

Western University
Faculty of Engineering
Department of Electrical and Computer Engineering

ECE 2238B: Introduction to Electrical Engineering
Course Outline 2019-20

Description-

Equipment such as cars, robots, smartphones and chemical sensor controls contain both hardware and software components that work cooperatively. With the increasing emphasis in industry on hardware/software co-design, it is important for software, integrated and green process engineering students to be familiar with hardware concepts. Students should not be content to consider these equipment as black boxes and not bother to know how these systems work. It is important for students to be familiar with these hardware concepts. Students must acquire a working knowledge of electrical circuit analysis and know the main functions of electronics such as amplification, conversion, modulation and demodulation of signals to name only the most important. In this course, students will learn the fundamentals of DC, transient and AC analysis and will become familiar with the use of electronic devices such as operational amplifiers, diodes and transistors.

Instructor- Tarik Menkad,

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Consultation hours-Office hours will be posted on OWL.

Academic Calendar Copy- DC analysis of circuits nodal and mesh analysis, superposition principle, Thévenin's\Norton's theorem; sinusoidal steady-state analysis: phasor concept, complex power, linear analog circuits, diodes, transistors, basic op-amp circuitry.

Contact Hours- 3 lecture hours, 1 tutorial hour, 1 laboratory hour, 0.5 course.

Antirequisite- ECE2205A/B, ECE2231A/B

Prerequisites- Engineering Science 1036A/B or Computer Science 1026A/B, Physics 1402A/B.
Pre-Corequisite(s): Applied Mathematics 2270A/B.

Co-requisite- N/A

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- G. Rizzoni and J. A. Kearns, *Principals and Applications of Electrical Engineering*, 6th Edition, McGraw-Hill, 2015.

Other Required References- ECE2238B Lab Manual (available on OWL site)

Recommended References-

1. G. Rizzoni, *Principals of Electrical Engineering*, McGraw-Hill, 2009.
2. D. V. Kerns Jr. and J. D. Irwin, *Essentials of Electrical and Computer Engineering*, Prentice Hall, 2004.
3. A. S. Sedra and K. C. Smith, *Microelectronic Circuits*, 5th, 6th, or 7th Edition, Oxford University Press.

4. General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	3/1	Use of Engineering Tools	3/1	Impact on Society and the Environment	
Problem Analysis	3/1	Individual and Team Work		Ethics and Equity	
Investigation		Communication Skills		Economics and Project Management	
Design		Professionalism		Life-Long Learning	

Notation: x/y , where x is the cognitive level (1: Remember, 2: Understand, 3: Apply) at which the attribute is assessed and y is the academic level (1: Beginner, 2: Intermediate, 3: Advanced) at which the attribute is assessed.

Topics and Specific Learning Objectives

1. Fundamentals of electric circuits

At the end of this section, students will be able to-

- a. Define a voltage, current, and resistance,
- b. Identify nodes and branches in a circuit,
- c. Apply Kirchhoff's and Ohm's laws to simple circuits to calculate voltages and currents,
- d. Understand and apply the passive sign convention to compute the electric power dissipated in circuit elements,
- e. Apply the voltage and current divider laws on series, parallel and series-parallel circuits,
- f. Know the rules to hook up a voltmeter and an ammeter to circuit to measure a current or a voltage.

2. DC Resistive Circuit Analysis

At the end of this section, students will be able to-

- a. Compute currents and voltages in a resistive circuits using nodal analysis,
- b. Compute currents and voltages in a resistive circuit using mesh analysis,
- c. Obtain Thévenin and Norton equivalent circuits.

3. AC Steady-State Circuit Analysis

At the end of this section, students will be able to-

- a. Calculate currents and voltages across reactive circuit elements: capacitors and inductors,
- b. Calculate the average and root-mean-square (rms) value of arbitrary periodic waveforms,
- c. Use phasor concept to solve RL, RC and RLC circuits and to represent the impedance,
- d. Measure time-varying voltages in a circuit using an oscilloscope.

4. Transient Analysis

At the end of this section, students will be able to-

- a. Calculate the time-domain response of first-order RC and RL circuits excited with step forcing functions,
- b. Calculate the time-domain response of second-order RLC circuits excited with step forcing functions.

5. Frequency Response

At the end of this section, students will be able to-

- a. Understand the physical significance of frequency-domain analysis and calculate the frequency response of circuits,
- b. Analyze simple first and second order filters, and determine their properties.

6. Operational Amplifiers

At the end of this section, students will be able to-

- a. Define the ideal amplifier and describe its properties: open-loop gain, input and output impedances,
- b. Define the open-loop and closed-loop configurations, and compute the close-loop gain of inverting, non-inverting, summing and differential amplifiers using the concept of the ideal amplifier.

7. Semiconductor Devices

At the end of this section, students will be able to-

- a. Qualitatively understand the basic principles underlying the physics of semiconductor devices in general and the *pn* junction in particular,
- b. Become familiar with the current vs voltage (*vi*) characteristic of a *pn* junction diode,
- c. Analyze basic diode circuits using the ideal diode model,
- d. Describe the functioning of half-wave and full-wave diode rectifiers.

8. Semiconductor Devices

At the end of this section, students will be able to-

- a. Qualitatively understand the basic principles of amplification,
- b. Qualitatively understand the physical operation of a bipolar junction transistor (BJT),
- c. Select and determine the operating point of a BJT-DC load line,
- d. Understand the ideal model for the BJT and how to apply it for basic amplifier configurations.

Evaluation

Course Component	Weight
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Laboratory	25%
Midterm Test	25%
Final Examination	50%

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

Homework Assignments- At least five assignments will be given. Assignments ARE NOT MARKED However, students are STRONGLY ADVISED to solve them in a timely manner. The solution is posted on OWL shortly after the assignment is out. The solution is discussed during Tutorials. Additional course such as practice problems material will be also available on OWL.

Quizzes- No quizzes are assigned to this course.

Laboratory- Four laboratories are assigned to this course. Students must complete their labs and obtain a mark of 50% at least for the lab component to pass the course. The laboratory schedule will be advertised on OWL course site.

Midterm Test- A two-hour exam will be likely scheduled in February. The exact date and modalities will be provided later.

Final Examination- The final examination will take place during the regular examination period.

Late Submission Policy- A report submission within the immediate 24 hours after the due date are stamped with a 50%-mark deduction. Any report submitted after the 24 hours window, or not submitted at all, will automatically receive a grade F.

Assignment Submission Locker- Locker 226 located on the second floor of TEB.

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.

Quality of work- Poorly written and presented work, at the exception of the final exam, may be sanctioned with 30%-mark deduction or be returned in extreme cases.

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, the exam will not be rescheduled. The student must follow the Instructions for Students Unable to Write Tests and provide documentation to their department within 24 hours of the missed test. The department will decide whether to allow the 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.

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-

Use of Personal Response Devices (“Clickers”)-

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.

INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

NEW: Requests for Academic Consideration using the Self-Reported Absence Form

If you experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render you unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) you should self-declare using the online Self-Reported Absence portal. This option should be used in situations where you expect to resume academic responsibilities within 48 hours or less.

Each student will be allowed a maximum of two self-reported absences between September and April and one self-reported absence between May and August. Self-reporting may not be used for final exams or assessments (e.g. midterm exams, tests, reports, presentations, or essays) worth more than 30% of any given course.

For full instructions about the Self-Reporting System refer to the Academic Calendar:

http://westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=1&Command=showCategory&Keywords=report&SubHeadingID=322&SelectedCalendar=Live&ArchiveID=#SubHeading_322

A. GENERAL REGULATIONS & PROCEDURES (other than self-reported absences)

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM/MIDTERM TESTS (other than self-reported absences)

1. If you are in first year and you are unable to write a midterm/term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a midterm/term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/term tests.

C. FINAL EXAMINATIONS (cannot be self-reported)

1. If you are unable to write a final examination, contact the Undergraduate Services Office **PRIOR TO THE SCHEDULED EXAMINATION TIME** to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department **and** the Associate Dean and in order to apply you must sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

D. LATE ASSIGNMENTS

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4.
 - i) 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.
 - ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

E. SHORT ABSENCES

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You are strongly encouraged to seek advice from your Academic Counsellor in the Undergraduate Services Office.

G. DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).
2. **You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your Academic Counsellor.

Calendar References: Check these regulations in your 2019 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Self-Reporting Absences:

http://westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=1&Command=showCategory&Keywords=report&SubHeadingID=322&SelectedCalendar=Live&ArchiveID=#SubHeading_322

Absences Due to Illness:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_12

Academic Accommodations for Students with Disabilities:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_10

Academic Accommodations for Religious or Holy Days:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_16

Course Withdrawals:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=6&SelectedCalendar=Live&ArchiveID=#Page_75

Examinations:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=5&command=showCategory&SelectedCalendar=Live&ArchiveID=#Page_78

Scheduling of Term Assignments:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#SubHeading_78

Scholastic Offences:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_20

Student Medical Certificate:

<https://www.eng.uwo.ca/files/undergraduate/forms/smc.pdf>

Engineering Academic Regulations:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=4&SelectedCalendar=Live&ArchiveID=#Page_86

Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

Add Deadlines:

First term half course (i.e. "A" or "F")	September 13, 2019
Full courses and full-year half course (i.e. "E", "Y" or no suffix)	September 13, 2019
Second term half course (i.e. "B" or "G")	January 14, 2020

Drop Deadlines:

First term half course (i.e. "A" or "F")	November 12, 2019
Full courses and full-year half courses (i.e. "E", "Y" or no suffix)	November 30, 2019
Second term half or second term full course (i.e. "B" or "G")	March 7, 2020

Contact Information:

Undergraduate Services Office:	SEB 2097 Phone: 519-661-2130	E-mail: engugrad@uwo.ca
Chemical & Green Process Engineering:	TEB 477 Phone: 519-661-2131	E-mail: cbeugrad@uwo.ca
Civil Engineering:	SEB 3005 Phone: 519-661-2139	E-mail: civil@uwo.ca
Computer, Electrical, Mechatronic Systems & Software Engineering	TEB 279 Phone: 519-661-3758	E-mail: eceugrad@uwo.ca
Integrated Engineering	ACEB 2410 Phone: 519-661-6725	E-mail: engceli@uwo.ca
Mechanical Engineering:	SEB 3002 Phone: 519-661-4122	E-mail: mmeundergraduate@uwo.ca