EEE 472 Power Electronics and Power Management (3)

Course (Catalog) Description: Principles of switch mode power conversion, analysis, design and control of dc-dc converters, PWM rectifiers and inverters, power management, power electronics applications in information technology, renewable energy systems, motion control and lighting.

Course Type: Elective.

Prerequisite: BS/BSE Engineering Students; must have completed EEE 203

Textbook:

N. Mohan, *Power Electronics: A first course*, 2012, Wiley

Supplemental Materials: http://myasucourses.asu.edu

Coordinator: Raja Ayyanar, Associate Professor

Prerequisites by Topic:

- Introductory physics
- Electric networks – dc and ac analysis, phasors
- Basic linear system theory – transfer functions, bode plots, Laplace transforms
- Familiarity with any circuit simulation software package

Course Objective(s):

- Students will be able to analyze and design switch mode power electronic converters for various DC-DC and DC-AC applications

Course Outcome(s):

- Students will have good understanding of the basic principles of switch mode power conversion
- Students will understand the operating principles and models of different types of power electronic converters including dc-dc converters, PWM rectifiers and inverters
- Students will be able to choose appropriate power converter topologies and design the power stage and feedback controllers for various applications
- Students will be able to use power electronic simulation packages for analyzing and designing power converters

Course Topics:

- Basic principles of switch mode power conversion
- Analysis of dc-dc converters using a building block approach
- Modeling and control of dc-dc converters
- Power management
- Switch mode power supplies with high frequency isolation
- PWM voltage source inverters and rectifiers

- Grid interface of renewable resources
- Practical aspects of power converter design

Computer Usage: Computer usage is significant in this class. Students are required to use simulation packages such as PLECS or Simulink for solving homework problems, and as a design tool. Students are also encouraged to use MathCAD and MATLAB for solving problems.

Laboratory Experiments: None.

Course Contribution to Engineering Science and Design:
- This course, with its emphasis on design oriented analysis, has a significant engineering design component. For example, as part of homework assignments or a mini-project the students need to consider a power conversion application, convert the system requirements to appropriate performance specifications, select a suitable topology, design the power stage and controllers, and finally validate the design through detailed simulation.
- This course contributes to engineering science by teaching students how to apply the theory studied in introductory physics courses and system theory to understand and analyze different types of power converters and electromagnetic components.

Course Relationship to Program Objectives:
- A.1, E.4 and 3(k): Students utilize modern tools such as computers and simulation tools to help in understanding concepts and to solve problems.
- A.2: Students gain an appreciation of how power electronic converters are used and controlled in a wide variety of applications such as microprocessor power supplies, renewable energy interface, electric drives and lighting.
- E.3 and 3(a): Students must apply both mathematics and physics to understand and solve problems in this course.
- E.1, 3(c) and 3(e): Students perform design type analyses and solve engineering problems in homework as well as in the mini-project.

Person(s) preparing this description and date of preparation: Raja Ayyanar, George Karady, Kory Hedman, February 2015.