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

Course Outline

Instructor

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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

Course Website:
https://umanitoba.ca/umlearn

Traditional Territories Acknowledgement

The University of Manitoba campuses and the Department of Electrical and Computer Engineering are located on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.

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 2021

IMPORTANT NOTICE – In-Person Laboratories

This course will be delivered using online lectures and *in-person laboratories*. ***Students are required to pre-screen themselves*** before travelling to campus for their laboratory and must not attend the campus if they are experiencing any COVID-19 symptoms or if they have been in contact with someone who has tested positive for COVID-19.

In addition, the University requires that ***all students must be fully vaccinated*** (first dose by Sept 22nd, second dose by October 31st). As well, ***students must wear a face mask*** at all times while attending the laboratory and in all common indoor spaces on campus, or whenever social distancing can not be maintained. For further information, please visit the *UofM COVID-19 Resources* website (https://umanitoba.ca/coronavirus/recovery).

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.

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). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Important Dates

- **Term Test**
  October 21st, 2021
  6:00PM – 8:00PM
- **Voluntary Withdrawal Deadline**
  November 23rd, 2021
- **National Day for Truth and Reconciliation**
  September 30th, 2021
  No classes or examinations
- **Thanksgiving Day**
  October 11th, 2021
  No classes or examinations
- **Remembrance Day**
  November 11th, 2021
  No classes or examinations
- **Fall Term Break**
  November 8th–12th, 2021
  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

1 - Knowledge (Able to recall information)
2 - Comprehension (Ability to rephrase information)
3 - Application (Ability to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships.)
5 - Synthesis (Able to combine separate elements into a whole)
6 - Evaluation (Able to judge the worth of something)

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	3	4	2	4	3	3	2	2		1	2	3
2	3	4	2	4	3	3	2	2		1	2	3
3	3	4	2	4	3	3	2	2		1	2	
4	3	4	2	4	3	3	2	2		1	2	
5	3	4	2	4	3	3	2	2		1	2	

Evaluation

The final course grade will be determined from a student's performance on assignments, in laboratories (including a design project), 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 exam for medical (or other acceptable) reasons will be assigned a grade based on their performance on the other assessment components (scaled to 100%). Calculators (incapable of communicating with other devices) are allowed in the mid-term and final exams. 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 (best 4 of 5)	10	S	1, 2, 3, 4, 5
Laboratories + Project	20	F, S	1, 2, 3, 4, 5
Term Test(1)	30	F, S	1, 2, 3, 4, 5
Final Examination(1)	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 (i.e., health & safety risks; standards; economic, environmental, cultural and societal considerations).

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.

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.

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

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