

EEE 360 Energy Systems and Power Electronics (4) [F,S]

Course (Catalog) Description:

Three-phase circuits, renewable and conventional energy supply systems, synchronous generators, transformers, induction and DC machines, power electronics for motor speed control and rectification, per unit systems and power system representation.

Lecture, lab. Pathway course. Required for majors and minors (4 out of 6).

Prerequisites:

EEE 202 & EEE 241.

Textbook:

G. Karady, K. Holbert, Electric Energy Conversion and Transport using an Interactive Computer-

Based Approach, Second Edition, John Wiley and Sons Inc. ISBN 978-0-470-93699-3- 2013.

Lecture notes posted on class web pages.

Supplemental Materials: None

Coordinator: George G. Karady, Professor

Prerequisites by Topic:

1. Electrical circuit analysis (steady state and transient)
2. Use of complex numbers for circuit analysis

Course Objective:

Students will obtain basic knowledge and develop problem solving ability in electric energy conversion and utilization

Course Outcomes:

1. Students understand electric energy conversion, transport, and utilization.
2. Students understand the operation of electric machines, such as motors and generators.
3. Students can analyze electric machine performance.
4. Students have knowledge of electronic control of electric machines

Course Topics:

1. Introduction, Electric power system
2. Electric generation stations
3. Single phase circuits
4. Three phase circuits including Per-unit System
5. Transformers
6. Synchronous Machine
7. Induction Machine
8. DC machines

9. Introduction Power Electronics and motor controls, Rectifiers, Inverters, Flexible AC transmission (FACT)

Computer Usage:

Use of MATLAB/MATHCAD for solving problems in homework, tests, exams, is encouraged. The course starts with individual components of energy systems and explains how they are integrated in a practical power system. The role of computers for solving power flow problems is explained via slide presentations. Several homework problems require extensive survey of literature (web search).

Laboratory Experiments:

Students meet weekly for a three-hour laboratory under the guidance of a TA.

1. Single phase power
2. Three phase power
3. Transformers
4. Induction Motors
5. Single Phase Induction Motors
6. Synchronous Machines
7. Alternator Synchronization
8. DC Machines/Special Machines

An introductory lecture at the beginning of the semester explains the laboratory safety procedures. Each laboratory experiment is introduced by a short lecture, outlining the objectives of the experiments. At the end of the semester, the students will have a written exam on the laboratory work.

Course Contribution to Engineering:

Some of the examples and assignments require the solution of open-ended problems where the student has to consider alternative solutions. In addition, they must consider economic and reliability constraints.

Course Relationship to Program Outcomes

Contributes to outcomes a,b,c,e,h:

This course is one of 4 (of the 6) pathway classes in the undergraduate program that the students select during their junior year. This course presents basic engineering knowledge by explaining the electric energy transport from the generator to the customers and the use of energy in motors (c,h). The energy system is a basic building block to the national infrastructure. Understanding the operation of this system is a basic part of electrical engineering knowledge (a,e). Lab experiments contribute to outcome (b).

Person(s) preparing this description and date of preparation: George Karady, Keith Holbert and Gerald Heydt, February, 20015.