

Department of Electronics  
Carleton University

**ELEC 3508: Power Electronics**  
Fall 2022

**Instructor:** Himavarsha Dhulipati

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TA office location: ME 5169

**Course Objectives:**

Power electronics is the application of solid-state electronics to the control and conversion of electric power. It also refers to a subject of research in electronic and electrical engineering which deals with the design, control, computation and integration of nonlinear, time-varying energy-processing electronic systems with fast dynamics (Wikipedia). This course covers the following contents:

- Introduction to power semiconductor devices (thyristors, GTOs, IGBTs)
- Theory and operation of converter circuits (controlled AC to DC rectifiers, choppers, DC to AC inverters, AC voltage controllers)
- Overview of applications of conversion circuits (motor drives, FACTS, distributed generation)

The main objectives of the course are:

- (1) to help students gain a thorough understanding of the basic concepts and techniques of power electronics devices;
- (2) to provide students with the fundamental knowledge necessary to design power converter circuits;
- (3) to enable students to acquire hands-on experience on control and operation of power converters;
- (4) to give student opportunities to learn industrial cases (power electronics industry)
- (5) to train students to independently and collaboratively conduct research and present research results.

By the end of the course, students will be able to:

- (1) explain principles of the focused power converter circuits, i.e., DC/DC, AC/DC, and DC/AC converters;

- (2) analyze switching waveforms of the focused power converters and calculate steady-state voltage, current, power, and other related factors of the converter waveforms;
- (3) understand the application theory of power electronics converters in industry;
- (4) review literature, identify questions, discuss solutions, and present results in the research area of power electronics.

**Tentative Course Schedule:**

Lecture: 11:35 am - 12:55 pm, Monday and Wednesday, 3356 Mackenzie Building (ME)

Week 1	Review of diodes, BJTs, MOSFETs, IGBTs, etc.
Week 2-3	Diode Rectifiers
Week 4-5	Thyristor and IGBT Converters
Week 6-9	DC-DC Switch-Mode Converters
Week 10-11	Switch-Mode DC-AC Inverters
Week 12-14	Application of Power Electronics Systems

**Tentative Lab Schedule:**

Laboratories: 3104 Canal Building (CB)

Week 3	Lab Demo
Week 5	Lab 1: Power Diodes
Week 7	Lab 2: Thyristors
Week 10	Lab 3: PWM Chopper Circuits
Week 11	Lab 4: PWM Chopper Circuits
Week 13	Lab 5: DC Motor Drives
Week 14	Lab 6: AC Motor Drives

**Course Textbook:**

Mohan, Undeland and Robbins, "Power Electronics, Converters, Applications and Design," Third Edition, ISBN 978-0-471-22693-2

**Prerequisite(s):** ELEC 2602 Electric Machines and Power

**Brightspace:**

Brightspace will be used for communication and posting of course material, including lecture slides. The Brightspace site can be accessed from <https://carleton.ca/brightspace/>. Please refer to the Brightspace site frequently in order to keep up-to-date with the course material that is posted there.

**Marking Scheme:**

Participation	5%
Midterm exam	25% (close book)

Final exam	50% (close book)
Lab Experiments	20%

Note:

1. The final exam is for evaluation purposes only and will not be returned to students.
2. In the event that you miss the midterm exam and have a valid reason, the equivalent of the term portion of the grade will be shifted to the final exam. If you miss midterm exam without a valid reason, you will receive a grade of 0 on the exam missed.

### **Labs:**

The objective of the labs is to gain hands on experience making measurements, recording and plotting data, not to write lengthy reports. Labs will be graded partly on the ability to demonstrate your experimental work to the TA, and partly on lab reports. Lab reports are normally due at the end of the laboratory period. In order to pass ELEC 3508, it is necessary to complete all 6 labs. If you miss a lab due to illness or other valid reason you must arrange a time to complete a make-up lab. All lab results are to be written directly in the space provided in the instruction sheets. A completed lab will include the introduction sheets, instruction sheets and any closing sheets. All is to be stapled together and handed to the TA at the end of the lab period. The TA will also sign you in at the start of the lab and sign you out at the end of the lab. No laboratory exemptions are given to students who are repeating the course. All laboratory pages are to be printed by the student from Brightspace. Late labs will be deducted 10% per day up to 3 days (after which they will receive 0 marks).

### **Academic Accommodation**

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

**Pregnancy obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the Student Guide

**Religious obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the Student Guide

**Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with

me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable). You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at <http://www.carleton.ca/equity/>