UNIVERSITY of GUELPH

ENGG*3510 Electromechanical Devices

01

Fall 2020
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - September 08, 2020

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1 Course Details

1.1 Calendar Description

The aim of this course is to develop an understanding of the electrical and electromechanical principles and their applications as devices used in engineering. The course covers magnetic fields of currents and coils; magnetic materials; magnetic circuits; induced, electric and magnetic fields (EMF), inductance, transformers magnetic forces, permanent magnets and electromagnets. The course examines the principles of variable-reluctance devices, stepper motors, moving-coil devices, direct current (DC) and alternating current (AC) motors. Semiconductors materials and devices, diodes, and transistors; principles of modern electronic devices and their applications in circuits; as well as operational amplifiers and digital logics are also studied.

Pre-Requisites: ENGG*2450, PHYS*1010

1.2 Timetable

Lectures:

Tuesday	10:00 am – 11:20 am	Online on WebEx
Thursday	10:00 am – 11:20 am	Online on WebEx

Class (Lectures) WebEx link:

https://uoguelph.webex.com/uoguelph/j.php?MTID=m1f27dafa74eb707370ae92ff583aa630

More ways to join the lectures:

Join by video system

Dial 1321344367@uoguelph.webex.com

You can also dial 173.243.2.68 and enter your meeting number.

Join by phone

+1-416-915-6530 Canada Toll

Access code: 132 134 4367

Weekly tutorial:

Thursday	1:00 pm - 2:50 pm	Online on WebEx
Friday	3:30 pm - 5:20 pm	Online on WebEx

Tutorial WebEx link
 https://uoguelph.webex.com/uoguelph/j.php?MTID=ma6de75ce3f119439638a2374ab114886

Note: for <u>weekly tutorials</u>, please contact only **Elyse Hill** (TA contact: page 3).

Matlab/Simulink Tutorials Only:

Thursday/ Friday	September 17/ September 18	Introduction to Matlab
Thursday/ Friday	September 24/ September 25	Matlab tutorial 1
Thursday/ Friday	October 1/ October 2	Matlab tutorial 2
Thursday/ Friday	October 8/ October 9	Simulink tutorial 1
Thursday/ Friday	October 15/ October 16	Simulink tutorial 2

<u>Tutorials WebEx link:</u>
 https://uoguelph.webex.com/uoguelph/j.php?MTID=ma6de75ce3f119439638a2374ab114886

Please be advised that the tutorial link for Matlab/Simulink is the same as the weekly tutorial. For the weeks that Matlab/Simulink tutorial will be held (dates in the above table), the second half of the tutorial is dedicated for teaching Matlab/Simulink. The TA will provide information in the tutorial on how to access Matlab remotely.

Note: for <u>Matlab/Simulink tutorials</u>, please contact **only Andrew Lee** (TA contact: page 3).

1.3 Final Exam

Final Exam: 7:00PM - 09:00PM (2019/12/07)

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

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2 Instructional Support

2.1 Instructional Support Team

Instructor:	Mohammad Biglarbegian
Email:	mbiglarb@uoguelph.ca
Telephone:	+1-519-824-4120 x56248
Office:	THRN 2339
Office Hours:	By appointment

2.2 Teaching Assistants

Teaching Assistant:	Elyse Hill
Email:	ehill06@uoguelph.ca
Office Hours:	TBA

Responsible for **Weekly** tutorials only.

Teaching Assistant:	Andrew Lee
Email:	alee32@uoguelph.ca

Responsible for **Matlab/Simulink tutorials** only.

Teaching Assistant:	Ali Taher
Email:	tahera@uoguelph.ca

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3 Learning Resources

3.1 Required Resources

Course Website (Website)
http://courselink.uoguelph.ca
Since the course will be handled online, it is very important and essential for the students to check ENGG*3510 Courselink very frequently. Course material, news, announcements, deadlines (for assignments), grades, etc. will be posted on the ENGG*3510 Courselink.

Students are responsible for checking Courselink (for ENGG*3510) regularly.

Students are expected to attend all of the lectures. Students are responsible for whatever material is taught in the class. Note that the textbook may not have all of the material taught in the class (Textbook)
Textbook:

"Electric Machinery Fundamental", by S. J. Chapman, McGraw Hill, 5th edition, 2011

* Purchase of the textbook is optional.

3.2 Additional Resources

Lecture Information (Notes)
Only lecture notes will be posted on Courselink after each class.

Assignments and project (Notes)
Assignments and their due dates will be posted on the Courselink. Submission is also on the Dropbox (of the Courselink).

Note: For the Matlab/Simulink tutorials, please contact only the designated TA for Matlab/Simulink (designated as Lab TAs on Page 3).

Miscellaneous Information (Other)
Other information related to Electromechanical Devices are also posted on the web page.

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4 Learning Outcomes

Electromechanical systems are used everywhere ranging from basic home devices to advanced machines used in industry. As a mechanical engineer, one should have a general understanding on these devices. The course covers magnetic material, permanent magnets, magnetic circuits and related topics such as EMF, MMF, inductance, etc. It also covers transformers, electric machines (motors and generators) both DC and AC, special motors such as stepper, servo, as well as speed control of motors. You will learn how the fundamental laws of magnetism are used in electromechanical systems such as transformers, electromotors, or generators. By the end of the term, you should have a good understanding of such devices.

4.1 Course Learning Outcomes

By the end of this course, you should be able to:
1. Apply the fundamental laws of physics and electromagnetism to electromechanical devices.
2. Describe magnetic material, their properties, and explain the B H curve.

3. Analyze and synthesize magnetic circuits to be able to understand the underlying principles of many electromechanical devices, transformers, etc.

4. Analyze semi conductor devices such as Diodes, Transistors, and their applications

5. Analyze transformers and utilize the knowledge of magnetic circuits to be able to analyze them.

6. Utilize the knowledge of electromagnetism to analyze, and design Linear DC machines: DC motors and generators.

7. Learn, understand, and be able to analyze the principles as well as applications of rotary DC machines: both DC motors and DC generators.

8. Explain and discuss the techniques (advantages and limitations) used for speed control of DC motors.

9. Explain the principles and analyze rotary AC machines: both AC motors and AC generators, and analyze them, and list their applications.

10. Explain special purpose motors, how they operate, and their applications.

11. Perform experiments with several electromechanical devices and concisely and articulately communicate the results through formal reports.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2, 4, 5, 6, 7, 8, 9, 10
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1
1.2	Recall, describe and apply fundamental principles and concepts in natural science	1, 2, 4, 5, 6, 7
1.3	Recall, describe and apply fundamental engineering principles and concepts	2, 4, 5, 6, 7
1.4	Recall, describe and apply program-specific engineering principles and concepts	4, 5, 6, 7, 8, 9, 10
2	Problem Analysis	3, 5, 6, 7, 9
2.1	Formulate a problem statement in engineering and non-engineering terminology	3, 5, 6, 7, 9
2.2	Identify, organize and justify appropriate information, including assumptions	3, 5, 6, 7, 9

#	Outcome	Learning Outcome
2.3	Construct a conceptual framework and select an appropriate solution approach	3, 5, 6, 7, 9
2.4	Execute an engineering solution	3, 5, 6, 7, 9
2.5	Critique and appraise solution approach and results	3, 5, 6, 7, 9
5	Use of Engineering Tools	11
5.1	Select appropriate engineering tools from various alternatives	11
5.2	Demonstrate proficiency in the application of selected engineering tools	11
6	Individual & Teamwork	11
6.2	Understand all members' roles and responsibilities within a team	11
7	Communication Skills	11
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	11
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	11
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	11
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	11

5 Teaching and Learning Activities

5.1 Class Schedule

Week	Day	Topic/Event	References	Objectives
1	Thursday	Introduction	Slides	1

2-3	Tuesday Thursday	Background and Fundamentals of Electromagnetism (1) Fundamentals of Electromagnetism (2)	Chapter 1	1, 2
3-4	Tuesday Thursday	Magnetic Materials, Magnetic Circuits	Chapter 1	1, 2, 3
5	Tuesday Thursday	Applications of Electromechanical Devices, Electronic Elements	Chapter 1 and class lectures	2, 3
6	Tuesday Thursday	Transformers Linear DC Machines (1)	Chapter 2 and class lectures	4, 5
7	Thursday	Linear DC Machines (2)	Chapter 1 and class lectures	4
8	Tuesday Thursday	Rotary DC Motors and Generators (1) Rotary DC Motors and Generators (2)	Chapters 7, 8	6, 7
9	Tuesday Thursday	Rotary DC Motors and Generators (3) Speed Control of DC Motors	Chapters 7, 8	6, 7, 8
10	Tuesday Thursday	Three Phase Circuits (1) Three Phase Circuits (2)	Class lectures	9

| 11 | Tuesday | Concept of Rotating Magnetic Fields (1) Concept of Rotating Magnetic Fields (2) | Chapter 3 | 9 |
| | Thursday | | | |

| 12 | Tuesday | AC Motors and Generators (1) AC Motors and Generators (2) | Chapters 4 | 9 |
| | Thursday | | | |

| 13 | Tuesday | AC Motors and Generators, Special Purpose Motors | Chapter 6 and class lectures | 9, 10 |
| | Thursday | | | |

- **Note:** The chapters mentioned here are only used as a **reference**. The instructor may not necessarily follow exactly the material covered in the chapters. Students are responsible for **whatever is taught** in the class. Furthermore, note that the class schedule may be subject to change. Please refer to the most recent syllabus or outline available

5.2 Weekly Tutorials

There is weekly tutorial. The first tutorial will be held on the week of September 14.

5.3 Matlab/Simulink Tutorial, Assignments, Project

In this activity we will have tutorials on Matlab and Simulink and there are assignments and a project.

There are tutorials on Matlab/Simulink according to the following table:

Week*	Topic	Due
Week of Sept. 14	**Introduction to Matlab**	--
Week of Sept. 21	**Matlab tutorial 1**	--
Week of Sept. 28	**Matlab tutorial 2**	Assignment 1 due date Oct. 8

Week of Oct. 5   **Simulink tutorial 1**

Week of Oct. 12   **Simulink tutorial 2**   Assignment 2 due date Oct. 29

Assignment 3 due date Nov. 13

All the submissions of the assignments are on Courselink.

Late policy: for every late date 10% mark of that assignment or project will be deducted.

5.4 Other Important Dates

Thursday Sept. 10, 2020: First day of class

Monday, October 12, 2020: Thanksgiving Day, No Classes

Tuesday, October 13, 2020: Study Day, No Classes

Thursday, December 3, 2020: Make up for Study Day (Tuesday Schedule)

Friday, December 4, 2020: Make up for Thanksgiving Day (Monday Schedule) and Last Day to Drop Fall Courses Without Academic Penalty

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6 Assessments

6.1 Assessment Details

Assignments and projects (12%)
Learning Outcome: 2, 3, 7
Assignment 1: 3%, due Oct. 8

Assignment 2: 3%, due Oct. 29

Assignment 3: 6%, due Nov. 13

These assignments will be posted on the Courselink. Submission also will be on Courselink (dropbox).

Late submissions are not accepted. A grade of zero will be assigned for the assignment that is submitted late.

Midterm (33%)

Date: Thu, Oct 22
Learning Outcome: 1, 2, 3, 4, 5
Important Note: Exam will be individual, online, open book. No communication(s) of any sort is allowed. Students will be asked to sign the Honour Code. Any plagiarism will not be tolerated and will be treated according to the University policies.

* If you miss a test **only due to grounds for granting academic consideration or religious accommodation**, the weight of the missed test will be added to the final exam. There will be no makeup midterm tests.

Final Exam (55%)
Due: Mon, Dec 7, 7:00 PM - 9:00 PM
Learning Outcome: 1, 2, 3, 6, 7, 8, 9, 10
Final exam will be individual, online, open book. No communication(s) of any sort is allowed. Students will be asked to sign the Honour Code. Any plagiarisms will not be tolerated and will be treated according to the University policies.

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7 Course Statements

7.1 Course Grading Policies

Missed Assessments: If you are unable to meet an in course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08 ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in course requirement due to religious obligations, please email the course instructor at the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08 accomrelig.shtml

Passing grade: In order to pass the course, you must obtain a grade of 50% or higher in total.

Assignment and Project Work: If you miss submitting the assignments or the project but do not have grounds for consideration (academic or religious), you will get zero on that assignment/project.

8 School of Engineering Statements

8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration

https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website

https://www.ridgetownc.com/services/accessibilityservices.cfm

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by

email.

9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

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