ECE 4610 (429) - Introduction to Power Electronics (4)
Section #12766
Winter 2018

Instructor: Manohar Das, Professor of Engineering. **Office Number**: 424 EC
Office Hours: T, Th: 11 am – 1 pm **Office Telephone:** 248-370-2237
Other times: please call/e-mail in advance **E-mail**: das@oakland.edu

Teaching Assistant: TBA **Office Hours:** TBA

Class Schedule: TR, 3:30pm – 5:17pm **Classroom:** 276 SFH

Prerequisite: ECE 3100 (327) and ECE 3204 (335) **Credit Hours:** 4.00

Textbook: Daniel W. Hart, Power Electronics, McGraw Hill, New York, 2010 .

References:
1. a) Ned Mohan , Tore M. Undeland , William P. Robbins, Power Electronics: Converters, Applications, and Design, 2nd ed., Wiley and Sons
   b) Ned Mohan , Power Electronics: A First Course, Wiley and Sons, 2012
2. M. H. Rashid, Power Electronics, 4th ed, Prentice-Hall, 2013.
3. R. W. Ericson, Fundamentals of power electronics, 2nd ed., Kulwer Academic.
4. P. T. Krein, *Elements of Power Electronics*, Oxford University Press, 1998.

Course description in catalog:

ECE 4610 Introduction to Power Electronics (4)
Power semiconductor devices and circuits. AC/DC Converters. Thyristors and commutation techniques. Phase-controlled rectifiers, choppers and inverters. AC voltage controllers and cycloconverters. Introduction to novel power electronic devices, such as IGBT and power MOSFET. Some industrial applications. With laboratory.
Prerequisite(s): ECE 3100 (327) and ECE 3204 (335).

ABET/Program Outcomes:
The Program Outcomes are a set of skills that assure the achievement of the program educational objectives. Before graduating, SECS students will demonstrate their skills in the following key areas:

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Objectives:
In this course, students are expected to gain knowledge and learn about basic theories and techniques related to power electronics. After completion of this course, students are expected to:
1. Be able to analyze simple power electronic switching circuits involving BJTs, MOSFETs, didoes and other semiconductor devices. [a, c, e];
2. Be able to analyze and design simple DC-DC converters. [a, c, e];
3. Learn the basic concepts of designing a feedback controlled switching mode power supply. [a, c, e];
4. Be able to analyze and design AC-DC converters. [a, c, e];
5. Be able to understand and analyze simple DC-AC and AC-AC converters.
6. Learn about various applications of power electronic circuits and systems.
7. Gain practical knowledge through laboratory experiments. [a, b, c, e, g, k];

Topics Covered (order may be changed slightly):

- Introduction, power electronic switches (Ch.1, parts of Ch. 10, and supplement)
- Power computations, Review of Fourier series (Ch. 2 and supplement)
- DC-DC converters (Ch. 6)
- (Switching mode) DC power supplies and power supply control (Ch. 7 and supplement)
- Half-wave rectifiers (Ch. 3)
- Full-wave rectifiers (Ch. 4)
- AC voltage controllers (Ch. 5)
- Inverters (Ch. 8)
- Drive circuits, snubber circuits and heat sinks (Ch. 10)
- (Time-permitting) Either resonant converters (Ch. 9) or power factor correction (from Ned Mohan's text)

Homework: Approximately 8 (selected problems from each homework will be graded).

Laboratories: Approximately 8 Pspice/hardware experiments.

Grading and Weights:
Homework 23%, Labs 12%, Two tests (2 best out of 3 given): 35%, Final: 30%.
Note: One homework may involve researching selected topics from power electronics literature.

Dates for Quizzes, Test and Final Examination:
Tests 1-3 (Tentative): 02/01/18, 03/01/18, 03/29/18
Final: Thursday, 04/19/18, 12:00 – 3:00 PM. (TO BE CONFIRMED)

Academic Conduct: Please see the student handbook for rules and regulations on academic conduct.