Western University
Faculty of Engineering
Mechatronic Systems Engineering Program

MSE 3310A – Electric Motors and Drives

Course Outline Fall 2025

COURSE DESCRIPTION: Overview of the fundamental principles related to the operation of DC and AC motors, the associated power electronic converters and drives. Emphasis will be placed on the design and integration of these devices into mechatronic systems.

ACADEMIC CALENDAR:

https://www.westerncalendar.uwo.ca/Courses.cfm?CourseAcadCalendarID=MAIN_028351_1&SelectedCalendar=Live&ArchiveID=

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PRE OR COREQUISITES: MSE 2201A/B, MSE 2233A/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: ECE 3332A/B, ECE 4457A/B

CEAB ACADEMIC UNITS: Engineering Science 75%, Engineering Design 25%

CONTACT HOURS:

LECTURE: 3 lecture hours/week

LAB: Laboratory sessions occur weekly. Attendance is mandatory. Laboratory sessions are 3 hours long and will occur 7 times during the term.

RECOMMENDED TEXT: Hughes, Electric Motors and Drives: Fundamentals, Types and Applications, 5th ed. Newnes, 2019

RECOMMENDED/ REQUIRED SOFTWARE: MATLAB/Simulink

RECOMMENDED REFERENCES:

- S. J. Chapman, *Electric Machinery Fundamentals*, 5th ed., McGraw-Hill, 2012
- R. Krishnan, *Electric Motor Drives: Modelling, Analysis and Control*, Pearson, 2001
- P.C. Sen, *Principles of Electric Machines and Power Electronics*, 3rd ed., Wiley, 2013
- T. Wildi, *Electrical Machines, Drives and Power Systems*, 6th edition, Pearson, 2005

- N. Mohan, *Advanced Electric Drives: Analysis, Control, and Modeling Using Simulink*, Wiley, 2014

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES)

Knowledge Base	D	Engineering Tools	A	Impact on Society	
Problem Analysis	D	Individual & Teamwork	A	Ethics and Equity	
Investigation	D	Communication		Economics and Project Mgmt.	
Design	D	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: Weekly content and guides for the laboratories will be available on the course OWL site.

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES: Mechatronics, as an engineering discipline, strives to optimally integrate mechanical, electronic and computer systems to create high quality products and processes. This course will introduce power electronics concepts, the theory of operation of multiple types of electric motors, and the combination of the two into motor drives. Students will develop knowledge and skills that will allow them to understand and design both open loop and closed loop motor drive systems.

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	(CAEB) Graduate Attribute
1. Power electronics converters At the end of this section, students will be able to: a. Explain the basic principles of operation of power electronics converters. b. Analyze and solve problems related to power electronics converters.	KB4, PA3, I3
2. Electromechanical energy conversion At the end of this section, students will be able to: a. Explain the basic principles of the electromechanical energy conversion related to electric machines.	KB4

3. Electrical machines At the end of this section, students will be able to: a. Explain the electrical machines structure and their operation. b. Analyze and solve problems related to induction machines, conventional DC machines, brushless DC and stepper motors.	KB4, PA3, I3
4. Electrical machine drives At the end of this section, students will be able to: a. Describe the commonly used electrical machine drive operation basics. b. Identify the proper method to drive an electrical machine. c. Design and simulate a drive for an electrical machine.	KB4, PA3, D3, **ET1**

ITW1 and **ITW2** will be assessed through the labs and project.

EVALUATION:

Name	**% Worth**	**Assigned**	**Due Date**	**CEAB GAs ASSESSED**
Laboratory	20%			I3, ITW1, ITW2
Project	15%			D3, ET1, ITW1, ITW2
Midterm	15% (50-minute midterm)			KB4, PA3
Final Examination	50%			KB4, PA3

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:

- Late submissions will be penalized 10% per weekday (applied at the due time and cumulative on a daily basis).
- Submissions will not be accepted after 7 days.
- For group assessments, the default assumption is that everyone contributes equally to the team effort, and hence all students will receive the same grade for group assessments.
- Each student may be asked to specify the contribution made by each member of the team, including his/herself.
- Team grades may be adjusted by up to 30% for each student based on self and peer evaluation.

For this course the following assessment has been designated as requiring supporting documentation: MIDTERM, Oct 21

Please note that this assessment is considered to be central to the learning objectives for this course. Accordingly, students seeking academic consideration for this assessment will be required to provide formal supporting documentation. Students who are granted academic consideration for this assessment will be provided with the following opportunity to make up this work: the instructor will decide between a make-up exam and re-weighting, depending on the number of students needing consideration/accommodation, scheduling, and room/TA availability.

Homework Assignments:

- Assignments provide important information that complements the learning experience and enriches the student's understanding of each topic. There will be up to three homework assignments. All assignments will be available on OWL but they will not be marked or be part of your course evaluation.

Laboratory:

- It is mandatory for all students to attend all lab sessions. Absence from any session without permission will result in a zero assigned to the corresponding laboratory report.
- Students are only permitted to work on lab exercises during their registered lab section unless special permission to attend an alternate lab section is given by the instructor.
- All work submitted must be clean, readable and organized. Failing one of these criteria, the report 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.
- Lab reports are to be submitted at the end of the laboratory period or when indicated by the instructor.
- All lab reports will be submitted online through the course website on OWL.
- Seven laboratory exercises are scheduled for the term, covering the following topics.
    1. AC-DC diode converters
    2. AC-DC thyristor converters
    3. DC-AC converters
    4. Induction motors
    5. BLDC motors

6. Brushed DC motors
7. Stepper motors

- A minimum mark of 50% in each laboratory exercise is required to pass the course.

Project: A project will be completed in which students will explore a motor drive design and simulation process. The details of the project will be distributed in the class.

A minimum of 50% must be obtained on the project in order to pass the course.

Midterm: Two midterm tests will be scheduled during class time. The dates, times, and material to be covered will be confirmed in class.

Final Examination: The final examination will take place during the regular examination period. The exam will cover all of the material covered in class and in the labs. The final exam will be three hours long, closed book, and only non-programmable calculators are allowed. A total of 3 hours will be assigned for the completion of the exam.

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, the final grade cannot be greater than 48%. Students who have failed this course (i.e., final average < 50%) must repeat all course components.