



EE370L: Electromagnetics for Engineering Systems

Units: 4

Term: Spring 2022

Lectures: Mon & Wed, 2:00-3:20 PM

Labs: Fr, 8:00-9:50 AM or 10:00-11:50PM

Location: Lectures: LVL17

Labs: OHE230

**Instructors: Gianluca Lazzi (Lectures)
Aluizio Prata (Laboratories)**

Office Hours: Gianluca Lazzi: M, 3:30-4:30 PM, or by appointment
Aluizio Prata: T & Th, 11:00-12:00 AM, or by appointment

Contact Info: lazzi@usc.edu
prata@usc.edu

Teaching Assistants

Office Hours: TBD; TBD

Contact Info: TBD; TBD

Course Description

Electromagnetic wave propagation and interactions with simple media, transmission and reception of wireless signals in complex environments, transmission lines, antennas, and waveguides. Optimization design methods for system applications.

Learning Objectives

Students who successfully complete EE 370L will be able to: 1) Calculate and measure voltages, currents, and impedances in transmission lines; 2) Perform time domain analysis and measurements (including bounce diagrams) and phasors domain analysis (including Smith chart) of transmission lines; 3) Design and experimentally verify matching systems for transmission lines; 4) Calculate electric and magnetic fields of a plane waves; 5) Calculate electric and magnetic fields of a plane waves reflected and transmitted at boundaries, for normal and oblique incidence; 6) Understand modes in rectangular waveguides; 7) Calculate the fields radiated by elementary dipoles, dipoles of arbitrary length, and simple arrays; 8) Design dipole antennas and measure their electric characteristics; 9) Compute and experimentally verify the link budget of simple wireless communication systems, and understand how the environment affects the received power.

Prerequisite(s)

PHYS 172 or PHYS 162.

Recommended Preparation

Knowledge of circuit theory and software packages to process and plot data (e.g., Matlab, Excel).

Course Notes

Lecture notes for this class, assignments, laboratory manuals, and any suggested additional reading will be posted on the Blackboard website.

Required Readings and Supplementary Materials

Textbook: Ulaby and Ravaioli, *Fundamentals of Applied Electromagnetics (8th Ed)*, Required.

Other References (not required): Kraus, *Electromagnetics with Applications*; U. Inan and A. Inan, *Electromagnetic Waves*; Hayt and Buck, *Engineering Electromagnetics*; Chen, *Field and Wave Electromagnetics*; Haus and Melcher, *Electromagnetic Fields and Energy* (<http://ocw.mit.edu>)

Description and Assessment of Assignments

Approximately 9 homework sets and 7 laboratory exercises will be assigned. These should all be turned in before class or discussion/laboratory, on the days these are due, as indicated on the assignments. All homeworks and laboratories have been designed to be completed at home. Although laboratory sessions are provided throughout the semester, their intent is mainly to stimulate the discussion of relevant laboratory details, as all laboratories are to be completed at home, using the USC provided laboratory kits.

Late homework assignments will not be accepted. However, the lowest homework grade in the semester will not be used to calculate average final homework scores, providing an opportunity to miss turning in a homework without grade consequence. Similarly, the lowest laboratory grade in the semester will not be used to calculate average final laboratory scores, providing an opportunity to miss turning in a laboratory report without grade consequence. Notice, however, that homework and laboratory exercises build on each other; even if a missed homework or laboratory report may not have a grade consequence, it is critical that all homework and laboratory exercises be completed anyways before progressing to the subsequent homework or laboratory.

All homework assignments and laboratory exercises are to be completed on your own. You are allowed, and encouraged, to consult with other students in the current class regarding the general approach to solving problems and doing experiments, but all work submitted by you must be your work alone. You are not allowed to possess or in any way derive advantage from existing solutions prepared in previous years by former students, earlier professors, or from on-line sources. In addition to homework and laboratory exercise assignments, there will be 2 midterms and a final exam. You will be tested on all material covered in class, on the assigned readings, on the laboratories, and on the homework problems and problems similar to those. Please bring your USC ID card to each exam; it may be checked during the exam. You must take the exams at the scheduled times: if you are absent during an exam, you will receive a grade of zero unless you have a valid reason for your absence *and* you have discussed it with the instructors *prior* to the exam.

Grading Breakdown

Grading will be based on the following weights:

- Homework assignments 15%
- Midterm No. 1 20%
- Midterm No. 2 20%
- Laboratory 25%
- Final Exam 20%

Important Dates

- First day of class 01/10/2021 (Mon)
- Martin Luther King Day 01/17/2021 (Mon)
- President's Day 02/21/2021 (Mon)
- Spring Recess 03/13/2021 – 03/20/2021 (Sun-Sun)
- First exam 02/16/2021 (Wed)
- Second exam 03/30/2021 (Wed)
- Last day of class 04/29/2021 (Fr)
- Final exam 05/9/2021 (Mon), 2-4 PM

Tentative Class Schedule

Week	Lecture / Lab Dates	Instructor	Chapters / Section Covered / Lab Topics	Exam Dates	HW due	Previous Lab due
1	Jan.10, Jan.12	Lazzi	1, 2.1-2.2			
	Jan.14	TBD	Problem or Review session			
2	Jan.19	Lazzi	2.3-2.5			
	Jan.21	Prata	Laboratory No. 1			
3	Jan.24, Jan.26	Lazzi	2.6-2.7		Jan.26	
	Jan.28	TBD	Problem or Review session			
4	Jan.31, Feb.02	Lazzi	2.8		Feb.2	
	Feb.04	Prata	Laboratory No. 2			Feb.4 (Lab.1)
5	Feb.07, Feb.09	Lazzi	2.9-2.10		Feb.9	
	Feb.11	Prata	Laboratory No. 3			Feb.11 (Lab.2)
6	Feb.14, Feb.16	Lazzi	Exam review (2/14), Midterm 1	Feb.16		
MIDTERM NO.1: Wednesday Feb. 16						
	Feb.18	TBD	Problem or Review session			
7	Feb.23	Lazzi	2.10-2.12			
	Feb.25	Prata	Laboratory No. 4			Feb.25 (Lab.3)
8	Feb.28, Mar.02	Lazzi	3.1-3.6, 7.1-7.4		Mar.2	
	Mar.04	TBD	Problem or Review session			
9	Mar.07, Mar.09	Lazzi	7.5-7.6, 8.1-8.5		Mar.9	
	Mar.11	Prata	Laboratory No. 5			Mar.11 (Lab.4)
SPRING RECESS: Mar. 13 to Mar. 20						
10	Mar.21, Mar.23	Lazzi	9.1-9.2		Mar.23	
	Mar.25	TBD	Problem or Review session			Mar.25 (Lab.5)
11	Mar.28, Mar.30	Lazzi	Exam review (3/28), Midterm 2	Mar.30		
MIDTERM NO.2: Wednesday Mar. 30						
	Apr.02	Prata	Laboratory No. 6			
12	Apr.04, Apr.06	Lazzi	9.2			
	Apr.08	TBD	Problem or Review session			Apr.8 (Lab.6)
13	Apr.11, Apr.13	Lazzi	9.3-9.6, 9.9		Apr.13	
	Apr.15	Prata	Laboratory No. 7			
14	Apr.18, Apr.20	Lazzi	9.10-9.11, 8.6-8.8		Apr.20	
	Apr.22	TBD	Problem or Review session			Apr.22 (Lab.7)
15	Apr.25, Apr.27	Lazzi	8.9-8.11, final review		Apr.27	
FINAL EXAM: Monday May 9, 2-4 PM						

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call

suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call

studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298

equity.usc.edu, titleix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

usc-advocate.symplcity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776

dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

ombuds.usc.edu

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.