ECE 534- Spring 2016
Fundamentals of Power Electronics and Utility Applications

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Course Objectives: This first level graduate level course is intended to develop an understanding of Power Electronics and switching mode power converters for various AC and DC applications. This course is intended to teach the fundamentals of power conversion and will cover the design, analysis, modeling and control of all types of power converters – such as, dc-dc converters, dc-ac inverters, ac-dc rectifiers / converters and also introduce the concepts of direct ac-ac converters. This course will also include interface and control considerations of power converters to single-phase and three-phase ac systems, and discuss utility applications of power electronic converters – including power quality and FACTS (Flexible AC Transmission Systems). The students will develop skills in complete design of these power converters through a project – especially focused on design of dc-dc converters. This will be an important course for understanding of renewable energy interface to the grid, power converters for ac- and dc motor drives and power electronics devices and their controls.

Teaching material:
References: (strongly recommended) “Power Electronics: Converters, Applications and Design” – Mohan, Undeland, Robbins, Second Edition

Course Locker:
http://courses.ncsu.edu/ece534/lec/601/wrap/

Please use the message board to ask questions about lectures, HW, projects, etc. It is the best way to broadcast questions that may be of interest to everyone.

Video Lecture & Annotated Slides:
http://engineeringonline.ncsu.edu/mediasite/Homepages_Video/ece534_lectures.html

Computing Tools:
MATLAB/Simulink, PLECS (www.plexim.com)

Grading policy:
Homework (5) : 20 %
Mid-term exam : 15 %
Final exam : 25 %
Final Project : 40 % (Design project)
Course Syllabus (weekly topics):
1. Introduction Chapter 1 – Power Conversion Principles
2. Steady-State Converter Analysis – Principles - Chapter 2.1, 2.2
3. Steady-State Converter Analysis – Basic Circuits – Chapter 2.3, 2.5, 2.6
4-5. Steady-State Converter Modeling - Chapter 3
6-9. Power Semiconductor Switches; Average and Small-Signal Models of PWM Converters - Chapters 7.1, 7.2, 7.4, 7.6
10-11. Converter Transfer Functions - Chapter 8
12-14. Output Feedback Control Design - Chapter 9, Current Programmed Control – Chapter 12
15. Non-isolated and isolated DC-DC Converter Topologies – Chapter 6.1 - 6.5

Homework:
1- Homework1 (01/13/2016-01/25/2016)
2- Homework 2 (01/25/2016-02/08/2016)
3- Homework 3 (02/08/2016-02/22/16)
4- Homework 4 (03/02/2016-03/16/2016)
5- Homework 5 (03/16/2016-03/30/2016)

Midterm Exam:
Friday 02/26/2015

Project:
Focus on design, analysis, modeling, and control of dc-dc converters, dc-ac inverters, ac-dc rectifiers / converters and also into ac-ac converters. (03/21/2016-04/20/2016)

Final Exam:
Friday 04/29/2015

TA Office Hours:
Teaching Assistant: Abhay Negi(anegi@ncsu.edu)
Saturday : 11 am – 1 pm (EST) (Web Meeting via Google Hangout)

Academic Integrity:
Students should refer to the University policy on academic integrity found in the Code of Student Conduct (found in Appendix L of the Handbook for Advising and Teaching). It is the instructor’s understanding and expectation that the student’s name/signature on any test or assignment means that the student neither gave nor received unauthorized aid. Authorized aid on an individual assignment includes discussing the interpretation of the problem statement, sharing ideas or approaches for solving the problem, and explaining concepts involved in the problem. Any other aid would be unauthorized and a violation of the academic integrity policy. Any computer work submitted must be completed on your own personal computer or from your own NCSU account to avoid confusion about the origin of the file, and no sharing of files in any way is allowed. Students
found in violation of the academic integrity policy will be reported to the NCSU Office of Student Conduct.