

EE 387– Energy Conversion

Designation: EE elective course for electrical engineering majors.

University Bulletin Description: EE 387: (3) Electromechanical energy conversion; magnetic circuits; transformers; steady-state and transient analysis of induction, synchronous, and dc machines.

Prerequisite: EE 350.

Prerequisites by Topics:

1. Understanding of basic electromagnetics, e.g., Ampere's Law, Faraday's Law.
2. Understanding of basic mechanics, e.g., forces and torques.
3. Understanding and the ability to use differential equations, linear algebra, and complex variables in the modeling and analysis of linear circuits.
4. Familiarity with MATLAB.

Textbook/Required Materials: *None*

Learning Outcomes:

This course provides an introduction to energy conversion techniques, with an emphasis on rotating magnetic-field-based machinery. Through lecture and out-of-class assignments, students are provided learning experiences that enable them to:

1. Analyze three-phase networks under balanced conditions.
2. Analyze basic magnetic circuits, such as inductors and transformers.
3. Understand the concept of electromagnetic force production, analyze basic electromechanical actuators.
4. Understand fundamental concepts associated with rotating electrical machinery, such as traveling magneto-motive force (mmf) waves and pole numbers.
5. Analyze rotating induction and synchronous machines to determine performance indicators such as torque and efficiency.

Topics:

1. ac power calculations
2. Poly-phase network analysis
3. Magnetic circuit analysis
4. Transformers
5. Energy conversion
6. ac machine fundamentals
7. Induction machine
8. Synchronous machine

Class/Laboratory Schedule: Three 50-minute lectures per week.

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.1.3. Graduates will have attained computer proficiency.
- O.2.1. Graduates will understand how to analyze and design simple electrical/electronic circuits.
- O.2.3. Graduates will understand the basic concepts of linear systems and how they interact with continuous-time signals.
- 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.4.1. Graduates will interact with industry both within and outside of a classroom setting.
- O.4.2. Graduates will develop an appreciation of continuing educational and professional development.

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