



## Course Outline

### Instructor

- Prof. Ani Gole, P.Eng.  
SP-330 Stanley Pauley Eng. Bldg.  
(204) 474-9959  
Aniruddha.Gole@umanitoba.ca

### Office Hours

- By appointment

### Teaching Assistant

- Prashanth Atputhakumar  
atputhap@myumanitoba.ca
- Troy Eskilson  
eskilsot@myumanitoba.ca
- Udeshika Madushani Hettiarachchi  
hettiaru@myumanitoba.ca

### Contact Hours

- 4 credit hours
- Lectures:  
3 hours x 13 weeks = 39 hours
- Laboratories:  
3 hours x 5 weeks = 15 hours

### Prerequisites:

- ECE 2160 Electronics 2E
- ECE 3720 Electric Power and Machines

## ECE 4370 – Power Electronics

Fall 2025

### Course Objectives

Theory and operation of power semiconductor devices, DC-DC converters (choppers), uncontrolled/controlled rectifiers, AC voltage controllers, voltage source converters, power electronic applications in motor drives and electric power systems.

### Course Content

The following topics will be covered:

- Electric circuit and Fourier series (review only)
- Power electronic devices, ratings, control and protection
- Uncontrolled and controlled rectifiers
- AC voltage controllers and cycloconverters
- Voltage source converters
- DC-DC converters
- Application areas:
  - Power systems
  - Motor drives.

### Textbook

*Power Electronics*, Daniel Hart, 2<sup>nd</sup> edition, McGraw-Hill, 2011. ISBN: 0073380679

### Learning Outcomes

1. Describe the characteristics of power semiconductor devices and identify suitable switch choices for a given application.
2. Analyze controlled and uncontrolled single- and three-phase rectifiers, and cycloconverters.
3. Analyze DC-AC converters, and use pulse-width modulation techniques.
4. Analyze DC-DC converters.
5. Explain power electronic applications in power systems and motor drives, and evaluate suitable converter types of a given application.

### Expected Competency Levels

Outcome	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1	I	I			I		I	I				
2	D	D	D	D	D		D	D				I
3	D	D	D	D	D		D	D				I
4	D	D	D	D	D		D	D				I
5	I	D	D	I	D		D	D				I

### Traditional Territories Acknowledgement

*The University of Manitoba campuses and research spaces are located on original lands of Anishinaabeg, Ininiwak, Anisininewuk, Dakota Oyate, Dene and Inuit, and on the National Homeland of the Red River Métis.*

*We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of Reconciliation and collaboration.*

### Copyright Notice

All materials provided in this course are copyright and are provided under the fair dealing provision of the *Canadian Copyright Act*. This material may not be redistributed in any manner without the express written permission of the relevant copyright holder. This includes recording class sessions for personal use and/or uploading any course materials to a website.

## Important Dates

- Term Test**  
October 20<sup>th</sup>, 2025  
6:00PM – 8:00PM
- Voluntary Withdrawal Deadline**  
November 18<sup>th</sup>, 2025
- National Day for Truth and Reconciliation**  
September 30<sup>th</sup>, 2025  
No classes or examinations
- Thanksgiving Day**  
October 13<sup>th</sup>, 2025  
No classes or examinations
- Remembrance Day**  
November 11<sup>th</sup>, 2025  
No classes or examinations
- Fall Term Break**  
November 10<sup>th</sup>–14<sup>th</sup>, 2025  
No classes or examinations

## Evaluation

The final course grade is determined by the student's performance in assignments, laboratories, and examinations. Students must complete all the laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments & Quizzes	10	F, S	1, 2, 3, 4, 5
Laboratories	15	F, S	1, 2, 3, 4, 5
Term Test	30	F, S	1, 3, 4
Final Examination	45	S	1, 2, 3, 4, 5

\* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

## CEAB Graduate Attributes Assessed

PA.3 – Analyzes and solves complex engineering problems.

DE.3 – Develops/implements possible solutions to an open-ended design problem, leading to an appropriate recommendation.

## Student Absences

Attendance in lectures, tutorials, and laboratories is mandatory. For short-term absences due to illness or other extenuating circumstances of 120 hours (5 days) or less, students are required to complete a *Self-Declaration Form for Brief or Temporary Absence* available on the University website.  This form must be submitted to the course instructor within 48 hours of the absence. (No additional documentation is required.)

Note that students are responsible to complete any missed work and must consult with the instructor to make appropriate arrangements.

For absences longer than 120 hours, students must contact the instructor and ECE Undergraduate Advisor, Tammy Holowachuk (Tammy.Holowachuk@umanitoba.ca) for further instructions.

## Deferred Final Examinations

Students who miss the regular scheduled writing of a final examination, for valid medical or compassionate reasons, may be given the opportunity to write a deferred examination, subject to approval by the Associate Dean (Undergraduate). All requests for a deferred examination must be made within 48 hours of the missed examination, and must follow the procedure described on the Faculty website, without exception. Course instructors do not have the discretion to grant deferred final examinations.

(<https://umanitoba.ca/engineering/student-experience#engineering-student-policies>)

## Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

## Accreditation Details

### Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 75%
- Engineering Design: 25%

### Graduate Attributes

KB: A knowledge base for engineering

PA: Problem analysis

IN: Investigation

DE: Design

ET: Use of engineering tools

IT: Individual and team work

CS: Communication skills

PR: Professionalism

IE: Impact of engineering on society/ environment

EE: Ethics and equity

EP: Economics and project management

LL: Life-long learning

### Competency Levels

I - Introduced (Introductory)

D - Developed (Intermediate)

A - Applied (Advanced)

## Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

## Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations on Academic Integrity* , students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). This includes the unauthorized use of AI when preparing course deliverables. A student found guilty of contributing to cheating by another student is also subject to serious academic penalty. Integrity also applies to respecting copyrighted course content, which should not be distributed without the creator's permission. Uploading content for the purpose of transcription or other AI-enabled features is commonly a violation of the copyright holder's rights.

## Requirements and Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University's *General Academic Regulations*, as well as Section 3 of the Faculty of Engineering *Academic Regulations* dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.
- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

