

Western University
Faculty of Engineering
Department of Electrical and Computer Engineering

ECE 2205A: Electric Circuits I

Course Outline 2022-2023

Description: This course introduces fundamental properties and methods for analysis of direct current (DC) electric circuits including components such as resistors, capacitors, inductors, operational amplifiers, switches, and ideal and dependent voltage and current sources. Both steady-state and transient circuit behaviour are covered as well as practical applications of circuit analysis.

Instructor: Dr. John McLeod
TEB 247, 519-661-2111 ext. 81265, jmcleod7@uwo.ca
Consultation hours: By appointment, in-office or via Zoom.

Academic Calendar Copy: Basic resistive circuits, Ohm's, Kirchhoff's laws. DC analysis: nodal and mesh analysis. Network theorems: linearity, superposition, Thévenin's and Norton's theorems. Time-domain analysis: first and second-order circuits, source-free and forced response. Sinusoidal steady-state analysis: phasors, complex power. Basic OpAmp circuitry.

Contact Hours: 3 lecture hours, 0 laboratory hours, 1 tutorial hours, 0.5 course.

Antirequisite: (none).

Prerequisites: Physics 1302A/B or Physics 1402A/B, Applied Mathematics 1411A/B, Applied Mathematics 1413, Engineering Science 1036A/B or Computer Science 1026A/B.

Co-requisite: Applied Mathematics 2270A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

CEAB Academic Units: Engineering Science 100%.

Required Textbook: J. D. Irwin and R. M. Nelms, *Basic Engineering Circuit Analysis*, 11th ed., Hoboken, NJ: John Wiley & Sons, 2014.

Other Required References: (none).

Recommended References: Additional reference materials will be posted to the course OWL site.

General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	I	Use of Engineering Tools		Impact on Society and the Environment	
Problem Analysis		Individual and Team Work		Ethics and Equity	
Investigation		Communication Skills		Economics and Project Management	
Design		Professionalism		Life-Long Learning	

Notation: where x be I : *Introductory*, D : *Intermediate*, A : *Advanced*, or *empty*. I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e.g. no review).

Course Topics and Specific Learning Outcomes	CEAB Graduate Attributes Indicators
<p>1. Electric Circuit Fundamentals</p> <p>At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> a. Define fundamental electrical properties including voltage, current, power, and resistance and state and apply mathematical relationships among those properties in simple circuits. b. Determine the equivalent resistance of series and parallel combinations of resistors. c. Apply Kirchoff's current law and Kirchoff's voltage law to analyze DC circuits consisting of voltage or current sources and resistors connected in a single loop or single node pair. 	<p>KB 3</p> <p>KB 3</p> <p>KB 3</p>
<p>2. Resistor Networks</p> <p>At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> a. Analyze DC linear circuits consisting of ideal and dependent voltage and/or current sources and resistor networks using both nodal and mesh analysis. b. Analyze DC resistor networks using linear systems methods such as scaling, superposition, and Thévenin and Norton equivalent circuits. 	<p>KB 3</p> <p>KB 3</p>
<p>3. Operational Amplifier Circuits</p> <p>At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> a. Analyze DC operational amplifier circuits using both the ideal op-amp model and an op-amp equivalent circuit model. b. Analyze operational amplifier circuits exhibiting positive feedback, no feedback, and saturated outputs. 	<p>KB 3</p> <p>KB 3</p>

<p>4. Capacitors, Inductors, and RCL Circuits</p> <p>At the end of this section, students will be able to:</p> <p>a. Describe and explain the steady-state and transient behaviour of capacitors and inductors in circuits possessing DC sources.</p> <p>b. Derive and solve first- and second-order differential equations describing time-domain transient responses of RC, RL, and RLC circuits.</p>	<p>KB 3</p> <p>KB 3</p>
<p>5. Circuit Applications and Simulation Tools</p> <p>At the end of this section, students will be able to:</p> <p>a. Understand and interpret models of practical electrical devices that are formulated using basic electric circuit principles.</p> <p>b. Employ the circuit simulation software Micro-Cap to investigate the behaviour of complicated circuits.</p>	<p>KB 3</p> <p>Taught, but Not Assessed</p>
<p>6. AC Analysis</p> <p>At the end of this section, students will be able to:</p> <p>a. Understand the concept of root mean square values and phasors.</p> <p>b. Employ all of the techniques learned for DC analysis for AC circuits.</p>	<p>KB 3</p> <p>KB 3</p>

Evaluation

Course Component	Weight
Homework Assignments	20%
Quizzes	15%
Midterm Test	15%
Final Examination	50%

To obtain a passing grade in the course, a mark of 50% or more must be achieved on the final examination. A final examination mark < 50% will result in a final course grade of 48% or less.

Homework Assignments: Homework assignments will regularly be posted to the course OWL site. Students shall upload a digital version of their answers to OWL. These assignments will be problem based.

Quizzes: The course OWL site will regularly host short, online quizzes. These quizzes will be open-book. They are designed to encourage regular participation in the course and will primarily test conceptual knowledge from recent lessons. Each quiz will be available on the course OWL site for a limited time and must be completed within that time window.

Midterm Test: The midterm test will be scheduled during the regular academic term; the exact date will be determined later. Students will be notified of the test date through the course OWL site with no less than 2 weeks of advance notice. The midterm test is expected to be an **in-person, closed-book** test. A non-programmable calculators may be used, but use of any other electronic device is not permitted during the examination.

The midterm test is **optional**, if students do not complete the midterm, that portion of their grade will be added to the final examination. Furthermore, if a student's grade on the final examination exceeds their grade on the midterm, the final examination will stand in place of the midterm.

Final Examination: The final examination will be take place during the regular examination period. The final examination is expected to be an **in-person, closed-book** exam. A non-programmable calculator may be used, but use of any other electronic device is not permitted during the examination.

Late Submission Policy: Assignments and quizzes should be submitted by the posted deadlines. Accommodations for late submission might be made at student's request (assuming this request is made in a timely manner) at the instructor's discretion. The priority will be marking submitted assignments and quizzes and posting the answers to OWL reasonably promptly after the assignment deadline as a study aid for students. No late assignments will be accepted, for any reason, after the answers are posted.

Use of English: In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance: Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Absence Due to Illness or Other Circumstances: Students should immediately consult with the instructor or department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see the attached "Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled"). The student should seek advice from the instructor or department Chair regarding how best to deal with the problem. Failure to notify the instructor or department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, see the relevant section of the Academic Handbook:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

For more information concerning accommodations for religious holidays, see the relevant section of the Academic Handbook:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Missed Midterm Examinations: If a student misses a midterm examination, she or he must follow the Instructions for Students Unable to Write Tests and provide documentation to Undergraduate Services Office within 24 hours of the missed test. If accommodation is granted, the department will decide whether to provide a make-up test or allow reweighting of the test,

where reweighting means the marks normally allotted for the midterm will be added to the final exam. If no reasonable justification for missing the test can be found, then the student will receive a mark of zero for the test.

If a student is going to miss the midterm examination for religious reasons, they must inform the instructor in writing within 48 hours of the announcement of the exam date or they will be required to write the exam.

Since the midterm is optional, any student who misses the midterm and does not provide a request for accommodation will have that portion of their grade automatically reweighted towards the final exam.

Online Activities: The course OWL site will be extensively used in delivering course content including announcements, lesson slides, and online quizzes. Some pre-recorded video lessons from last year's remote course delivery will be available as learning aids and to supplement in-class activities. Public distribution of lecture materials including course notes, slides, and video lessons is not permitted.

COVID-19 Contingency Clause: In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online at the discretion of the course instructor.

Cheating and Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Use of Electronic Devices: Not applicable.

Use of Personal Response Devices (“Clickers”): Not applicable.

Policy on Repeating All Components of a Course: Students who are required to repeat an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment, or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted by the student for grading in subsequent years.

Internet and Electronic Mail: Students are responsible for regularly checking their Western e-mail and the course web site (<https://owl.uwo.ca/portal/>) and making themselves aware of any information that is posted about the course.

Accessibility: Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 ext. 82147 for any specific question regarding an accommodation.

Support Services: Office of the Registrar, <http://www.registrar.uwo.ca/>
Student Development Centre, <http://www.sdc.uwo.ca/>
Engineering Undergraduate Services, <http://www.eng.uwo.ca/undergraduate/>
USC Student Support Services, <http://westernusc.ca/services/>

Students who are in emotional/mental distress should refer to Mental Health @ Western, http://www.health.uwo.ca/mental_health/, for a complete list of options about how to obtain help.