Western University
Faculty of Engineering
Department of Electrical and Computer Engineering

ECE 2236B: Magnetic Circuits and Transmission Lines

Course Outline 2021-22

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.

Instructor: Dr. Firouz Badrkhani Ajaei
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Consultation hours: By appointment

Academic Calendar Copy:

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

Contact Hours: 3 lecture hours, 1 tutorial hour, 1 lab hour, 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, 11th edition,
Authors: J.D. Irwin and R.M. Nelms,
Publisher: J. Wiley & Sons, 2015.

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.

General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	I	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: **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, PA1, PA2, PA3
2. Inductance, Coupled Circuits, and Transformers At the end of this section, a successful student will be able to: **a.** understand Faraday's Law and concept of Inductance **b.** analyze circuits that include magnetic coupling and transformers **c.** understand model of real transformers	KB3, 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: **a.** describe the principles of three-phase electric power transmission **b.** analyze three-phase circuits	KB3, PA1, PA2, PA3
4. Transmission Lines: At the end of this section, a successful student will be able to: **a.** describe the distributed circuit model of transmission lines **b.** analyze transmission lines in the frequency domain under steady state conditions **c.** determine the reflection coefficients of transmission lines under different loads **d.** understand the concepts of electromagnetic wave propagation and impedance matching	KB3, 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:

As long as the course is delivered online:

- Recorded lectures will be posted on the course OWL site.
- Classes will be held live on Zoom during the scheduled class time (Fridays from 3:30 pm to 5:30 pm EASTERN time zone). These two-hour classes will be used for reviewing the lectures, solving problems, and having discussions.
- The one-hour scheduled class time (Wednesdays from 12:30 pm to 1:30 pm EASTERN time zone) will be used as consultation hour (by appointment).
- Tutorials and labs will be online (Zoom).

If the course delivery mode changes to in-person:

- The course will be delivered using a flipped classroom teaching style, meaning that you will watch recorded lecture videos before attending the in-person meetings. The in-person meetings will be held during the scheduled class time (Fridays from 3:30 pm to 5:30 pm EASTERN time zone) for reviewing the lectures, solving problems, and having discussions. These meetings will not be recorded, but the students will be able to remotely join through Zoom.
- The one-hour scheduled class time (Wednesdays from 12:30 pm to 1:30 pm EASTERN time zone) will be used as consultation hour (by appointment).
- Tutorials and labs will be in-person.

Online Activities: At least a portion of this course requires the students to engage in online activities such as downloading and watching lecture videos, attending online classes, participating in online group activities and discussions. Depending on future circumstances, this course may require taking online tests and submitting assignments and lab reports through OWL. Each student is expected to have access to a computer equipped with a microphone and a camera.

All or some of the remote learning sessions for this course will be recorded.

The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

If the course delivery mode changes to in-person, the in-person classes will not be recorded.

Evaluation:

Course Component	Weight
Homework Assignments	20 %
Laboratory	10 %
Midterm Test	35 %
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.

Laboratory: There will be 3 lab experiments. Each experiment will be conducted after the corresponding topic is covered in the lectures. The lab schedule will be announced on the OWL course website. In case some or all of the lab experiments have to be completed online, the required instructions and data will be provided through OWL.

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). In case the mid-term exam becomes online, it will be given through the course OWL website. The students must independently answer the questions without sharing information with each other.

Final Examination: The final examination will be in mixed format and will cover all course content. In case the final exam becomes online, it will be given through the course OWL website. The students must independently answer the questions without sharing information with each other.

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. Any computer code or model that is developed by the student as part of the solution for the assignment/lab must be submitted along with the PDF file. The files should not be compressed.

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 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.

Course Delivery with Respect to the COVID-19 Pandemic:
Although the intent is for this course to be delivered in-person, the changing COVID-19 landscape may necessitate some or all of the course to be delivered 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 assessments affected will be conducted online as determined by the course instructor.

When deemed necessary, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: https://remoteproctoring.uwo.ca.

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.