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/](http://courses.ncsu.edu/ece534/lec/601/wrap/)

Computing Tools:
MATLAB

Grading policy:
Homework (6): 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- Howermrok1 (08/27/2014-09/15/2014)
2- Howermrok2 (09/15/2014-09/29/2014)
3- Howermrok3 (09/29/2014-10/13/2014)
4- Howermrok4 (10/13/2014-10/27/2014)
6- Howermrok6 (11/10/2014-11/24/2014)

**Midterm Exam:**
Monday 10/20/2014

**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. (11/03/2014-12/03/2014)

**Final Exam:**
Wednesday 12/17/2014 (8.00-11.00AM)

**TA Office Hours (Online students-Distance Education):**
Mondays & Wednesdays 3:30-4:30 PM via email (mghapan@ncsu.edu)/(aazideh@ncsu.edu)

**TA Office Hours (On-campus students):**
Mondays & Wednesdays 4:30-5:30 PM with appointment.