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

Course Outline

Instructor
- Prof. Behzad Kordi, P.Eng.
  SPC–308 Stanley Pauley Centre
  (204) 474–7851
  Behzad.Kordi@umanitoba.ca
- Douglas Thomson, P.Eng.
  E3–455 EITC
  (204) 474–8797
  Douglas.Thomson@umanitoba.ca

Office Hours
- By appointment

Teaching Assistant
- Nahal Akbari
  akbarin@myumanitoba.ca
- Amir Attar
  attara1@myumanitoba.ca
- Bita Esmaeili Jamakani
  esmaeilb@myumanitoba.ca
- Thisal Gunawardena
  gunawart@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

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 3670 – Electronics 3E

Fall 2025

Course Objectives

As a continuation of ECE 2160 Electronics 2E, the objectives of this course are for students to learn to both analyze and design fundamental electronic circuits, and to explore their practical applications.

Course Content

The following topics will be covered:

- MOSFETs
- Differential Amplifiers: Common-mode vs. differential mode, common-mode rejection ratio, small-signal and large-signal operation, input/output characteristics, non-ideal characteristics, active load, frequency response.
- Single-stage IC Amplifiers: BJT, biasing, high-frequency response, large-signal transfer characteristics, follower circuits, paired transistors, current mirror.
- Feedback: Theory, feedback topologies, examples of feedback circuits, circuit characteristics improvement using feedback.
- Oscillators: Loop-gain criteria, Wien-Bridge oscillators, tank circuit/tuned circuit oscillators, crystal oscillators, multi-vibrators, timers.
- Power Amplifiers: Classification, some common configurations, detailed class B power amplifiers.
- Digital Circuits: Inverter characteristic, noise margins, loading and fan-out, power dissipation.

Textbook

Microelectronic Circuits, A.S. Sedra, K.C. Smith, T. Chan Carusone, and V. Gaudet, Oxford University Press, 8th edition, 2020.

Other References

The Arts of Electronics, P. Horowitz and W. Hill, Cambridge University Press, 3rd edition, 2015.

Learning Outcomes

1. Analyze and design differential amplifiers.
2. Analyze and design single stage amplifiers.
3. Analyze and design feedback and oscillators.
4. Analyze and design power amplifiers.
5. Analyze digital circuits.

Expected Competency Levels

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

Important Dates

- **Term Tests**
  September 22rd, 2025
  6:00PM – 7:30PM
  October 21st, 2025
  6:00PM – 7:30PM
  November 24th, 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: 67%
- Engineering Design: 33%

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 will be determined from a student's performance on assignments, term tests, in laboratories (including a design project) including a laboratory test, and on examinations. Students must receive a minimum of 50% on the final examination in order to be eligible to receive a passing grade. Students who are unable to write the mid-term test for medical (or other acceptable) reasons will have their final examination weighted to include the mid-term weighting. Calculators (incapable of communicating with other devices) are allowed in the term tests and final exam. Students must complete all the laboratories and project, and pass the laboratory test in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Quizzes	0	S	1, 2, 3, 4, 5
Laboratories	10	F, S	1, 2, 3, 4, 5
Design Project	10	F, S	1, 2, 3, 4, 5
Term Tests (10% + 15% + 15%)	40	F, S	1, 2, 3
Final Examination	40	S	1, 2, 3, 4, 5

* The midterm and final will include approximately 50% design problems (DE).
* 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.2 – Uses an appropriate design process that considers all relevant factors (ex. health & safety risks; standards; economic, environmental, cultural and societal considerations).

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)

Copyright Notice

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.

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 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.

🔗 *Supplemental Resources*