

EE 430 – Principles of Electromagnetic Fields

Designation: EE elective course for electrical engineering majors.

University Bulletin Description:

EE 430 (1): Laws of electrodynamics, boundary value problems, relativistic effects, waves in dielectrics and ferrites, diffraction and equivalence theorems. Taught Spring semesters.

Prerequisite: EE 330.

Prerequisites by Topics:

Static electric and magnetic fields; solutions to static field problems, Maxwell's equations; electromagnetic waves; boundary conditions; engineering applications.

Textbook/Required Materials:

ELECTROMAGNETIC FIELD THEORY: A Problem Solving Approach, Zahn, M., Kreiger Publishing, 1987, ISBN 0-89874-985-9.

Learning Outcomes:

This course provides the education in fundamental laws of electromagnetics and provides practical training in solution of engineering electromagnetics problems. Through lecture and out-of-class assignments, students are provided learning experiences that enable them to:

1. Understand sources of electric and magnetic fields and coupling between these fields.
2. Understand boundary conditions and relationships between fields in material media.
3. Understand electromagnetic waves in material media and at interface between different media.
4. Understand concepts of energy and power associated with electromagnetic fields.
5. Understand and design transmission lines and waveguides.
6. Understand and analyze radiation from antennas and antenna arrays.

Topics:

1. Review of vector analysis
2. The electric field
3. Polarization and conduction
4. The magnetic field
5. Electromagnetic induction
6. Electrodynamics - fields and waves
7. Guided electromagnetic waves
8. Radiation

Class/Laboratory Schedule:

Three 50-minute classes/week. The class is all lecture (100%).

Computer Usage:

Computers are used in an individual project (worth 20% of the final grade) on a topic of the student's interest, subject to approval of the instructor.

Laboratory Projects/Assignments:

There are a total of six homework assignments and a final independent project (eight-weeks long). The homework assignments are based on the eight course topics. The final project is a design or a review project in which students use a combination of the techniques learned in class to study a topic related to their area of interest. Students have the choice of **either** submitting a term paper (topic, scope, and extent approved by the instructor) **or** submitting a solution to a design problem from a list provided by the instructor. This independent work is due on the last day of class.

Contribution to Meeting the Requirements of Criterion 5. Curriculum:

This course contributes to both the engineering topics and design components.

Relationship to Program Outcomes:

- O.1.1. Graduates will possess mathematics skills necessary for electrical engineering.
- O.1.2. Graduates will have a theoretical and practical background in both physics and chemistry.
- O.2.4. Graduates will understand fundamental electricity and magnetism concepts and be able to use them in applications.
- O.3.1. Graduates will have in-depth technical knowledge in one or more areas of specialization.
- O.3.2. Graduates will have practical understanding of the major electrical engineering concepts and demonstrate application of their theoretical knowledge of the concepts.
- O.4.2. Graduates will develop an appreciation of continuing educational and professional development.
- O.6. Graduates will appreciate their role as engineers in society.

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