University of Manitoba | Price Faculty of Engineering
Department of Electrical and Computer Engineering

Course Outline

Instructor

- Prof. Athula Rajapakse, P.Eng.
  SPC–307 Stanley Pauley Centre
  (204) 480–1403
  Athula.Rajapakse@umanitoba.ca

Office Hours
- Mondays and Wednesdays,
  1:30PM–2:30PM,
  or by appointment

Teaching Assistants
- Yasas Sanju Kandemulla Arachchige
  sanjukay@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 3650 Electric 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.

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.

ECE 4300 – Electrical Energy Systems 1

Fall 2025

Course Objectives

Modeling of power transmission systems, and introduction of computational methods for solving problems such as load flow, faults, and stability analysis.

Course Content

The following topics will be covered:

- Introduction to the main elements of a power system (power generation, transmission, and distribution).
- Review of basic concepts and machine models (three phase systems, per unit system, transformer and generator models).
- Power transmission line models and performance (calculation of line constants, two port models of transmission lines, line compensation design)
- Power flow analysis (Gauss-Seidel, Newton-Raphson and decoupled power flow)
- Fault analysis (symmetrical faults, short circuit capacity, symmetrical components, asymmetrical faults)
- Power system stability (swing equation, equal area criterion).

Textbook

Power System Analysis, Hadi Saadat, PSA Publishing, 3rd edition, 2010.

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

Learning Outcomes

1. Recognize the structure and operation of electricity generation, transmission and distribution systems and its impact on the society and environment.
2. Solve problems involving modeling, design and performance evaluation of power transmission lines.
3. Analyze power flow in power transmission networks and apply power flow results to solve simple planning and operation problems.
4. Calculate currents and voltages in a faulted power system under both symmetrical and asymmetrical faults, and relate fault currents to circuit breaker ratings.
5. Analyze the transient stability of simple power systems using equal area criterion.

Important Dates

- **Term Tests**
  October 6th, 2025
  6:00PM – 7:30PM
  November 3rd, 2025
  6:00PM – 7:30PM
- **Voluntary Withdrawal Deadline**
  November 18th, 2025
- **National Day for Truth and Reconciliation**
  September 30th, 2025
  No classes or examinations
- **Thanksgiving Day**
  October 13th, 2025
  No classes or examinations
- **Remembrance Day**
  November 11th, 2025
  No classes or examinations
- **Fall Term Break**
  November 10th –14th, 2025
  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)

Expected Competency Levels

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

Evaluation

The final course grade will be determined from a student's performance on assignments, in laboratories, and on examinations. Calculators and one 8.5 x 11 page of hand-written notes (one side only) will be allowed 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
Assignments	15	F, S	1, 2, 3, 4, 5
Laboratories	10	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)

CEAB Graduate Attributes Assessed

PA.3 – Analyzes and solves complex engineering problems.

IE.1 – Understands engineering as a socio-technical process with inherent environmental, economic, health, safety, legal and socio-cultural aspects.

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)

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.

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.

Requirements/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.

Supplemental Resources