ECE 46000 – Power Electronics

Type of Course
Required for EE Program

Catalog Description
Introduction to power semiconductor devices, their characteristics and ratings. Analysis and design of power electronics circuits are emphasized. Topics include diode rectifiers, controlled rectifiers, a.c. voltage controllers, thyristor commutation techniques, choppers, pulse - width modulated (PWM) and resonant pulse inverters, static switches, and power supplies.

Credits
4

Contact Hours
Class: 3; Lab: 3

Prerequisite Courses
ECE 25500, ECE 20200

Prerequisites by Topics
Have knowledge of diode, bipolar transistor, and FET circuit models for the design and analysis of electronic circuits. Single and multistage analysis and design; introduction to digital circuits. Computer - aided design calculations, amplifier operating point design, and frequency response of single and multistage amplifiers. High - frequency and low - frequency designs are emphasized. Understand the description of deterministic signals through the use of Fourier series. Fourier and Z - transforms. Systems description treated by differential and difference equations including transform methods. Computation of system response to both continuous and discrete inputs.

Textbook
Power Electronics, by Daniel W. Hart, McGraw-Hill, 2010.Course Objectives

Course Outcomes

Students who successfully complete this course will have demonstrated an ability to:

1. An ability to calculate power, power factor, and THD for a periodic power source. (2)

2. An ability to understand and design buck, boost, and buck - boost dc - dc converters to meet input - output specifications, assuming ideal components. (2)
3. Select commercially - available power components that would function in the designs and estimate temperature rise expected in these components. (7)
4. An ability to simplify and analyze power circuits with transformers. (1)
5. Understanding of the operating principles of soft - switch converters and dc - ac inverters. (1)
6. Identify significant power quality concerns in ac and dc power systems. (1)
7. An ability to use computational tools for power electronics circuits design and analysis (6)

Lecture Topics

1. Power semiconductor devices
2. Switches
3. Magnetic circuit concepts
4. Computer Simulation of Power Electronic Circuits
5. AC - DC Converters (Rectifiers)
6. DC - DC Converters (Choppers)
7. DC - AC Converters (Inverters)
8. Phase Displacement Control
9. Soft Switching Techniques
10. Resonance
11. Switch - mode power supply

Computer Usage

High

Laboratory Experience

High

Design Experience

High

Coordinator

Elizabeth Thompson, Ph.D.

Date

09/30/2018