

Western University
Faculty of Engineering
Department of Electrical and Computer Engineering

MSE 2201A: Introduction to Electrical Instrumentation

Course Outline 2021-2022

Description: This course is primarily a laboratory course that uses lecture material to support experimental investigations. It therefore provides the students with hands-on experience in electric circuits and instrumentation. Students registered in MSE 2201a must simultaneously register in the concurrent course ECE 2205a, which provides the required theoretical background in analysis and design of electric circuits. This course is restricted to students enrolled in the Mechatronic Systems Engineering program.

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: Introduction to instrumentation and basic electronics; laboratory experiments associated with ECE 2205A/B, as well as laboratory experiments in instrumentation and measurement; review of laboratory practice, health and safety issues, simulation software, data collecting methods; errors and their calculus; accuracy; averaging, signal conditioning, and data interpolation.

Contact Hours: 3 lecture hours, 2.5 laboratory hours, 0 tutorial hours, 0.5 course.

Antirequisite: ECE2240A/B.

Prerequisites: (none).

Co-requisite: ECE2205A/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%, Engineering Design 0%.

Required Textbook: (none).

Recommended References:

- David Alciatore and Michael B. Histand, Introduction to Mechatronics and Measurement Systems, McGraw-Hill, 4th Edition, 2012.
- Giorgio Rizzoni, Fundamentals of Electrical Engineering, McGraw-Hill Education, 5th Edition, 2007.

- Alan R. Hambley, Electrical Engineering: Principles and Applications, Pearson-Prentice Hall, 7th Edition, 2017.

Required Equipment: A take-home circuit kit is available from the ECE electronics lab. All students are required to purchase this kit to complete the laboratory.

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
1. Circuit Concepts and Diagrams At the end of this section, students will be able to: a. Identify the principal elements of electric circuits. b. Define Kirchoff's Voltage and Current Laws (KVL and KCL).	Taught but Not Assessed Taught but Not Assessed
2. Resistor Networks and Measurements At the end of this section, students will be able to: a. Apply KVL and KCL to resistive networks and derive basic circuit equations. b. Understand the rules for connecting electric measuring instruments to electric circuits.	KB 3 KB 3
3. Sensors At the end of this section, students will be able to: a. Understand the fundamentals of simple electro-mechanical sensors.	Taught but Not Assessed

	b. Apply engineering principles to interpret data from encoders, thermistors, and phototransistors.	KB 3
4. Diode Circuits	At the end of this section, students will be able to: a. Understand the basic principles of semiconductor devices. b. Use various circuit models of diode in simple circuits.	Taught but Not Assessed KB 3
5. Transistor Circuits	At the end of this section, students will be able to: a. Be aware of the similarities and differences between BJTs and FETs. b. Understand how transistors can be used as switches and design basic transistor circuits.	Taught, but Not Assessed KB 3
6. Operational Amplifier Models and Circuits	At the end of this section, students will be able to: a. Understand the properties of ideal amplifiers. b. Analyze basic op-amp circuits.	KB 3 KB 3
7. Motors and Control Circuits	At the end of this section, students will be able to: a. Identify actuators including DC motors. b. Design basic DC motor control circuits.	Taught, but Not Assessed KB 3
8. Transient Response Analysis	At the end of this section, students will be able to: a. Understand the meaning of transients in electric circuits. b. Determine the DC steady-state solution of circuits containing capacitors and inductors.	Taught, but Not Assessed KB 3

Evaluation

Course Component	Weight
Laboratory	40%
Project	10%
Final Examination	50%

To obtain a passing grade in the course, a mark of 60% or more must be achieved on the final examination and the laboratory. A final examination or laboratory mark of < 60% will result in a final course grade of 48% or less.

Laboratory: Eight lab experiments are to be performed in this course. During the laboratory, students shall work individually. Individual laboratory reports are also required. Each exercise is to be completed within the three-hour lab period. Attendance in the laboratory is mandatory.

Students who miss a single laboratory session without legitimate reason will be given a mark of zero for that particular lab. Students who miss two or more laboratory sessions without legitimate reason will receive a final course grade of 48% or less.

Project: Each student will be required to design, build, and test an electric circuit on a breadboard and write a report. The details of the design requirements for this electric circuit will be distributed in class, at least two weeks before the report is due.

Final Examination: The final examination will 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: Laboratory reports should be submitted before leaving the laboratory. Late submission is not accepted.

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.

Online Activities: The course OWL site will be extensively used in delivering course content including announcements, lesson slides, and lab manuals. Some pre-recorded video lessons from last year's remote course delivery may be made 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.

In the event completely remote learning is required, students must be prepared to upload their lab reports and examination papers to the course OWL site. This may require a digital scanner or camera to capture material written on paper, or students may prepare their answers entirely electronically (typeset or using a touchscreen and stylus). It is each student's responsibility to determine a method of digitizing their submissions that is reliable and legible.

Students must have access to a computer/laptop/tablet that can regularly access OWL, can run Zoom (free with Western ID, Zoom runs on Windows, OSX, and Linux), can run MicroCap (freeware, only runs natively on Windows, can probably run in OSX through parallels, will run on Linux through Wine), and can run Multi VirAnalyzer (freeware, only runs natively on Windows).

Attendance: All laboratories are mandatory unless otherwise stated. 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

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.