

Western University
Faculty of Engineering
Department of Electrical and Computer Engineering

ECE 2236B: Magnetic Circuits and Transmission Lines
Course Outline 2023-24

Description:

This course aims to provide the students with knowledge on basic concepts and applications of magnetic, coupled, and three-phase circuits, and transmission lines. The students will become familiar with magnetic fields and magnetic circuits, inductance and transformers, balanced three phase circuits, transmission line models, electromagnetic wave propagation on transmission lines, and impedance matching. This course provides background knowledge for three third-year courses in electric machines, power systems, and electromagnetic theory.

Academic Calendar Copy:

Three phase circuits, magnetic coupling and circuits, transformers. Transmission lines and the telegrapher equation.

Contact Hours: 3 lecture hours per week (3 hours in-person), 1 tutorial hour per week, 3 lab hours (3 labs per term), 0.5 course.

Prerequisites: NMM 2270A/B or the former Applied Mathematics 2270A/B, ECE 2205A/B, Physics 1302A/B or Physics 1402A/B.

Co-requisite: NMM 2276A/B.

Pre-or Corequisite(s): ECE 2241A/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%.

Textbooks:

Basic Engineering Circuit Analysis, 12th edition,
 Authors: J.D. Irwin and R.M. Nelms, Publisher:
 J. Wiley & Sons, 2021.

Engineering Electromagnetics and Waves, 2nd edition,
 Authors: U. S. Inan, A. Inan, R.Said, Publisher:
 Pearson, 2014.

Electric Machinery Fundamentals, 5th edition,
 Author: S.J. Chapman, Publisher: McGraw
 Hill, 2012. (Selected material referencing this
 text will be provided.)

General Learning Objectives (CEAB Graduate Attributes)

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

Notation: 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).

Topics and Specific Learning Objectives	CEAB Graduate Attributes Indicators
1. Magnetic Fields, Magnetic Materials, and Magnetic Circuits At the end of this section, a successful student will be able to: <ol style="list-style-type: none"> a. describe the basic laws of magnetic fields b. explain the parameters describing the magnetic field c. describe and analyze magnetic circuits d. determine the magnetic field intensity and magnetic flux density in linear and non-linear magnetic circuits 	KB3, KB4, PA1, PA2, PA3
2. Inductance, Coupled Circuits, and Transformers At the end of this section, a successful student will be able to: <ol style="list-style-type: none"> a. understand Faraday’s Law and the concept of Inductance b. analyze circuits that include magnetic coupling and transformers c. understand models of real transformers 	KB3, KB4, PA1, PA2, PA3

d. analyze the voltage regulation and efficiency in real transformer based circuits	
3. Three-Phase Circuits At the end of this section, a successful student will be able to: <ol style="list-style-type: none"> describe the principles of three-phase electric power transmission analyze three-phase circuits 	KB3, KB4, PA1, PA2, PA3
4. Transmission Lines: At the end of this section, a successful student will be able to: <ol style="list-style-type: none"> describe the distributed circuit model of transmission lines analyze transmission lines in the frequency domain under steady state conditions determine the reflection coefficients of transmission lines under different loads understand the concepts of electromagnetic wave propagation and impedance matching 	KB3, KB4, PA1, PA2, PA3

Intellectual Property Statement: Course material (i.e. course content, videos, solutions, practice questions and other supplementary material posted on OWL) is the intellectual property of your instructors and course developers and is made available to you for your personal use in this course. *Sharing, posting, selling or using this material outside your personal use in this course is considered to be an infringement of intellectual property rights.*

Course delivery: The lectures for the course will be presented in-person, with supplemental readings and/or video material as needed.

Tutorials and labs will be in-person.

Evaluation:

Course Component	Weight
Homework Assignments	20 %
Quizzes	10 %
Laboratory	10 %
Midterm Test	25 %
Final Examination	35 %

Homework Assignments: Each student must independently work on the assignments and prepare/submit their own results. In other words, the students are not allowed to share solutions. Selected problems from the assignments will be marked.

Quizzes: Quizzes may be given up to once per week, except during the first week. Student responses may be collected online (using iClicker or another tool) or on paper. Students may be requested to work in groups or individually. Students must bring a device that can access the OWL platform to class in order to access any online quizzes.

Laboratory: Each lab experiment will be conducted after the corresponding topic is covered in the lectures. The lab schedule will be announced on the OWL course website.

Midterm Test: The exam date will be announced on the OWL course website. The exam will be in mixed format (multiple choice questions and problems).

Final Examination: The final examination will be in mixed format and will cover all course content.

Assignment and Lab Report Submission: All assignments and lab reports must be submitted electronically via OWL (hard copy will not be accepted). Each submission must be a **single PDF file**. There will be a 10% penalty if you submit your assignment as multiple files or a file type other than PDF.

Late Submission Policy: All assignments and lab reports are due by 23:55 on the due date. Late submissions will not be accepted. In case the assignment/report cannot be submitted through OWL due to technical issues, the students can submit them by sending an email to the lead TA and copying the instructor.

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.

Academic Consideration for work worth less than 10% of the overall grade in the course: A student seeking academic consideration for any work worth less than 10% of the total course grade must contact the Dean's office and, if applicable, submit the relevant medical documentation to that office.

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

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.