



Course Outline

ECE 4360 – High Voltage Engineering

Winter 2026

Instructor

- Behzad Kordi, P.Eng.
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(204) 474-7851
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Office Hours

- After lectures or by appointment

Teaching Assistant

- Nishadini Perera
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Contact Hours

- 4 credit hours
- Lectures: 3 hours per week
- Laboratories: 3 hours x 5 weeks

Prerequisites:

- ECE 3580 Foundations of Electromagnetics
- ECE 3720 Electric Power and Machines

Course Objectives

The course serves as an introduction to high voltage engineering, including basics of electrical breakdown, high voltage generation, high voltage test systems, measurement and analysis techniques as applied to power system apparatus such as cables, insulators, transformers, and generators.

Course Content

The following topics will be covered:

- Generation of high voltage: AC, DC, and impulse generating equipment.
- High voltage measuring systems.
- Quasi-electrostatic field calculation and simulation models.
- Standard high voltage laboratory test and measurement methods and analysis of results.
- Electrical breakdown fundamentals; electrical breakdown in solids, liquids, and gases.
- Non-destructive tests such as corona testing and partial discharge.
- Insulation coordination as related to equipment ratings and test requirements.
- Review of other industrial applications of high voltage engineering.

Textbook

High Voltage Engineering: Fundamentals, E. Kuffel, W. S. Zaengl, and J. Kuffel, Newnes: Oxford, 2nd edition, 2000.

Other Resources

High Voltage Test Techniques, D. Kind and K. Feser, Newnes: Oxford, 2nd edition, 2001.

Learning Outcomes

1. Understand fundamental concepts of high voltage AC, DC, and impulse generation.
2. Learn the techniques employed in high voltage measurements.
3. Apply analytical and numerical techniques for electric field calculations in high voltage systems.
4. Learn the fundamental concept of electric breakdown in liquids, gases, and solids.
5. Become familiar with non-destructive test techniques in high voltage engineering.

Expected Competency Levels

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

Traditional Territories Acknowledgement

The University of Manitoba campuses and research spaces are located on original lands of Anishinaabeg, Ininiwak, Anisiniinewuk, 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.

Evaluation

The final course grade is determined by the student's performance on assignments, a project & seminar, in laboratories, and on examinations. Students must complete all components of the course and receive a minimum of 50% on the final examination in order to be eligible to receive a passing grade.

Important Dates

- Term Test**
March 5th, 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

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments	15	F, S	1, 2, 3, 4, 5
Laboratories	15	F, S	1, 2, 3, 4, 5
Project / Seminar	10	F, S	1, 2, 3, 4, 5
Term Test	20	F, S	1, 2, 3, 4
Final Examination	40	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

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

CS.2 – Designs, produces, and delivers effective technical presentations for specific audiences.

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.

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)

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.

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.

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](#)

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.