ELECTRICAL, COMPUTER AND SYSTEMS ENGINEERING DEPARTMENT

Fields and Waves (ECSE-2100) Spring 2024

Version 3

Basic Information

Instructors

Name	Role	Office Hours	Email	Discord
J. Dylan Rees	Instructor	By appointment	reesj3@rpi.edu	j.dylanrees
Ziqiao Fang	Grad TA	12-2pm Wed JEC6318	fangz7@rpi.edu	darkfantasy.
Dongyang Li	UGSA	12-2pm Wed and 2-4pm Thur in Flip-Flop Lounge	lid21@rpi.edu	TBA

During the office hour times specified above, the instructor and TAs will check and respond to messages in the Discord channel as well as being available at the locations mentioned. They will also be available for voice and video meetings in the Discord voice channel by request at these times.

Class Meeting Times & Locations

Meeting Type	Time	Oncampus Location
Lectures	Mon, Thur 10am-11:50am	Low 3039
Labs	Wed 2pm-3:50pm	JEC 4107
Exams	During specified lecture times	Low 3039
Office Hours	See Instructors section	

Overview (Catalog Description)

Development and application of Maxwell's equations in free space and within materials. Introduction to vector calculus and computer-aided analysis and design methods in electromagnetics. Applications include calculation of lumped circuit elements from field theory, plane wave propagation in various materials, and reflection from boundaries. Transmission line concepts, Smith charts, and other design tools for distributed circuits.

Student Learning Outcomes

The students who finish this course in a satisfactory manner will be able to demonstrate:

- an ability to obtain solutions to electrostatic and magnetostatic fields for typical configurations of materials and sources
- an ability to determine the capacitance of simple practical systems of conductors
- an ability to determine the self and mutual inductance of simple practical current carrying systems
- an ability to apply the basic principles of electromagnetic motors and generators
- an ability to determine the transmission of power by low loss TEM transmission lines from a simple source to a passive load
- an ability to determine the reflection and transmission of TEM waves for uniform plane waves incident on planar material boundaries for low loss or conducting media

Prerequisites

ECSE 2010 - Electric Circuits
MATH 2010 - Multivariable Calculus and Matrix Algebra

Textbook

Fawwaz T. Ulaby, "Fundamentals of Applied Electromagnetics" Prentice Hall 8th Edition

Standards-Based Grading

Most other courses you have taken at RPI have most likely calculated your final course grade based on an average of your scores on homeworks, tests, and/or labs. This semester, Fields and Waves will use a different method: standards-based grading, or SBG. SBG operates in the following manner:

- The content of the course is broken down into a list of testable Core Skills. Two-thirds of your grade in the class will be determined by your degree of mastery of these skills.
- Your primary tool for demonstrating your mastery of Core Skills is taking the course's exams. The feedback you get on your exam will indicate your degree of mastery of the Core Skills on the exam. You will be given a grade of 4 (complete concept mastery with accurate calculation), 3 (complete concept mastery), 2 (partial concept mastery), 1 (limited concept mastery) or 0 (no mastery) on each Core Skill.
- You may book an oral retest exam during specific time slots in order to demonstrate any Core Skills you failed to demonstrate successfully on the first attempt. These retests consist of small, personalized exams on the topics of your choice. Oral retest exams are held outside of class. There is no hard limit on the number of times you

may retest a skill but retests will be limited by the instructors' availability.
- There will be one optional midterm retest exam allowing the retesting of all skills up to that point in the class. The final exam is optional; it consists of a large comprehensive retest that allows you to show mastery of any remaining Core Skills.
- The Core Skills are listed in the Core Skills document on the course website. Your progress in mastering the Core Skills will also be documented in a personalized spreadsheet shared via Box.

The goals of standards-based grading are as follows:
- Grades are easy to understand - the scoring rubric is clearly spelled out to every student.
- Grading is reliable and consistent.
- Students can better prepare for exams and labs because the grading criteria are clearly spelled out.
- At the end of the semester, each student will have a clear record of what new skills they have acquired, as well as areas where they struggled or need improvement.

Effort, Design, and Integration Grades

- You will also be graded on your effort - that is, the frequency with which you attend class and labs, turn in homework assignments, and attempt exams. Homeworks factor into this effort grade and are graded on a participation basis - you will not lose points for making mistakes on homework; you will only lose points if you do not turn them in.
- On Wednesdays, a Studio Session is held. On some days, this consists of a short one-week activity that is related to the current lecture material and followed by a short mini-report. At other times, Studio Sessions will be devoted to multi-week design projects that are followed by more detailed lab reports. These sessions are intended to help you apply and integrate the Core Skills taught in the class as well as to implement them in an engineering design setting.

The following is a numerical breakdown of the course grading:

Effort Grade **(15%)**
- Completing at least 90% of in-class exercises (5%)
- Attending all exams (the final is optional) (4%)
- Turning in all homeworks on time, missing no more than 1 (6%)

Core Skills Grade **(67%)**
- The percentage of possible points earned through mastery the class's Core skills according to the table below

+1 point	**One point is added to the score below if all answers are given in correct units.**
4 points	**Complete Mastery with Partial Calculation Mastery.** Skill has been successfully demonstrated using a calculation for which the correct result was achieved.
3 points	**Concept Mastery.** Skill has been successfully demonstrated. (small math errors will not prevent a student from earning a 3)

2 points	**Partial mastery.** Some understanding of the core skill was shown, but with some conceptual issues.
1 point	**Limited mastery.** Some basic understanding of the core skill was shown, but with major conceptual issues.
0 points	**No mastery.** Student has not yet demonstrated an understanding of this concept.

Design and Integration Grade **(18%)**

- Project 1 report (Channel Blocker Lab) (6%)
- Project 2 report (Faraday's Law Lab) (6%)
- Mini-reports for the other Studio Sessions (6%)

Grading and Attendance Policy

- As described above, you are expected to attend class, although a few absences during the semester are understandable. Class time is an important opportunity to practice concepts with your fellow students. Attendance will be counted via the lecture exercises on Gradescope. You will be given full points as long as you complete them during the lecture.
- Homework is graded as "participation plus" in this class. This means that full credit will be awarded for any student who completes all problems and generates an understanding of all problem concepts, even if there are a few mistakes. TAs / SAs will provide feedback on your homework upon request.
- Homework and project reports are due by **11:59pm** on the designated due date. Late assignments will not be accepted unless an official excuse is provided. Please plan accordingly and communicate directly with me via email if serious circumstances prevent you from completing assignments. While collaboration in homework is encouraged, obvious copying of homework from another person will result in a grade of 0 points and potential sanctions due to academic dishonesty.

Technology Used in This Class

- Analog Discovery 2 Board / Analog Devices ADALM1000 / Analog Devices ADALM2000 (and accompanying software)
- LTSpice (circuit simulation)
- Discord (class correspondence between meetings)
- pCloud shared drive (course materials)
- Gradescope (assignment submission and grading)

Inclusivity and Accessibility Statement

Rensselaer Polytechnic Institute strives to make all learning experiences as accessible as possible. I
will strive to provide an environment that is equitable and conducive for learning for all students. Please contact me as soon as possible if you:

1) live in a distant time zone and may need accommodations for exams. Course material will be made available online for your reference. You may set up lab sessions with partners during times that best fit your schedule. For additional help, please be proactive about attending open hours and office hours.

2) have internet accessibility issues where you live at any time during the semester. Contact me directly if events cause disconnection for any important portion of the course. If you know this will be a consistent problem, please contact me early in the semester.

3) anticipate or experience academic barriers based on a disability, please let me know immediately so that we can discuss your options. To establish reasonable accommodations, please register with The Office of Disability Services for Students. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. To receive any academic accommodation, you must be appropriately registered with DSS.

DSS contact information: dss@rpi.edu ; 518-276-8197, 4226 Academy Hall.

Assignment Detail Section

Electronic Submissions

All team assignments, homework assignments, and lab reports will be submitted by you, the student, via Gradescope unless otherwise noted. Make sure before submitting any assignment that all of your work is legible and easy to read. Most submissions can be scanned from your smart phone.

Homework

Homework assignments are due as indicated on the schedule in the following section. The purpose of homework is to provide practice in applying the course's key theoretical concepts, and it will be graded for completeness (you will not be penalized for incorrect answers as long as you work contains a complete attempt at solving all problems). Solutions will be submitted after the homework due dates in order to allow students to check their answers and comprehension. Late homework will not be accepted after the deadline posted on Gradescope except with prior approval. While homework can be done with your partner(s) as a collaborative effort, each student must submit their own work. Blatantly copied homework assignments will result in 0 points and you are subject to severe corrective action as it is a violation of the academic dishonesty policy.

Software

Some of the homework and lab assignments require the use of the LTSpice circuit simulation program. LTSpice can be downloaded here: https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html

The course's LMS page will contain copies of all relevant course documents, including all homework, labs, solutions, and this syllabus. Assignments will be submitted via Gradescope.

The Analog Devices pages for the ADALM1000 and ADALM2000 describe the specific software packages designed to interface with these boards on your computer.