



Course Outline

Instructor

- Shaahin Filizadeh, P.Eng.
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Office Hours

- By appointment

Teaching Assistant

- Devin Aluthge
aluthged@myumanitoba.ca
- Evan Tyerman
tyermane@myumanitoba.ca

Contact Hours

- 5 credit hours
- Lectures: 3 hours per week
- Laboratories: 3 hours x 8 weeks
- Tutorials: 3 hours x 2 weeks
- Field Trip: 6 hours

Prerequisites:

- ECE 3720 Electric Power and Machines

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.

UM recognizes that the Treaties signed on these lands are a lifelong, enduring relationship, and we are dedicated to upholding their spirit and intent. We acknowledge the harms and mistakes of the past and the present. With this understanding, we commit to supporting Indigenous excellence through active Reconciliation, meaningful change, and the creation of an environment where everyone can thrive. Our collaboration with Indigenous communities is grounded in respect and reciprocity and this guides how we move forward as an institution.

ECE 3650 – Electric Machines

Winter 2026

Course Objectives

Constructional features, analysis, modeling, and applications of three phase transformers, synchronous machines, and single phase induction motors; Principle of operation of special motors.

Course Content

The following topics will be covered:

- Three phase transformers:
- Cylindrical-rotor synchronous machines
- Salient pole synchronous machines
- Single phase motors
- Special motors

Textbook

Principles of Electric Machines and Power Electronics, P.C. Sen, 3rd edition, Wiley, 2013.

Other Resources

Electric Machinery and Transformers, Bhag S. Guru and Huseyin R. Hizirogulu, 3rd edition, Oxford University Press, 2000.

Learning Outcomes

1. Analyze electric circuits with three-phase transformers.
2. Develop phaser diagrams to obtain phase relationships of three-phase transformers and special transformers.
3. Analyze performance and operating limits of a grid connected synchronous machine using equivalent circuits.
4. Analyze the performance of salient pole synchronous machines using d-q theory and phasor diagrams.
5. Explain different starting methods and analyze the operating performance of single phase induction motors using equivalent circuits.

Expected Competency Levels

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

CEAB Graduate Attributes Assessed

PA.2 – Develops and/or implements a strategy to analyze complex engineering problems.

IN.4 – Understands appropriate safe work procedures during experiments or laboratory exercises.

Important Dates

- Term Test**
February 26th, 2026
6:00PM–8:00PM
- Voluntary Withdrawal Deadline**
March 19th, 2026
- Louis Riel Day**
February 16th, 2026
No classes or examinations
- Spring Break**
February 17th – 20th, 2026
No classes or examinations
- Good Friday**
April 3rd, 2026
No classes or examinations

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 100%
- Engineering Design: 0%

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)

Evaluation

The final course grade is determined by the student's performance in laboratories, in quizzes, and on 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
Quizzes	10	F, S	1, 2, 3, 4
Laboratories	15	F, S	2, 3, 4, 5
Term Test	30	F, S	1, 2, 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)

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>)

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.

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.

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 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.

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.

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 passing final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if they are uncertain about their standing in the course and about their potential for receiving a failing grade. Students should also familiarize themselves with the University's *General Academic Regulations* , as well as the Price Faculty of Engineering *Academic Regulations*  dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, smart phones, smart watches, 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.

 [Supplemental Resources](#)