

Villanova University  
Department of Electrical and Computer Engineering

**ECE 7580**

**INTRODUCTION TO POWER ELECTRONICS**

**Fall 2020**

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Instructor:

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Office Hours:

M 3:30-5:00 p.m.  
Other times by appointment

Course Objectives:

1. To develop an understanding of circuit topologies used for performing power conversion at the  $\leq 500$  kW power level.
2. To examine and analyze input/output conditions of typical power circuits with regard to power, efficiency, waveshape, and harmonic distortion.
3. To become familiar with techniques to perform computer simulation of power electronic circuits.

Textbook:

“*Power Electronics*”, by Daniel W. Hart, 1st. edn., McGraw Hill, 2011

References:

1. “*Power Electronics*”, N. Mohan, T. Undeland and W. Robbins, 3<sup>rd</sup> edn., John Wiley & Sons, 2003
2. “*Power Electronics; Principles and Applications*”, J. Vithayathil, 1st. edn., McGraw-Hill, 1995
3. “*Power Semiconductor Devices*”, B. J. Baliga, 1st. edn., PWS Publishing, 1996
4. “*Power Electronics*”, M.H. Rashid, Prentice-Hall, 1988

Grading:

Midterm Exam	20%
Final Exam	30%
Homework	20%
Project	30%
Total	100%

<u>Topics</u>	<u>No. of Lectures (tentative)</u>
1. Power semiconductor devices ; review of PSPICE;Power Computations	1.5
2. Diode bridge rectifiers and AC voltage controllers	3
3. Switchmode DC to DC converters	2
4. Switchmode power supply design	2
5. Switchmode DC to AC inverters	1.5
6. Resonant converters; zero voltage/zero current switching	2
7. Heat sinking; snubber circuits; drive circuits other practical design considerations.	1

Text: “*Power Electronics*”, by Daniel W. Hart, 1st. edn., McGraw Hill, 2011

<u>Date</u>	<u>Topic</u>	<u>Page Nos.</u>
8/17	Overview of power electronic devices and systems; PSpice Review	1-19
8/24	Review of Power Computations; Uncontrolled Half-Wave rectifiers	21-59; 65-81
8/31	Controlled half-wave rectifiers	81-105
<b>9/7</b>	<b><i>NO CLASS; Labor Day Holiday</i></b>	
9/14	Full-wave rectifiers	111-144
9/21	AC Voltage Controllers	171-192
9/28	Buck and Boost DC-DC converters	196-220
10/5	Other DC-DC converters	221-259
<b>10/12</b>	<b>MIDTERM EXAM</b>	
10/19	DC Power Supplies (isolated DC-DC converters)	265-291
10/26	Full bridge DC-DC converter; Power Supply Control	291-302; 302-326
11/2	Switchmode DC-AC inverters	331-373
11/9	Resonant converters	387-400
11/16	Snubber circuits; drive circuits; Heat sinks; magnetics design	431-457
11/23	Project presentations	
<b>11/30</b>	<b>FINAL EXAM</b>	