Western Engineering

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEEING

ECE 2240A – Electronics Laboratory I

Course Outline Fall/Winter 2025

COURSE DESCRIPTION: This course provides students with hands-on experience that will enhance the concepts studied in the second-year courses on electrical circuits and familiarizes the student with the standard equipment in the undergraduate laboratories as well as circuit simulation software. At the end of this course, it is expected that each student will be able to operate the equipment and interpret the measurements and use a circuit simulation software package.

ACADEMIC CALENDAR:

Link to the course description

Laboratory experiments associated with ECE 2205A/B, as well as laboratory experiments in instrumentation and measurement; the lecture component includes review of laboratory practice, health and safety issues, simulation software, data collecting methods; errors and their calculus; accuracy; averaging, signal conditioning, and data interpolation.

PRE OR COREQUISITES:

Prerequisite(s): Computer Science 1026A/B or Engineering Science 1036A/B.

Corequisite(s): ECE 2205A/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.

ANTIREQUISITES: none

CEAB ACADEMIC UNITS: Engineering Science 85%, Engineering Design 15%

Timetable information is available at https://draftmyschedule.uwo.ca/.

Lectures and Tutorials occur weekly starting September 9. Laboratory sessions occur weekly starting September .

LECTURE:	Friday 1.30 pm-2.30 pm HSB-236 (weekly) Some lectures will be on Zoom/YouTube
LAB:	3hrs/session (weekly); 10 sessions
TUTORIAL:	Friday 12.30-1.30 pm (weekly) UCC-56

RECOMMENDED/REQUIRED TEXT: Course notes and lab equipment manuals available on OWL

RECOMMENDED/ REQUIRED SOFTWARE: Microcap 12 (circuit simulations); Altium (PCB layout) **RECOMMENDED RESOURCES/REFERENCES:**

1. David A. Bell, Electronic Instrumentation and Measurements, 2nd Edition, Prentice-Hall, 1994.
2. Joseph Carr, Elements of Electronic Instrumentation and Measurements, 3rd Edition, Prentice-Hall, 1996.
3. Albert D. Helfrick and William D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, 2nd Edition, Prentice-Hall, 1990.
4. Larry D. Jones & A. Foster Chin, Electronic Instruments and Measurements, 2nd Edition, Prentice-Hall, 1991.
5. Alan S. Morris, Principles of Measurement and Instrumentation, 2nd Edition, Prentice-Hall, 1993.
6. J. David Irwin and R. Mark Nelms, Basic Engineering Circuit Analysis, 8th, 9th or 10th Edition, Wiley, 2011.

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES)

Knowledge Base	I	Engineering Tools	I	Impact on Society	
Problem Analysis	I	Individual & Teamwork		Ethics and Equity	
Investigation	I	Communication	I	Economics and Project Mgmt.	
Design	I	Professionalism		Life-Long Learning	

Notation: x represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

Rating: 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 MATERIALS:

The laboratory exercises, supplementary material and relevant manuals of instruments and software will be posted to the course website. Course material is taught in course lectures, tutorials, and laboratory sessions. Therefore, it is imperative that students attend these.

For circuit simulation, students are required to use the Micro-Cap 12 circuit simulation software and can be found of the OWL course site (for local installation) or alternatively available via *AppsAnywhere* cloud service in the Engineering Computer labs or for your personal Windows-based computer. This software will be needed in some of the laboratory exercises.

For PCB design, students are required to use the Altium Designer student license can be downloaded from: Altium Designer Student License. Note: registration of a student account with Altium is required.

The laboratory equipment and software used in the course require using a Windows PC or laptop. It is student's responsibility to assure hardware compatibility and proper drivers for other types of computer devices, using Apple iOS or other operating systems.

UNITS: SI

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES: Topics covered in this course focus on the practical aspects of using the conventional test bench equipment to test and verify the operation of
electronic circuits. Students will develop knowledge and skills related to the prototyping and testing of physical circuits and the components within. The learning outcomes will support the circuit analysis
theory taught in the corequisite course.

The following table summarizes the course learning outcomes along with CEAB GAIs where the GAIs in bold indicate ones to be measured and reported annually.

Course Topics and Specific Learning Outcomes	CEAB Graduate Attributes Indicators
1: Building circuits on a circuit breadboard. At the end of this section, students will be able to: **a.** Understand layout of circuit breadboard **b.** Build a circuit on the circuit breadboard without mistakes.	ET1, **I2, I3**
2: Measuring resistance, voltage and current using digital and analog multimeters. At the end of this section, students will be able to: **a.** Connect a multimeter and select appropriate settings. **b.** Understands how to interpret measured values for both DC and AC signals	**ET1**, KB3

3: Assessing the errors in measurements and the effect of the input resistance of the instruments. At the end of this section, students will be able to: **a.** Estimate effects of input resistance on measurement. **b.** Calculate input resistance of the instruments and its effects on measurement accuracy.	ET2, **I3**
4: Using the MicroCap (SPICE based) circuit simulation software. At the end of this section, students will be able to: **a.** Build and edit parameters of the circuits in the MicroCap schematic simulator **b.** Set and run DC, AC and Transient Analysis of the simulated circuit	ET1, ET2
5: Measuring parameters of AC signal using laboratory function generator and digital oscilloscope. At the end of this section, students will be able to: **a.** Connect function generator and oscilloscope and select appropriate settings. **b.** Understand operation and main functions of the function generator and oscilloscope and how to interpret measured values for both DC and AC signals	KB3, ET1, ET2, **I1**, **I2, I3**
6: Study the characteristics and operation of basics op-amp circuits. At the end of this section, students will be able to: **a.** Calculate parameters and simulate in MicroCap non-inverting and inverting aamplifiers, and integrator circuit based OpAmp application. Build and edit parameters of the circuits in the MicroCap schematic simulator **b.** Build the circuits on the breadboard and measure their parameters.	KB3, ET1, ET2 **I1**
7: Study the characteristics and operation of first- and second order circuits. At the end of this section, students will be able to: **a.** Calculate parameters, simulate in MicroCap and investigate the natural and step response of an RC and RL circuits. Build the circuits on the breadboard and measure their parameters. **b.** Calculate parameters, simulate in MicroCap and investigate response of a second order RLC circuits. Build the circuits on the breadboard and measure their parameters.	**ET1**, PA1, PA2, I1, I2, I3
8: Design an electrical circuit by given parameters, design a Printed Circuit Board (PCB) using Altium software, solder and test the device, write a formal Report. At the end of this section, students will be able to:	**ET2, CS3**

a. Design and calculate component values of an electrical circuit, simulate it in MicroCap and verify the design. Build the circuit on the breadboard and measure its parameters. b. Design a Printed Circuit Board using Altium software, solder components and test the completed device.	

EVALUATION:

Name	% Worth	Assigned	Due Date	CEAB GAs ASSESSED
Labs (Total = 8)	50%	Weekly (Sept 16th through Nov.22nd)	Lab Report due 24hrs after each Lab Session	I1, I2, I3, ET1, ET2
PCB Project	20%	Oct 21st	Nov.29th	ET2, CS3
Final Examination	30%	TBD by Registrar	TBD by Registrar	

Note that the dates listed above are **tentative** and may be adjusted if needed. Marks will be assigned on the basis of method of analysis and presentation, correctness of solution, clarity and neatness.

COURSE POLICIES:

All work submitted must be of professional quality in the requested format. Material that is handed in dirty, illegible, disorganized, or in an unapproved format will be returned to the student for resubmission and the late submission penalty will take effect. An additional penalty of 10% may be deducted for poor grammar, incoherence, or lack of flow in the written reports.

LABORATORIES: Labs will run every week starting Week 2 (Sept 16th). There will be eight introductory labs covering (e.g. circuit breadboards, soldering, Digital Multimeters, oscilloscopes, function generators, etc). Students are required to purchase a lab kit that includes a portable oscilloscope- multimeter and PCB/components necessary to build a power distribution board for at-home lab exercise preparation. Test bench equipment used in the lab exercises and components required for the labs will be provided.

Attendance at all laboratory sessions is mandatory. Absence from any session, or a portion of a session, without permission will result in a zero assigned to the corresponding laboratory report. The teaching assistants will sign your lab report as testimony to your attendance. Students who arrive 20 min after the scheduled lab time without a legitimate reason, leave the lab early without permission from the teaching assistant, or miss the lab without a legitimate reason will receive a zero for the corresponding laboratory assignment. Students who miss a lab with academic consideration are required to contact the course instructor within 3 days for further instructions. Failure to do so will result in a zero mark for that lab.

Except where indicated, the laboratory exercises are to be completed in assigned pairings of students. If a lab section has an odd number of students or one member of the pairing is absent, then a student may be required to perform the exercise on their own.

A minimum average of 60% across all laboratory exercises is required to pass the course.

FINAL EXAMINATION: The final exam will take place during the regular examination period. The final exam will be three 2 hours long, closed book. Only simple, nonprogrammable calculators are allowed.
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.
If the above conditions are not met, your final grade cannot be greater than 48%. Students who have failed this course (i.e., final average < 50%) must repeat all components of the course.

LATE SUBMISSION POLICY:

Advise the instructor if you are having problems completing the assignment on time prior to the due date of the assignment and be prepared to submit an Academic Consideration Request and provide documentation if requested by the instructor at:
https://www.eng.uwo.ca/undergraduate/academic-consideration-for-absences.html
If you are granted an extension, establish a due date with the instructor. The approval of the Chair of your Department is not required if assignments are completed prior to the last day of classes. Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate
Studies. Documentation is mandatory.

All lab or project report submissions will be penalized by 30% of the available marks per day for late submission. Deliverables submitted more than 3 days late will not be accepted.

ATTENDANCE: Attendance is mandatory for all lab exercise and project laboratory sessions. Attendance at lectures and tutorials is not mandatory, but strongly encouraged.

FACULTY OF ENGINEERING POLICIES:

Students must familiarize themselves with the policies of the Faculty of Engineering
https://www.eng.uwo.ca/electrical//pdf/2025-UG-Policy-and-Procedures.pdf