ESE 520 (Applied Electromagnetics)
Spring 2025

Stony Brook University

Syllabus

1. Instructor

Jayant P. Parekh
jayant.parekh@stonybrook.edu
Light Eng. 225

2. Course Description

Wave phenomena and their importance in electromagnetic engineering. Harmonic waves. Phase and group velocities. Dispersive and nondispersive propagation. Transmission lines. Maxwell Equations. Uniform plane waves, waveguides, resonators. Scattering matrix theory. Introduction to antenna theory. Electrostatics and magnetostatics as special cases of Maxwell equations.

Credits: 3

3. Recommended Textbook

"Fundamentals of Applied Electromagnetics (7th Edition)", F. Ulaby and U. Ravaioli, Pearson 2015. This book is recommended for the main part of the course but it is not required. Extensive class notes including sample problems with solutions will be provided by the instructor.

4. Topics

I. Review of microwave applications, e.g., AM radio, FM radio, TV, microwave ovens, RF identification (RFID), radars, wify, bluetooth, hotspot, IoT. These applications demonstrate that the technology of microwaves is the mother of all technologies to such an overwhelming extent that, without microwaves, the human technological progress would be set back by at least a century. — 1 week

II. Wave phenomena and their importance in applied electromagnetics. Generic uniform plane waves (UPW). Travelling and standing waves. Phase and group velocities. Uniform plane electromagnetic waves (UPEMWs) as a composite of an electric field UPW and a magnetic field UPW, both moving synchronously in space and time and with two other properties later derived from Maxwell equations. Dispersion diagram. Dispersive and nondispersive propagation. — 2 weeks

III. Transmission lines. Voltage reflection coefficient. VSWR. Impedance transformation. Smith Chart and applications. Design of quarter-wave and shorted single stub tuners. Double stub tuners. — 2 weeks

IV. Maxwell Equations. UPEMWs in lossless media. Dispersion relationship. Poynting vector. Poynting theorems. Boundary conditions. Scattering of plane waves incident normally or well as obliquely

	at one or more planar boundaries. Brewester and critical angle phenomena. Solution of UPEMW scattering at boundaries using an equivalent transmission-line circuit. EM wave propagation in a conducting medium, skin depth.	3 weeks
V.	Waveguides, dominant waveguide mode, cutoff frequency, including optical fibers. Resonators.	2 weeks
VI.	Scattering parameters and application to microwave measurements of power reflection and transmission coefficients. Microwave components.	2 weeks
VII.	Anisotropic media: UPEMWs in magnetized plasmas and ferrites	2 weeks

7. Assignments

7.1. Homework Assignments

Homework Assignments will be issued once every week. All homework solutions must be submitted on the Blackboard by the midnight of the assigned day. No late submission of homework is accepted except under extenuating circumstances.

7.2. No makeup Exams or Homeworks:

There will be no "make-up" exams or homeworks except under absolutely extenuating or exceptional circumstances.

8. Questions on grading:

Any grading issues must be brought to the attention of the instructor and resolved within ten days of the return of the homeworks or exams to the students. Late queries will not be entertained.

9. Academic Honesty:

Cheating of any kind is considered a serious offence, and will be treated according to the university rules of academic dishonesty, which provide for failure, suspension, and/or dismissal of the students involved. Regarding homework assignments and test preparation, you may freely interact with other students. But when you do the actual homework assignment or exam, you are to work alone and your work is to be yours alone.

10. Grading:

1. 1 Term Exam	40%
2. Homework	20%
3. Final Exam	40%

11. Exam schedule:

Term Exam:	We., Mar. 12
Final Exam:	Mo., May 19

11. Teaching Modality:

The present course is taught in class. Instructor-prepared written material in the form of lessons, homework and sample problems with solutions will be distributed to students every week. Video recording of the lectures will also be distributed to the students. The student will study the distributed material and do assigned homework (typically one per week) which must be submitted to the instructor online in pdf format through the Blackboard. To assist the students in learning the material, the instructor will hold office hours twice a week when any issue relative to the course will be discussed, including answering any questions the students may have on the course material and homeworks.

12. Office Hours:

Wed., 2 PM to 6 PM or by appointment
Students are invited to visit with the instructor in his office during his office hours. Online office hours may also be held by appointment.

13. Attendance:

Students are required to attend all in-class lectures. Unannounced attendance will be taken, and, although attendance will not be considered directly in grading, students with grades in borderline regions will be adversely affected if their attendance record is not satisfactory. Regular attendance to the in-class lectures helps the student in being aware of what goes on in the class and affords the student the chance to participate in question and answer sessions.

14. Critical Incident Management:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Until/unless the latest COVID guidance is explicitly amended by SBU, during Spring 2022 "disruptive behavior" will include refusal to wear a mask during classes.
For the latest COVID guidance, please refer to:
https://www.stonybrook.edu/commcms/strongertogether/latest.php

15. Syllabus subject to change:

This syllabus is subject to change in terms of course content or any other way as dictated by progress in the class.