COURSE SYLLABUS

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YEAR COURSE OFFERED: 2018

SEMESTER COURSE OFFERED: Fall

DEPARTMENT: Earth and Atmospheric Sciences

COURSE NUMBER: GEOL 4397-03 (23816)

NAME OF COURSE: Electromagnetic Methods for Exploration

NAME OF INSTRUCTOR: Jiajia Sun

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The information contained in this class syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.

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Learning Objectives

This course focuses on important concepts and fundamentals of electromagnetic (EM) methods applied to geophysical explorations. This class consists of both lectures and lab exercises. After completion of the class, students can expect to

- Understand basic concepts in electromagnetics;
- Understand and explain the physical phenomena (e.g., current density, magnetic fields and their change with time) involved in an EM survey;
- Be able to ask and answer relevant questions for an EM exploration project;
- Be able to implement EM modeling codes in Jupyter Notebook;
- Be able to read and evaluate existing literature on EM exploration;
- Be able to present an EM case study to their geophysics peers;
- Understand how different airborne EM systems work;
- Be able to perform simple interpretation of EM data.

Major Assignments/Exams

Please see Page 5 for a list of the lab exercises, reports and exams.

Required Reading

No required textbook. The instructor will suggest complementary reading materials.

Recommended Reading

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There is no required textbook for this class. The powerpoint slides and lab exercises developed by the instructor will be the primary teaching materials used for this class. However, the instructor suggests the following resources for those who are interested in learning more by themselves outside of the classroom.

- David J. Griffiths, Introduction to electrodynamics (Fourth Edition), Cambridge University Press, 2017.
- Misac Nabighian, Electromagnetic method in applied geophysics: Volume 1, Theory, Society of Exploration Geophysicists, 1987.
- Misac Nabighian, Electromagnetic method in applied geophysics: Volume 2, Applications, Parts A and B, Society of Exploration Geophysicists, 1991.

The following website provides an excellent collection of materials on EM that are highly relevant to this class. The students are highly encouraged to make the most of this website outside the classroom.

- em.geosci.xyz

List of discussion/lecture topics

Please see Page 6 for a list of the detailed lecture topics as well as lab exercises.

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Electromagnetic Methods for Exploration

Department of Earth and Atmospheric Sciences
University of Houston

Instructor

- Dr. Jiajia Sun

Office hours:

- Office location: SR1-127A
- Office phone: 713-743-7380
- Email: jsun20@uh.edu
- Office hours: 2:00 - 3:30pm, Tuesdays and Thursdays, or by appointment.

Teaching Assistant:

- Felicia Nurindrawati
- Email: rnurindr@gmail.com
- TA hours: 10:30 am – 1:00 pm on Mondays and 8:00 – 9:30 am on Thursdays
- Location: GLC

Lecture sessions:

- Location: M 108 (McElhinney Hall – room 108)
- Time: 4:00 – 5:30 PM, Tuesdays and Thursdays
- Classroom equipment help: 713-743-1155

Lab sessions:

- Location: SR1 230
- Time: 4:00 – 5:30 PM
- Dates: See the schedule on next page for specific dates

Grading policy:

- Class participation & involvement: 15%
  Participating and actively involving in the class is extremely important for students to be successful in this class, as the electromagnetic induction and the associated phenomena, such as the distribution of current density, electrical and magnetic field, and their change with time, are complicated, and a student will have a much better chance of understanding the EM induction with active participation and involvement. There will be several random in-class quizzes. The points that a student will obtain for class participation & involvement will be based on these in-class quizzes.

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- Exam: 20%
  The focus of the exam will be on fundamentals and important concepts of electromagnetic methods that will have been discussed by Oct. 25th. Note: the exam date is Oct. 30th. If any student needs to take the exam at UH Center for Students with Disabilities instead of M 108, please notify the instructor by Oct. 2nd.
- Lab exercises + reports: 50%
  There will be 7 lab sessions focusing on different aspects of electromagnetic methods. Students are expected to finish the assignments in each lab exercise, and to submit a report.
- Final presentation: 15%
  Final presentations will be graded based on the quality of the slides (figures, texts, contents, structure, etc.), the quality of the presentation itself (introduction, eye contact, transition, clarity, etc.), and how well the students answer the questions from the instructor and the fellow students.

- Late policy
  The lab reports are always due at 4 PM on the seventh day after the lab session. For example, the lab session is scheduled on Sept. 6th, and the lab report is due at 4 PM on Sept. 13th. After the due time, late submissions will be penalized by 2% per hour.

- Collaboration
  Students are encouraged to discuss with each other. But the lab exercises and lab reports must be done individually. Any suspected plagiarism will be reported to the Department.

Class policy:

- In the event of extenuating circumstances that prevent a student from attending the class, taking an exam and giving their presentations, such as medical reasons, the student must notify the instructor as early as possible, and provide relevant documents to the instructor.
- There is no make-up exam except for rare justifiable circumstances. The exam is scheduled at regular class time on Tuesday, Oct. 30th. And the final presentations are scheduled on Nov. 27th and Nov. 29th. It is the students' responsibility to make necessary adjustments in order to be present in class and take exams (and give presentations).
- If students disagree with the grading of their graded work, they have 2 days from the day it is physically or electronically returned to the class to request for re-grading. A written request with a clear explanation of the potential grading error must be submitted to the instructor. Re-grading

request entails re-grading the entire assignment with a possibility of a lower grade than the original grade.

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Week	Date	Topics	Comments
1	08/21 Tues	Lecture: Introduction to electromagnetics	
	08/23 Thur	Lecture: Vector analysis & PDE	
	08/27 Mon		Last day to add a class
2	08/28 Tues	Lecture: static electrical field & DC theory	
	08/30 Thur	Lecture: DC (survey & data)	
3	09/04 Tues	Lecture: DC (applications)	
	09/05 Wed		Last day to drop w/o a grade
	09/06 Thur	Lab: Understanding DC survey and sensitivity	Report due on 09/13 @ 4 PM
4	09/11 Tues	Lecture: complex variables & FFT	
	09/13 Thur	Lecture: review of electrodynamic theory	
5	09/18 Tues	Lecture: RL circuit with DC and AC	
	09/20 Thur	Lecture: RL circuit model of EM induction	
6	09/25 Tues	Lab: RL circuit	Report due on 10/02 @ 4 PM
	09/27 Thur	Lecture: Plane waves in frequency and time domain	
7	10/02 Tues	Lab: plane waves	Report due on 10/09 @ 4 PM
	10/04 Thur	Lecture: Time domain EM (inductive source)	
8	10/09 Tues	Lab: Time domain EM	Report due on 10/16 @ 4 PM
	10/11 Thur	Lecture: Frequency domain EM (inductive source)	
9	10/16 Tues	Form a team & Select a topic for presentation	In-class attendance not required
	10/18 Thur	Literature search & reading	In-class attendance not required
10	10/23 Tues	Lab: Frequency domain EM	Report due on 10/30 @ 4 PM
	10/25 Thur	Lecture: Recap & Review	
11	10/30 Tues	Exam	
	11/01 Thur	Lecture: EM_grounded sources	last day to drop a course with a 'W'
12	11/06 Tues	Lecture: EM_grounded sources	
	11/08 Thur	Lab: EM_grounded sources	Report due on 11/15 @ 4 PM
13	11/13 Tues	Lecture: EM_natural sources	
	11/15 Thur	Lecture: EM_natural sources	
14	11/20 Tues	Lab: EM_natural sources	Report due on 11/27 @ 4 PM
	11/22 Thur	No class due to Thanksgiving	
15	11/27 Tues	Final presentation	
	11/29 Thur	Final presentation	
Note	27 Class Meetings		

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Students with Disabilities

University of Houston provides, upon request, appropriate academic adjustments for qualified students with disabilities. Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Center for Students with Disabilities (713/743-5400) for more assistance.

UH Counseling and Psychological Services (CAPS) Statement

Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless. You can reach CAPS (www.uh.edu/caps) by calling 713-743-5454 during and after business hours for routine appointments or if you or someone you know is in crisis. No appointment is necessary for the "Let's Talk" program, a drop-in consultation service at convenient locations and hours around campus.

Website: http://www.uh.edu/caps/outreach/lets_talk.html

UH Academic Calendar

http://publications.uh.edu/content.php?catoid=25&navoid=9117