video, which may be electronically accessed via the University police department's webpage: ["Run. Hide. Fight."](#)

College Policies

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

Smoking/Tobacco Policy

College policy prohibits using tobacco products in any building owned or operated by MSU. Adult students may smoke only 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 MSU are informed that strictly enforced policies are in place, which prohibit 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 during university-sponsored activities.

Grade Appeal Process

Students who wish to appeal a grade should consult the Midwestern State University [appeal of course grade](#) and [grade appeal checklist](#).

Notice

Changes in the course syllabus, procedure, assignments, and schedule may be made at the instructor's discretion. These changes will be communicated to all students through [D2L](#). Please check the course news regularly for schedule

updates. The course schedule details are on the next page. The Table lists lecture topics, textbook readings, and the three lecture exams.

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
03-Sep	Potential Field: Methods-Gravity methods	Pages 349-427
05-Sep	Potential Field: Methods-Gravity methods Assignment 1-Gravity methods	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 Assignment 2- Magnetic Methods	Pages 429-497
24-Sep	Magnetic methods-Lab	
26-Sep	Exam 1: Gravity and Magnetics	
01-Oct	Electrical methods: Resistivity Method	Pages 265-335
03-Sep	Electrical methods: Resistivity Method	Pages 265-335
08-Oct	Electrical methods: Resistivity Method Assignment 3- Resistivity Method	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 Assignment 4- Seismic Methods	Pages 7-263
29-Oct	Exam 2: Resistivity & Seismic Methods	
31-Oct	Electrical and Electromagnetic methods- Instantaneous Potential (SP)	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	Ground Penetrating Radar	Pages 499-553
21-Nov	Assignment 5- EM, IP, and GPR	

Date	Topic and Topic Number	Textbook Pages
26-01-Nov	Thanksgiving Break - No Class	
03-Dec	Final Research Presentation and Submission	Assignment 5 submitted
05-Dec	Final Review	
10-Dec. Tuesday	Final Exam 8.00–10:00 am	