

****Disclaimer****

This syllabus is to be used as a guideline only. The information provided is an example of topics to be covered in the class. Information contained in this document such as assignments, grading scales, due dates, office hours, required books and materials are subject to change. Please refer to your instructor for the most recent version of the syllabus.

EEE 341: Engineering Electromagnetics

Purpose of the Course

The purpose of this course is to learn about the fundamental principles of time varying electromagnetic fields as well as some of the technologies that have been developed to exploit these phenomena.

Prerequisite

EEE 241

Prerequisites by Topic

1. Electrostatics and magnetostatics
2. Phasors and complex numbers
3. Differential equations.
4. Vector analysis

Textbook

D. K. Cheng, Field and Wave Electromagnetics, Second Edition, Addison Wesley, 1989.

Supplemental Materials

S. Ramo, J. R. Whinnery, T. V. Duzer, Fields and Waves in Communication Electronics, John Wiley and Sons, 1994.

Course Contribution to Engineering Science and Design

EEE 341 contributes to engineering science through creating a basic understanding of electromagnetics theory and its most important applications in electrical engineering, and allows the student to develop and apply the mathematical skills that are vastly used in different areas of engineering and applied physics.

Computer Usage

Students use MATLAB to develop and visualize solutions to moderately complicated field problems. Students are exposed to industry standard RF/microwave circuit and electromagnetic field solvers. *Students enrolled in this course must have access to a personal computer running the Windows operating system in order to utilize the industry standard software Agilent ADS as well as EZNEC.*

Help

For technical support, use the Help icon in the black global navigation menu in your Canvas course or call the ASU Help Desk at +1-(855) 278-5080. Representatives are available to assist you 24 hours a day, 7 days a week.

Course Objectives

1. This is an undergraduate level course in engineering electrodynamics that encompasses topics from all major areas of applied electromagnetics.
2. It constitutes a foundation for more advanced courses for students with emphasis in electromagnetics.
3. It serves as an introduction to wave phenomena and high-frequency concepts for students with areas of emphasis other than electromagnetics.

Course Outcomes

1. Students can write and interpret phasor Maxwell's equations in differential and integral forms, both in time and frequency domains.
2. Students understand the meaning of complex permittivity, permeability, and conductivity, and perfect electric and perfect magnetic conductors.
3. Students can comfortably work with plane waves, derive Snell's laws from phase matching, and calculate the reflection and transmission coefficients at the interface of simple media.
4. Students understand the meaning of and can differentiate between phase velocity and group velocity.
5. Students understand and can apply complex Poynting theorem to calculate average power.
6. Students understand the meanings of characteristic impedance and complex propagation constant and can relate them to the basic transmission line parameters (L' , C' , R' and G').
7. Students can calculate input impedance and reflection coefficient of an arbitrarily terminated transmission-line and can use Smith chart to convert these quantities.
8. Students can use attenuation constant to calculate the losses of a transmission line section or the quality factor of a transmission-line resonator.
9. Students understand the concept of propagating modes, TE and TM decomposition, evanescent modes and cutoff frequency in waveguides.
10. Students can calculate the cutoff frequency and propagation constant for parallel plate, rectangular, and dielectric slab waveguides.
11. Students can calculate the resonant frequency of simple cavity resonators.
12. Students understand the meaning of elemental electric and magnetic dipoles.
13. Students understand the basic parameters of antennas and can relate antenna radiation pattern to its directivity.
14. Students are exposed to the examples of array theory.

Course Relationship to EE Program Outcomes

1. EM is the foundation of all contemporary electrical technology and is applicable to almost all EE industry work. Differential equations, Vector differential Operators and physics backgrounds are utilized.
2. Students receive some experiment design/data interpretation instruction in the lab and are taught problem solving methodologies and acquire some modeling experience.
3. MATLAB and industry standard software packages are used for solving field theory and transmission line problems.

Course Planning Map

Course Topics

1. Recap of electrostatic and magnetostatic axioms
2. Time-varying fields and Maxwell's equations
3. Time-harmonic electromagnetic fields
4. Plane waves in lossless media
5. Plane waves in lossy media
6. Poynting vector and energy transport
7. Reflection of plane waves by conducting boundaries
8. Reflection and refraction of plane waves at the interface of simple media
9. A general introduction to the theory of transmission lines
10. Calculating transmission line parameters
11. Wave characteristics in finite transmission lines
12. Smith chart and impedance matching
13. Transients on transmission lines
14. Electromagnetic waves in uniform guiding structures
15. Parallel plate and rectangular waveguides
16. Rectangular cavity resonators
17. Dielectric slab waveguide
18. Elemental dipoles
19. Radiation pattern and other antenna parameters
20. Half-wave dipole antenna
21. Introduction to antenna arrays
22. Laboratory experiments

Grade Percentage Points Range

(This class uses the "standard" ASU grading schema.)

Grade	Percentage
A+	Above 97
A	94 - 97
A-	90 - 94
B+	87 - 90
B	84 - 87
B-	80 - 84
C+	76 - 80
C	70 - 76
D	60 - 70
E	Below 60

Grading Procedure

Grades reflect your performance on assignments and adherence to deadlines. Graded assignments will normally be available within 72 hours of the due date via the Gradebook.

Communicating With Your Classmates and the Instructor/TA

This course uses Ed Discussion for peer-to-peer interaction. You are encouraged to respond to the questions of your classmates. The instructor will check approximately once per day and comment on postings where appropriate. All questions related to course material should be asked on Ed Discussion to allow all students to see the question and student/instructor answers. Note that Ed Discussion is not the appropriate medium for communicating with the instructor regarding matters concerning your performance in this class.

You can also email questions not related to the course material to your instructor or assigned TA. During normal business hours (9AM – 5PM MST Monday through Friday), the instructor will endeavor to respond within about 4 hours. Outside of normal business hours, you can expect a response within about 12 hours.

Email and Internet

ASU email is an official means of communication among students, faculty, and staff. Students are expected to read and act upon email in a timely fashion. Students bear the responsibility of missed messages and should check their ASU-assigned email regularly. All instructor correspondence will be sent to your ASU email account.

Third-Party Instructional Materials

This course makes use of certain instructional materials provided by third parties including software from Mathworks, Keysight, Ansys and EZNEC. In addition, students may choose to access additional third-party materials at their own discretion. The third-party materials specifically recommended for this course have been deemed of value in achieving course objectives. No such determination has been made nor will be made about any other third-party materials.

Course Time Commitment

This four-credit course nominally requires at least 180 hours of work. Please expect to spend at least 12 hours each week preparing for and actively participating in this course during the 15 week semester. If it has been more than one year since you completed the pre-requisites for this class, you may be spending substantially more than 12 hours per week on this course.

Late or Missed Assessments

Notify the instructor BEFORE an assessment is due if an urgent situation arises and the assignment absolutely cannot be submitted on time. Published assignment due dates (Arizona Mountain Standard time) are firm. Please follow the appropriate University policies to request an accommodation for religious observances/practices that are in accord with [ACD 304-04](#), "Accommodation for Religious Practices", for University-sanctioned events/activities that are in accord with [ACD 304-02](#), "Missed Classes Due to University-Sanctioned Activities", or for military line-of-duty activities that are in accord with [ACD 304-11](#), "Missed Class Due to Military Line-of-Duty Activities," and SSM 201-18, "Accommodating Active Duty Military".

Submitting Assessments

All assessments, unless otherwise announced, MUST be submitted to the designated area of Canvas. Do not submit an assessment via email unless you have received prior authorization to do so from the instructor.

Drop and Add Dates/Withdrawals

This course adheres to a compressed schedule and may be part of a sequenced program, therefore, there is a limited timeline to drop or add the course. Consult with your academic advisor to add or drop this course. If you are considering a withdrawal, review the following ASU policies: Withdrawal from Classes, and Medical/Compassionate Withdrawal.

Grade Appeals

Grade disputes must first be addressed by discussing the situation with the instructor. If the dispute is not resolved with the instructor, the student may appeal to the department chair per the University Policy for Student Appeal Procedures on Grades.

Incomplete Grades

A grade of “incomplete” (“I”) is given by the instructor only when a student doing acceptable work is unable to complete a course because of illness or other conditions beyond the student’s control. It is used only under extreme extenuating circumstances with the expectation that the student will make up missed work in a matter of weeks.

Academic Integrity and Copyright Laws

Academic Integrity

Students in this class must adhere to the ASU Student [Honor Code](#) and ASU’s academic integrity policy, which can be found at <https://provost.asu.edu/academic-integrity/policy>. Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. All academic integrity violations will be reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). The AIO maintains record of all violations and has access to academic integrity violations committed in all other ASU college/schools.

Copyright

All course content and materials, including lectures (Zoom recorded lectures included) are copyrighted materials and students may not share outside the class, upload to online websites not approved by the instructor, sell, or distribute course content or notes taken during the conduct of the course (see [ACD 304–06](#), “Commercial Note Taking Services” and ABOR Policy [5-308 F.14](#) for more information).

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student’s original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Policy against threatening behavior, per the Student Services Manual, SSM 104–02

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services. Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Disability Accommodations

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with the ASU disabilities resource Center and provide documentation of that registration to the instructor. Students should communicate the need for an accommodation in sufficient time for it to be properly arranged. See [ACD 304-08](#) Classroom and Testing Accommodations for Students with Disabilities.

Harassment and Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/fags>.

Mandated sexual harassment reporter: As an employee of the University I am considered a mandated reporter and therefore obligated to report any information regarding alleged acts of sexual discrimination that I am informed of or have a reasonable basis to believe occurred.

ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if you wish to discuss any concerns confidentially and privately.