Philadelphia University

Faculty of Engineering - Department of Electrical Engineering

Course Details:

Title:	Power Electronics (610530)
Prerequisite:	Electronics (2) (650342)
Credit Hours:	3 credit hours (16 weeks per semester, approximately 45 contact hours)
Textbook:	"Power Electronics: Circuits, Devices, and Applications" M. H. Rashid, Prentice Hall, 3rd edition.2004.
References:	Power Electronics, Converters, Applications, and Design, N. Mohan, T. M. Undeland, and W. Robbins, John Wiley, 1995.
Course Description:	The course is a requirement for the electrical engineering students. It introduces the principles, operation, and design of power electronics converter circuits. Students will learn converter topologies, control techniques, and applications. Also learn analysis and design aspects of converters and understand losses and protection of power semiconductor devices.

Course Outlines:

Week	Topic
1,2	Introduction: Overview of power semiconductor devices, characteristics, drives circuits.
3,4,5	AC-DC Converters and its controls: Single-phase; three-phase and poly – phase, half-wave and full – wave AC/DC uncontrolled rectifiers.
6	Application to D.C. drives fed from 1-phase and 3-phase controlled-rectifiers.
7, 8	DC-DC Converters: Step-down; Step-up; Operation with *R* and *R-L* loads
9	Applications to D.C. drives fed by D.C. chopper.1, 2 & 4 quadrant operations.
10, 11	AC-AC Converters: Single-phase and three-phase AC choppers; Cycloconverters; Applications.
12, 13,14	DC-AC Converters: Single-phase invertors: (parallel, half-bridge, full-bridge); PWM inverter; Three-phase inverter; Voltage and frequency control.
15	Thyristor triggering circuits; Protection of power semiconductor devices using Snubber circuits; Switching loss in power semiconductor devices.
16	Introduction to Wide Band Gap (WBG) power semiconductor devices, and Revision

Course Learning Outcomes with reference to ABET Student Outcomes:

Upon successful completion of this course, student should:

1.	Be able to list the types of power semiconductor devices, and know how to choose the suitable device for each application, and calculate the power losses of the power semiconductor	[a, c, e, k]
2.	Explain the operation; calculate the performance parameters of each converter such as the average and rms values of the load voltage and current, power and power factor, efficiency of the converter and the ripple factor .	[a, c, e]
3.	Have the ability to specify the voltage and current ratings of the semiconductors for single-phase and three-phase uncontrolled and phase-controlled rectifiers feeding passive loads.	[a ,c, e]
4.	Understand the applications of power semiconductor devices and power electronic converters to power supplies and DC motor drives.	[a, c, k]
5.	Explain the operation of the step-down (buck) and step-up (boost) DC-DC	[a , c , k]

	converters, calculate the size and ratings of inductor and capacitor, determine the circuit losses, and specify the ratings of the semiconductor devices. Applications: DC power supplies, DC motor drives.	
6.	Explain the operation of the single-phase and three-phase AC-to-AC converters and their industrial applications.	[a, c, k]
7.	Explain the operation of the half-bridge and full-bridge single-phase inverters feeding resistive and resistive- inductive loads. Calculate the load voltage and current, determine the inverter losses, and specify the ratings of the semiconductors.	[a , c ,e, k]

Assessment Guidance:

Evaluation of the student performance during the semester (total final mark) will be conducted according to the following activities:

Sub-Exams: The students will be subjected to two scheduled written exams, first exam and second exam during the semester. Each exam will cover materials given in lectures in the previous 3-4 weeks.

Quizzes: (3-5) quizzes of (10-15) minutes will be conducted during the semester. The materials of the quizzes are set by the lecturer.

Tutorials, Homework and projects: Lectures will be supplemented with tutorial classes. Eight to nine tutorial sheets are expected, each including about ten problems. Tutorial classes will be largely problem solving sessions based on converter circuits recently covered. Students will be expected to participate in problem solving efforts vigorously. Questions and clarifications, both by students and the tutor should be treated as desirable aspects of these sessions. Homework should be solved individually and submitted before or on a set agreed date. Student may be assigned to present project(s).

Collective Participation: Brain storming and collective discussions will be carried out during any lecture. Individual student will be assessed accordingly

Final Exam: The students will undergo a scheduled final exam at the end of the semester covering the whole materials taught in the course.

Grading policy:

First Exam	20%
Second Exam	20%
Homework and projects	5 %
Quizzes and participation	15%
Final Exam	40%
Total:	100%

Attendance Regulation:

The semester has in total 45 credit hours. Total absence hours from classes and tutorials must not exceed 15% of the total credit hours. Exceeding this limit without a medical or emergency excuse approved by the deanship will prohibit the student from sitting the final exam and a zero mark will be recorded for the course. If the excuse is approved by the deanship the student will be considered withdrawn from the course.

January, 2018