ECE4330 Course Syllabus

ECE4330

Power Electronics (2-0-2-3)

CMPE Degree

This course is Elective for the CMPE degree.

EE Degree

This course is Elective for the EE degree.

Lab Hours

2 supervised lab hours and 0 unsupervised lab hours

Course Coordinator

Divan,Deepakraj M

Prerequisites

ECE 3040 [min C] and (ECE 3042* [min C] or ECE 3043 [min C]) * Prerequisites indicated with an asterisk may be taken concurrently with ECE4330

Corequisites

None

Catalog Description

Introduces power semiconductor devices and power electronic converters, including single-phase and three-phase ac/dc rectifiers, ac voltage controllers, dc/dc converters and dc/ac inverters.

Textbook(s)

Mohan, Undeland and Robbins, *Power Electronics*, Wiley, 1997.(optional)

Course Notes.(optional)

Course Outcomes

Upon successful completion of this course, students should be able to:

1. Design and analyze basic power converter circuits across a range of applications.
2. Explain how parasitics at the device level impact performance at a system level.
3. Model the behavior of systems in frequency and time domain.
4. Extract linearized operating models of non-linear systems at a given operating point.
5. Apply basic principles to complex real life design problems with multiple constraints.

Student Outcomes

In the parentheses for each Student Outcome:
"P" for primary indicates the outcome is a major focus of the entire course.
“M” for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.
“LN” for “little to none” indicates that the course does not contribute significantly to this

outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (P) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (LN) An ability to communicate effectively with a range of audiences
4. (M) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (LN) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (P) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (P) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

1. Introduction (1week)
Definitions of power, rms, average quantities, Fourier Series; Revi

2. Principles of power conversion (2 weeks)
Ideal switch converters and state variables; Volt-sec and charge ba

3. DC/DC Converters (2 weeks)
Buck converters; Boost converters; Buck-boost converters; Four quad

4. AC/DC Rectifiers (1 week)
Single phase AC/DC diode rectifiers; Three phase AC/DC diode rectif

5. Real Converter Issues (2 weeks)
Power semiconductors ? diodes, MOSFETs, IGBTs, thyristors; Conducti

6. AC/DC Converters with galvanic isolation ? switching power suppl
Flyback converter; Forward converter; Other single transistor conve

7. DC/AC Inverters (1 week)
Single phase DC/AC inverters; Control of voltage and frequency ? PW

8. Control of power converters (1 week)
State space averaging; Digital control techniques

9. Examples of power converter applications (1 week)
Switched mode power supplies; Motor drives including electric vehic