EE370L: Electromagnetics for Engineering Systems

Units: 4
Term: Spring 2021

Lectures: **Mon & Wed, 2:00-3:20 PM**
Discussions / Labs: **Fr, 9:00-11:50 AM or 1:00-3:50PM**
Location: Online (Zoom) + Blackboard

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

Office Hours: Gianluca Lazzi: M, 4:00-5:00 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:

Amine Abouzaid: F, 4:00-5:00 PM, or by appt.
Radhika Bhuckory: T, 1:00-2:00 PM, or by appt.
Olivia Brasher: W, 3:30-4:30 PM, or by appt.
Swarnabha Chattaraj: W, 10:00 -11:00 AM, or by appt.
Buyun Chen: T, 1:00 – 2:00 PM, or by appt.

Contact Info:

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

Learning Objectives
Students who complete EE 370L will be able to: 1) Calculate voltages, currents, and impedances in transmission lines; 2) Perform time domain analysis (including bounce diagrams) and phasors domain analysis (including Smith chart) of transmission lines; 3) Design 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) Write expressions of modes in rectangular waveguides; 7) Calculate the fields radiated by elementary dipoles, dipoles of arbitrary length, and arrays; 8) Compute the link budget for a simple wireless communication system and explain how the environmental affects the received power.

Prerequisite(s)
PHYS 172 or PHYS 162.

Recommended Preparation
Knowledge of software packages to plot/process data (e.g., Matlab, Excel) is helpful.

Course Notes
Lecture notes for this class, assignments, and any suggested additional reading will be posted on the Blackboard site.

Required Readings and Supplementary Materials
Textbook: Ulaby and Ravaioli, *Fundamentals of Applied Electromagnetics (7th 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 10 homework sets and 7 laboratory exercises will be assigned. These should be turned in before class or discussion/laboratory, on the days these are due as indicated on the assignments. Late homework assignments will not be accepted: however, the lowest homework grade in the semester will not be used to calculate average final scores, providing an opportunity to miss turning in a homework without grade consequence. Late laboratory exercises will be accepted only after obtaining permission from the instructors: such permission may be granted for valid medical excuses, delays in receiving the necessary equipment, or other extenuating circumstances to be discussed with the instructors. 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, 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, 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 exercises 25%
- Final Exam 20%

Important Dates

- First day of class 01/20/2021 (Wed)
- Last day of class 04/28/2021 (Wed)
- Martin Luther King Day 01/18/2021 (Mon)
- President's Day 02/15/2021 (Mon)
- Wellness Day 04/07/2021 (Wed) (1 of 5 USC Wellness days)
- First exam 02/24/2021 (Wed)
- Second exam 03/31/2021 (Wed)
- Final exam 05/10/2021 (Mon), 2-4 PM

Tentative Class Schedule

Week	Lecture / Discussion / Lab Dates	Instructor	Chapters / Section Covered / Lab Topics	Exam Dates	HW due	Previous Lab due
1	1/18, 1/20	Lazzi	MLK, 1, 2.1-2.2			
	1/22	TBD	Discussion			
2	1/25, 1/27	Lazzi	2.3-2.6		1/27	
	1/29	TBD	Discussion			
3	2/1, 2/3	Lazzi	2.7-2.12		2/3	
	2/5	Prata	Laboratory No.1: Vector Network Analyzer (VNA) Fundamentals			
4	2/8, 2/10	Lazzi	3.1-3.6		2/10	
	2/12	Prata	Laboratory No.2: Characteristics of High-Frequency Transmission Lines			2/12
5	2/17	Lazzi	7.1-7.4		2/17	
	2/19	Prata	Laboratory No.3: Scattering Parameters and the Smith Chart			2/19
6	2/22, 2/24	Lazzi	Exam review (2/22)	2/24		
	2/26	TBD	Discussion			
7	3/1, 3/3	Lazzi	7.5-7.6			
	3/5	Prata	Laboratory No.4: Impedance Matching			3/5
8	3/8, 3/10	Lazzi	8.1-8.5		3/10	
	3/12	TBD	Discussion			
9	3/15, 3/17	Lazzi	8.6-8.8		3/17	
	3/19	Prata	Laboratory No.5: Attenuators and Baluns			3/19
10	3/22, 3/24	Lazzi	8.9-8.11		3/24	
	3/26	Prata	Laboratory No.6: Impedance of Antennas			3/26
11	3/29, 3/31	Lazzi	Exam review (3/29)	3/31		
	4/2	TBD	Discussion			
12	4/5, 4/7	Lazzi	9.1-9.5, wellness day			
	4/9	Prata	Laboratory No.7: Near- and Far-Zone Antenna Coupling			4/9
13	4/12, 4/14	Lazzi	9.6-9.11		4/14	
	4/16	TBD	Discussion			
14	4/19, 4/21	Lazzi	10.1-10.6		4/21	
	4/23	TBD	Discussion			4/23
15	4/26, 4/28	Lazzi	10.7-10.8, final review		4/28	

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.symplicity.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.