ECE410: Power Electronics
Course Syllabus
Summer 2015

Instructor: Dr. Kala Meah
Assistant Professor
Electrical and Computer Engineering
Department of Physical Sciences
York College of Pennsylvania
York, PA 17403
Office: KEC 111
Phone: 717 815 1238, fax: 717 849 1660
E-mail: kmeah@ycp.edu, web: http://faculty.ycp.edu/~kmeah/

Office Hours: M W 1:00 pm – 2:00 pm; T 2:00 pm – 3:00 pm; F 10:00 am – 12:00 noon or by appointment.

Meeting Day and Time: T TR: 10:45 am – 1:15 pm

Course Description: Power electronics is the application of electronic circuits to energy conversion. This course discusses modeling, design, analysis, and control of DC/DC converters, AC/DC rectifiers, DC/AC inverters, AC/AC cycloconverters, and switch-mode power supplies. Power electronics applications in motor drives, uninterrupted power supplies, and power systems are also discussed. Other applications include high-efficiency energy conversion, process control and automation, vehicular power systems, and renewable energy systems. Software and hardware are used in the lab to design and analyze power electronics circuits in real time. Prerequisite: 2.0 or higher in ECE310. 3.0 credit hours.

Learning Objective: In this course students will learn a basic competence of the following areas of power electronics needed in junior and senior-graduate courses in the Electrical and Computer Engineering:

- Power electronics devices
- Converter operations
- Switch-mode power supplies
- Power electronics applications

Program Outcome(s): This course supports the following student program outcomes (a) through (k) established for the engineering program:

- An ability to apply knowledge of mathematics, science, and engineering (a)
- An ability to design and conduct experiments, as well as to analyze and to interpret data (b)
- An ability to identify, formulate, and solve engineering problems (e)
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (h)
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (k)
- A knowledge of contemporary issues (j)

Course Outcome(s): This course is intended to be an introduction to the power electronics discipline as outlined in the course description. Following completion of this course, students should (letters in parentheses indicate program outcomes (a)-(k)):

- be able to model power electronics circuits using the knowledge of mathematics, science, and engineering (a).
- be able to analyze and interpret experimental data and reach the conclusions (b).
- be able to identify, formulate, and solve power electronics related engineering problems (e)
- be able to understand environmental and economic aspects of power electronics (h)
- be able to use modern software and hardware to model and analyze the power electronics circuits (k).
- have the knowledge of safety procedures in the power electronics laboratory (k).
- have the knowledge of contemporary technical issues in power electronics field (j)

Textbook:

- Philip T. Krein, "Elements of Power Electronics," Oxford University Press, 1998, ISBN: 978-0-19-511701-1

Grading Policy:

Homework and Quiz	20%
Laboratory exercises	30%
Exam 1	20%
Exam 2	20%
Research Paper	10%
Total	**100%**

GRADING SCALE: The grading criteria for this course, as adopted by York College, are given below:

4 (Excellent): This grade denotes accomplishment that is truly distinctive and decidedly outstanding. It represents a high degree of attainment and is a grade that demands evidence of originality, independent work, an open and discriminating mind, and completeness and accuracy of knowledge, as well as an effective use of the knowledge.

3.5 (Very Good): This grade denotes mastery of the subject matter. It represents very good achievement in many aspects of the work, such as initiative, serious and determined industry, the ability to organize work, and the ability to comprehend and retain subject matter and to apply it to new problems and contexts.

3 (Good): This grade denotes considerable understanding of the subject matter. It represents a strong grasp and clear understanding of the subject matter and the ability to comprehend and retain course content.

2.5 (Above Average): This grade denotes above average understanding of the subject matter. It represents a good grasp of the subject matter and the ability to comprehend and retain course content.

2 (Average): This grade denotes average understanding of the subject matter. It represents the grade that may be expected of a student of normal ability who gives the work a reasonable amount of time and effort.

1 (Below Average): This grade denotes below average understanding of the subject matter. It represents work that falls below the acceptable standard.

0 (Failure): This grade denotes inadequate understanding of the subject matter. It signifies an absence of meaningful engagement with the subject matter and that the student is not capable of doing or understanding the work or has made little or no effort to do so.

Cumulative Class Percentage	**Grade Point**
90% and up	4.0
86% - 89.99%	3.5
80% - 85.99%	3.0
76% - 79.99%	2.5
70% - 75.99%	2.0
60% - 69.99%	1.0
below 59.99%	0.0

Typically, there will be one homework assignment, one quiz, and one laboratory exercise in each week. Solutions to the homework will be posted after the turn-in date. Exams will be given during normal class time. Unless arranged for ahead of time by the student with the instructor, it is not possible to make up a missed exam or a missed quiz. This policy is followed strictly.

Turn-in Policy:

All homework assignments are due at the beginning of the lecture period on the associated due date. Late turn-in will not be accepted unless an extraordinary situation exists. Assignments turned in late, but within one day of the due date, will receive a 50% reduction. No credit will be given for assignments turned in more than one day late. Plan ahead, you can always drop off your assignment at your instructor's office before the due date.

Communication Standards:

York College of Pennsylvania Communication Standards *"York College recognizes the importance of effective communication in all disciplines and careers. Therefore, students are expected to competently analyze, synthesize, organize, and articulate course material in papers, examinations and presentations. In addition, students should know and use communication skills current to their field of study, recognize the need for revision as part of their writing process, and employ standard conventions of English usage in both writing and speaking. Students may be asked to further revise assignments that do not demonstrate effective use of these communication skills."*

Academic Integrity

"York College's mission statement stipulates that strict adherence to principles of academic honesty is expected of all students. Therefore, academic dishonesty will not be tolerated at York College of Pennsylvania. Academic dishonesty refers to action such as, but not limited to,

cheating, plagiarism, fabricating, research, falsifying academic documents, etc., and includes all situations where students make use of the work of others and claim such work as their own. To solve the homework and computer assignments, you are encouraged to work with other students currently enrolled in ECE360. You must, however, document any of the help you receive in the form of comments directly on your homework paper. No comments mean you are submitting the item as totally your own work. Simply copying another person's assignment is not allowed – the actual item you turn in must ultimately be your own work. For more information about academic dishonesty consult student handbook."

Students with Disabilities

"If you are a student with a disability in need of a classroom accommodation and have not already registered with Linda Miller, Director of Disability Support Services, please contact her at 815-1785 or lmille18@ycp.edu to discuss policies and procedures related to disability services and to establish the accommodations for which you are eligible."

Few Tips:

Don't miss classes: New Material is covered in each lecture. Attendance at lecture is required, if you miss a class, you are responsible for covering the missed material on your own. Repeat lectures will not be given during office hours

Read in advance: Try to review the material in advance. It will help you to understand better during the lecture.

Start homework and laboratory project early: Give yourself some time to consider the problems and determine whether or not you need instructor assistance. Last-minute question is a bad idea.

Don't ignore the homework, laboratory exercises, quiz, and research paper. They are 60% of your grade!!!!

Disclaimer: The Following table shows an approximate day-by-day schedule. The syllabus and the schedule are subject to change. Changes will be announced in class, sent via e-mail, or posted on the course web site.

Anticipated class schedule

Lecture#	Topic	Date	Reading Sections	Lab/Project/Remark
1	Introduction power electronics	5/19	1.1-1.4	Lab # 1
2	Introduction to switching	5/21	1.5-16	
3	Switching matrix	5/26	2.1-2.4	Lab # 2
4	Switching devices and Fourier analysis	5/28	2.5-2.11	
5	Harmonics and regulation	6/2	3.1-3.5	Lab # 3
6	Filtering and Introduction to converters	6/4	3.6-3.9, 4.1-4.2	Research paper discussion
7	dc-dc converters	6/9	4.3-4.4.2	Lab # 4
8	dc-dc converter controller	6/11	Lecture notes	
9	dc-dc converters	6/16	4.4.4	Lab # 5
10	dc-dc converters	6/18	4.5	
11	dc-dc converters-DCM	6/23	9.1-9.3	Lab # 6
12	Make up/review	6/25		
Break (only for engineering classes) -- 6/29/2015-7/5/2015				
13	**Exam # 1**	**7/7**	**Chapters 1-4 and 9**	**Cheat sheet is allowed**
13	Magnetics	7/9	12.1-12.5	Lab # 7
15	Magnetics	7/14	12.6-12.7	**Draft # 1 due**
16	Dc motor drive and controller	7/16	Lecture notes	Lab # 8
17	Ac-dc conversion	7/21	5.1-5.6	
18	Ac-dc conversion	7/23	5.7-5.8	Lab # 9
19	Dc-ac conversion	7/28	6.1-6.3	**Draft # 2 due**
20	Dc-ac conversion	7/30	6.4	
21	Ac-ac regulation	8/4	7.8	
22	Review and makeup	8/6		**Final Paper due**
23	Review and makeup	8/11		
24	**Exam # 2**	**8/13**	**Chapter 5, 6, 7, 8, and 12**	**Cheat sheet is allowed**

Laboratory Experiments:

Laboratory #	Topic
Laboratory experiment 1	Familiarizing with power pole board, SCR box, and FET box
Laboratory experiment 2	PWM generator
Laboratory experiment 3	Single-phase ac-dc conversion
Laboratory experiment 4	Buck converter and Boost converter
Laboratory experiment 5	Build a Buck converter
Laboratory experiment 6	Voltage control mode operation of a Buck converter
Laboratory experiment 7	Buck-Boost converter and discontinuous mode (DCM)
Laboratory experiment 8	Flyback converter and Forward converter
Laboratory experiment 9	dc motor drive and controller