University of Waterloo
Department of Electrical & Computer Engineering
ECE 663: Energy Processing
Spring 2018

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Lectures: [redacted]

COURSE OUTLINE

Introduction to Power Electronics
Evolution, Scope and Applications
Power Semiconductor Devices
Diodes, Thyristors, Controllable Switches (actual and ideal characteristics, switch losses, overview of BJT, MOSFET, GTO, IGBT, and IGCT)
Power Converter Topologies
Line-Frequency Diode-Rectifiers, Line-Frequency Phase-Controlled Converters, dc-to-dc switch-mode converters, dc-to-ac and ac-to-dc switch-mode converters, interleaved converters, multilevel inverters, ac-to-ac converters
Control Techniques in Power Converters
Hysteresis control, Pulse Width Modulation (PWM) and linear power amplifier concept, Space Vector Modulation, square-wave control, Selective Harmonic Elimination, modeling of converters, controller design
Power Quality:
Harmonic Distortion, Power Quality Indices, Input/Output Filters
Applications of power electronic converters
Switch-mode dc power supplies, Motor drives, HVDC Transmission Systems, Flexible AC Transmission Systems (FACTS), Grid interface of distributed generation, Active power filter, Grid interface of energy storage systems, Microgrids

Project: The project description will be given during the first month of the term. The project will be performed individually. The deliverable is a report in the IEEE journal paper format composed of the following components: literature review, analysis, modeling, simulation results and suggestions for improvement upon the existing solutions.

References:
- Mohan, Undeland, and Robbins, *Power Electronics: Converters, Applications, and Design*, 2nd or 3rd Edition, John Wiley & Sons, Inc., 1995 or 2003.
- D.W. Hart, *Power Electronics*, McGraw Hill, 2011.
- Mehrdad Kazerani, *ECE663 Lecture Slides*.

LEARN:
LEARN will be used for posting course materials, drill problems, special assignment, project, old exams and announcements. It will also be used for uploading the deliverables to the appropriate drop boxes.

GRADING SCHEME

Midterm Exam	15%
Project	30%
Final Exam	55%

Note: Those who audit the course are responsible for attendance and the project only.