



Electrical and Computer Engineering Department

Power Electronics- ENEE3305

Course Outline

Instructor: *Dr. M. Abu-Khaizaran*

First Semester 2019/2020

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Office No.: Masri216

Text book:

Muhammad H. Rashid 'Power Electronics: Circuits, Devices and Applications', 4th edition
Prentice Hall 2013

A second reference book:

Ned Mohan, Tore M. Undeland, and William P. Robbins 'Power Electronics: Converters, Application, and Design', 3rd edition 2003

Prerequisite: Electronics I

Lecture 1 on TR 10:00-11:15AM in Masri 108 **Lecture 2** on TR 8:00-9:15AM in Masri 108

Office Hours: S: 11:00 - 12:00, W: 10:00 - 2:00, and T&R: 12:30 - 14:30

Intended Learning Outcomes (ILO's)

	Intended Learning Outcomes (ILO's) of the course	Programme objectives
1	To be able recognize and describe the characteristics of various types of power electronic devices and power electronic circuits	a
2	To be able to analyze various types of single/three phase controlled and uncontrolled rectifiers	a
3	To be able to analyze and simulate power electronic circuits using Orcad/Pspice or MatLab software packages	a, k
4	To be recognize the topology and to identify the functionality of various types of AC Controllers such as: phase-angle and on-off AC Controllers, Cyclo-Converters, or Matrix Converter	a
5	To be able to analyze the characteristics and topology of various types of DC-to-DC Converters, such as: Buck, Boost, Buck-Boost or Full Bridge	a
6	To be able to describe and to analyze DC-to-AC Converters	a

Course Contents:

- 1.** Introduction to Power Electronics and their Applications
 - 2.** Power Devices, Characteristics, Switching Behavior and Limitations:
Power Diodes, Thyristors, TRIACs, GTOs, Power BJTs, Power MOSFETs and IGBTs
 - 3.** Commutation Techniques for Thyristors and Commutation Circuits
 - 4.** Snubber Circuits
 - 5. Diode Circuits and Rectifiers:**
 - Introduction (Diodes with RC and RL loads)
 - Single Phase Half and Full Wave Rectifiers
 - Multiphase Star Rectifiers
 - Three Phase Bridge Rectifiers
 - Rectifier Circuit Design:
Capacitor smoothing, Inductor smoothing and LC Filters
 - The Effects of Source and Load Inductances
 - Linear Regulated Power Supplies
 - 6. Controlled Rectifiers (Converters)**
 - Single Phase Semi Converter
 - Single Phase Full Converter
 - Three Phase Half Wave Converter
 - Three Phase Semi-Converter
 - Three Phase Full Wave Converter
 - Power Factor Improvement; Extinction and Symmetrical Angle Control (**self study**)
- Mid Term Exam on Thursday (14/11/2019) in class**
- 7. DC Converters (Chopper Circuits)**
 - Step-Down (Buck) Converters
 - Step-Up (Boost) Converters
 - Step Down/Up (Buck-Boost) Converters
 - Full Bridge Converters
 - Classification of Chopper Circuits

8. AC Voltage Controllers

- Control Schemes and Principle of Operation
- Single and Three Phase Controllers
- Cyclo-Converters
- Matrix Converters

9. Inverters

- Voltage and Current Source Inverters
- Switching Schemes
- Square Wave Operation of Single and Three Phase Inverters
- Voltage Cancellation method for Single Phase Inverters
- Sinusoidal Pulse Width Modulation (SPWM) for Half Bridge
- Sinusoidal Pulse Width Modulation (SPWM) for Single and Three Phase Inverters

If Time permits

10. Space Vector Modulation (SVM) Switching Scheme

Teaching Methods:

Power Point Presentations, Traditional methods using illustration by markers and white board, interactive discussions, simulation of studied circuits and assignments....

Grading:

Mid Term Exam on 14/11/2019:	25%
Practical Project:	15%
Assignments, and Short Exams:	15%
Classwork and Participation:	5%
Final Exam:	40%