ECE 240 - Electronic Circuits I (2A) – Winter 2023

Instructor: Prof. Lan Wei

Introduction to electronic signal processing; operational amplifier circuits; diode device and circuits; MOSFET device; MOSFET digital circuits; MOSFET amplifier biasing networks; diode, MOSFET and small-signal equivalent circuits; single-stage small-signal MOSFET amplifiers.

Prerequisites: ECE 106, 140, MATH 119; Level at least 2A Computer Engineering or Electrical Engineering **Co-requisites:** ECE 205, MATH 215

Course objectives: This course is the second of a three-course sequence (ECE 140, ECE 240, ECE 340) on electronic circuits. In this course, we will complete the coverage of linear (both passive and active) circuits, and will start to look at circuits that contain nonlinear circuit elements such as diodes and transistors (MOSFET). Although transistors are highly nonlinear, we will also look at how to bias transistor-based circuits to achieve nearly linear gain. In addition to *analyzing* circuits (e.g. figuring out node voltages, and branch currents), we also will begin to *design* circuits (i.e. creating a circuit from scratch to achieve a given functionality and performance specification).

Teaching team

Course instructor: Lan Wei, Ph.D., P.Eng
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Laboratory instructor: Omid Bagheri
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Teaching assistants:

- Rubaya Absar (rabsar@uwaterloo.ca) (lecture)
- Yijing Feng (y263feng@uwaterloo.ca) (lecture/lab)
- Ryan Fang (ryan.fang@uwaterloo.ca) (lab)
- Jessica Chong (jkchong@uwaterloo.ca) (lab)

Course Materials

Mandatory textbooks:

- Sedra et al, *Microelectronic Circuits*, 8th Ed., Oxford Press, 2020.
- Alexander and Sadiku, *Fundamentals of Electric Circuits*, 7th Ed., McGraw Hill, 2020. (from ECE 140)

Websites

LEARN: Main course website for announcement, documents, recordings and pre-lab quizzes.

- Any course related announcement (e.g. schedule changes, etc) will be communicated on LEARN and/or emails. Please check the course website frequently.
- Handouts, including notes, lab documents, problem sets and solutions, will be posted on LEARN.
- Pre-lab quizzes will be conducted via LEARN.
- Lecture quizzes will be conducted via LEARN (tentative).

Piazza: Online Q&A. Link: https://piazza.com/uwaterloo.ca/winter2023/ece240
The website will be monitored by the teaching team on a regular basis. We will try our best to address the questions within 2 business days. **It is highly encouraged to post any course related questions on Piazza** as the answers may benefit other students as well. The site allows anonymous question posting.

Zoom: All office hours and exam review sessions will be conducted via Zoom. Please access zoom sessions through the course homepage on LEARN. (Please make sure to check your time zone setting in zoom to avoid any confusion.)

Crowdmark: Post-lab report submission.

Schedule

Lectures

Section 001-LEC (E7- 4043)
Regular sessions: Mon, 10:30 – 11:20; Thu 11:30 – 12:20; Fri, 10:30 – 11:20
Make-up sessions: Jan13, Jan27, Feb10, Mar03, Mar17, Mar31, 11:30 – 12:20

Section 002-LEC (E7- 4043)
Regular sessions: Mon/Thu/Fri 13:30 – 14:20
Make-up sessions: Jan13, Jan27, Feb10, Mar03, Mar17, Mar31, 14:30 – 15:20

- I intend to make use of most extra lectures. Changes will be posted on LEARN.

Tutorials

Section 101-TUT (Associated with Section 001-LEC) Mon 15:30 – 16:20, E7-4053
Section 102-TUT (Associated with Section 002-LEC) Fri 9:30 – 10:20, E7-5343

- No tutorial in Week 1.

Office hours (tentative)

Office hours will be conducted remotely throughout the term. Zoom link can be accessed from LEARN course homepage.
Tentative schedules are as follows starting from Week 2. Office hours before exams will be announced on LEARN.

- Prof. Wei – TBD
- Lecture TA – TBD.

You are also encouraged to post on Piazza. The Q&A board will be monitored closely by the teaching team.

Problem Sets

Problem sets will be assigned at the end of each week and made available through the course website on LEARN. Numerical solutions will be provided, and full solutions to selected problems will be provided a few weeks after the problem set is assigned. Selected problems will be covered in the tutorial sessions. **Problem sets do not need to be submitted and are not graded. However, you are expected to attempt all assigned problems.**

Lecture Quizzes

Tentatively, four lecture quizzes are planned. The details of the quizzes (coverage and time) will be announced during the term. You are expected to complete the quizzes independently. The highest two marks of the quizzes will be counted towards the final marks. No make up quizzes.

Labs

- You must read the document "General Laboratory Information" for more details and guidelines about the labs that will be posted on Learn later.
- Lab sections, lab dates and report due dates are listed in the General Laboratory Information document. All the Lab sessions will be in-person and Lab 1 (intro-lab) will start on Jan 24th. No pre-lab for Lab 1.
- Pre-lab reports (in the format of LEARN quizzes) have a due date of Tuesdays at 8 am, before starting each lab week, check the due date and time.
- Postlab report will be due in the week after the lab week in around a week period. All the postlab reports have the due dates on Thursdays at 11:59 pm in the week following each lab week. Postlab reports should be submitted via Crowdmark.
- The lab manuals and lab report templates will be posted on LEARN before starting each lab week.
- Please contact the lab instructor for further questions.

Lab penalty

The late lab report submission penalty will be 1 % per hour for the first 24 hours and then 100 %. The penalty will be applied to the postlab report. Prelab report must be submitted before the due time. Please read "General Lab Information" document for more details.

Grading and Exam Policies

Your final grade of the course will be the better of the following two schemes:

Scheme 1	Scheme 2
Lab (5): 23% Lecture Quizzes (highest 2 out of 4): 2% Midterm: 25% Final: 50%	Lab (5): 23% Lecture Quizzes (highest 2 out of 4): 2% Midterm: 10% Final: 65%

Materials

- The midterm and final examination are *closed book and closed notes.*
- Programmable and/or scientific calculators without formula storage or text display features may be used during the midterm and final examinations. Other electronic devices are not permitted during the midterm and final examinations. A list of approved calculators can be found at https://math.uwaterloo.ca/math/current-undergraduates/regulations-and-procedures/calculator-regulation

Midterm Policies

- If you miss the midterm for any *valid* reason (e.g. illness declared following university policy, passing of immediate family members, etc), your final exam will be worth 75%. No make-up midterm.
- The *instructor is the final judge of validity* for the reason behind your absence. As per the university's policies, under no circumstances will travel be accepted as a valid reason.

Midterm and Final Coverage

- The midterm is expected to cover material up to the last lecture before the midterm. Further instruction will be given later.
- The final examination will be **comprehensive**, i.e. will cover material from the start of term.

Note: If you *must* miss a lab session due to a scheduling conflict, e.g., for a co-op interview or major surgery, please contact the lab instructor. It will be the instructor's decision whether you can be accommodated or not.

Tentative Course Materials

	Week	Material	Reading*	Quizzes**	Lab
Jan 9	1	Review of ECE140	ECE140 materials		
Jan 16	2	Opamp Circuits	A&S Ch. 5 S&S 1.1-1.5, 2.1-2.5		
Jan 23	3	RC & RL Circuits	A&S Ch. 14.1-14.4	Quiz 1	Lab 1 week
Jan 30	4	RC & RL Circuits	A&S Ch. 14.7-14.8 S&S Ch. 2.5		Lab 1 postlab due Thu 11.59 PM
Feb 6	5	Diode Models & Circuits	S&S 4.1-4.4	Quiz 2	Lab 2 week and Prelab due Tue by 8 AM
Feb 13	6	Diode Models & Circuits	S&S 4.5-4.7		Lab 2 postlab due Thu 11.59 PM
Feb 20	RW	Reading week, no lectures			
Feb 27	MW	Midterm week, no lectures			
Mar 6	7	MOSFET Operation and I-V	S&S 5.1-5.2		Lab 3 week and Prelab due Tue by 8 AM
Mar 13	8	MOSFET Digital Circuits	S&S 14.1-14.3	Quiz 3	Lab 3 postlab due Thu 11.59 PM
Mar 20	9	MOSFET Digital Circuits	S&S 14.4-14.6		Lab 4 week and Prelab due Tue by 8 AM
Mar 27	10	MOSFET Amplifier Circuits	S&S 5.3, 7.1-7.3	Quiz 4	Lab 4 postlab due Thu 11.59 PM
Apr 3	11	MOSFET Amplifier Circuits	S&S 7.3-7.5		Lab 5 week and Prelab due Tue by 8 AM
Apr 10	12	2nd-Order Circuits (subject to course progress)	A&S Ch. 8		Lab 5 due on Tue (April 11th) by 11:59 pm

* Refer to "Reading and KeyknowledgePoints" document for more details.
** Details of the Quizzes will be announced during the term. Time subject to change according to the progress of the course.

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check www.uwaterloo.ca/academicintegrity/ for more information.] **Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance. **Discipline:** A student is expected to know what constitutes academic integrity [check www.uwaterloo.ca/academicintegrity/] to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties check Guidelines for the Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm. **Appeals:** A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) www.adm.uwaterloo.ca/infosec/Policies/policy72.htm. **Note for Students with Disabilities:** AccessAbility Services, located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with them at the beginning of each academic term.