

Course Outline (W2026)

ELE637: Energy Conversion

Instructor(s)	Dr. Mohammadreza Arani [Coordinator] Office: ENG323 Phone: (416) 979-5000 x 556109 Email: marani@torontomu.ca Office Hours: Mondays 1:00 PM - 2 PM, Wednesdays 11:00 AM - 12:00 PM
Calendar Description	Basic principles of operation of different types of machines and their control; magnetic circuit analysis, single-phase, and three-phase transformers, principles of electromechanical energy conversion, DC machines, three-phase induction motors, synchronous machines, introduction to solid-state motor controls and devices, transients and dynamics of machines, introduction to programmable logic controller (PLC), control of electric motors by PLC.
Prerequisites	ELE 302 and ELE 531
Antirequisites	None
Corerequisites	None
Compulsory Text(s):	1. P.C. Sen, Principles of Electric Machines and Power Electronics, 3rd Edition John Wiley and Sons, ISBN: 978-1- 118-80434- 6, 2013.
Reference Text(s):	1. G.R. Slemon, Electric Machines and Drives Addison-Wesley, ISBN-13: 978-0201578850, 1992.
Learning Objectives (Indicators)	At the end of this course, the successful student will be able to: <ol style="list-style-type: none"> 1. Apply engineering fundamentals (Amperes Law, Faradays Law, Ohms Law, etc.) to solve electromagnetic engineering problems. Apply electromagnetic and electromechanical engineering principles to solve energy conversion engineering problems. (1c) 2. Use engineering fundamentals to formulate models for magnetic devices, transformers, dc machines, induction machines, and synchronous machines. Use the models to solve real-world engineering problems on electromagnetic circuits, transformers and electric machines. Address the limitations of the models. (2b) 3. Determine the limitations of laboratory measurements on magnetic components, transformers, and electric machines. Verify the models of magnetic devices, transformers, and electric machines with laboratory measurements. (3b), (3a) 4. Select the best proceeds to achieve various design objectives on energy conversion and decide the optimal designs of electromagnetic and electromechanical transformations subjected to various real-world engineering conditions. (4c) 5. Evaluate and select appropriate equipment and test apparatus for measuring electromagnetic circuits, transformers, electric machines. (5a) 6. Understand the impact of electric machines to the sustainable development. Know the relevant regulations in the engineering activities. (9a)

	<p>7. Using the professional and ethical protocols and procedures when performing the experiments with high voltage, including the safety considerations. (10a)</p> <p>NOTE: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p>																		
Course Organization	<p>3.0 hours of lecture per week for 13 weeks 2.0 hours of lab per week for 12 weeks 0.0 hours of tutorial per week for 12 weeks</p>																		
Teaching Assistants	<p>Tafan Ali (tafan.ali@torontomu.ca) Ahmad Karimi Rizvandi (ahmad.karimi@torontomu.ca) Niki Sheibani (niki.sheibani@torontomu.ca)</p>																		
Course Evaluation	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: left;">Theory</th> </tr> </thead> <tbody> <tr> <td style="width: 80%;">Midterm Exam</td> <td style="text-align: right;">20 %</td> </tr> <tr> <td>Final Exam</td> <td style="text-align: right;">35 %</td> </tr> <tr> <td>Quizzes</td> <td style="text-align: right;">10 %</td> </tr> <tr> <td>Reading Project</td> <td style="text-align: right;">5 %</td> </tr> <tr> <th colspan="2" style="text-align: left;">Laboratory</th> </tr> <tr> <td>Lab Reports</td> <td style="text-align: right;">15 %</td> </tr> <tr> <td>Lab Work</td> <td style="text-align: right;">15 %</td> </tr> <tr> <td>TOTAL:</td> <td style="text-align: right;">100 %</td> </tr> </tbody> </table> <p>Note: In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both "Theory and Laboratory" components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the "Course Evaluation" section above for details on the Theory and Laboratory components (if applicable).</p>	Theory		Midterm Exam	20 %	Final Exam	35 %	Quizzes	10 %	Reading Project	5 %	Laboratory		Lab Reports	15 %	Lab Work	15 %	TOTAL:	100 %
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Examinations	<p>Midterm exam in approximately Week 7 during lecture hours, three hours.</p> <p>Final exam, during the exam period, three hours, details will be announced on D2L.</p>																		
Other Evaluation Information	<p>Quizzes and a reading project</p>																		
Teaching Methods	<p>All lectures, laboratory sessions, examinations, and evaluations will be conducted in person. The course will be delivered using a blended learning approach that integrates pre-recorded lectures with in-person instruction. Each week, pre-recorded lecture videos will be made available on D2L, organized into short segments of approximately 10-15 minutes. During the subsequent in-person sessions, the material from the recorded lectures will be reviewed, reinforced, and extended through interactive discussion and the solution of additional examples and problems.</p>																		
Other Information	<p>Students may use Generative AI (e.g. ChatGPT, Grammarly, Perplexity, DeepL Translator) only for minor grammar correction. This includes translating individual words and correcting spelling, punctuation and basic grammar issues. AI tools may not be used to make substantial revisions</p>																		

such as edits to style, tone, content nor rewrite phrases. Failure to stay within these limits will be considered a breach of Policy 60.

Course Content

Week	Hours	Chapters / Section	Topic, description
1-2	6	1	Topic 1: Magnetic Circuits
3-5	9	2	Topic 2: Transformers
7	3		MIDTERM
6 and 8	6	3	Topic 3: DC Machines
9-11	9	4	Topic 4: Induction Machines
12-13	6	5	Topic 5: Synchronous Machines

Laboratory(L)/Tutorials(T)/Activity(A) Schedule

Week	L/T/A	Description
2-5	ENG309	Tutorial (1hour): Lab orientation tutorial on Three-phase Power Measurement Lab Work (3hours): A: Three-phase Power Measurement B: Three-phase Transformer Tutorial (1hour): Lab orientation tutorial on Three-phase Transformer Lab Work (3hours): A: Three-phase Transformer B: Three-phase Power Measurement
6-9	ENG309	Tutorial (1hour): Lab tutorial on DC motor speed control Lab Work (3hours): A: DC Motor Speed Control B: Three-phase Induction Motor

		Tutorial (1hour): Lab tutorial about Induction Motors Lab Work (3hours): A: Three-phase Induction Motor B: DC Motor Speed Control
10-13	ENG309	Tutorial (1hour): Lab tutorial on Synchronous Generators Lab Work (3hours): A: Synchronous Generator B: PLC Tutorial (1hour): Lab tutorial on PLC Lab Work (3hours): A: PLC B: Synchronous Generator

University Policies & Important Information

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on [the Senate website](#)

Refer to the [Departmental FAQ page](#) for further information on common questions.

Important Resources Available at Toronto Metropolitan University

- [The University Libraries](#) provide research [workshops](#) and individual consultation appointments. There is a drop-in Research Help desk on the second floor of the library, and students can use the [Library's virtual research help service](#) to speak with a librarian, or [book an appointment](#) to meet in person or online.
- [Student Life and Learning Support](#) offers group-based and individual help with writing, math, study skills, and transition support, as well as [resources and checklists to support students as online learners](#).
- You can submit an [Academic Consideration Request](#) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the [Senate website](#) and select the blue radio button on the top right hand side entitled: Academic Consideration Request (ACR) to submit this request.

For Extenuating Circumstances, [Policy 167: Academic Consideration](#) allows for a once per semester ACR request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. Absences more than 3 days in duration and those that involve a final exam/final assessment, always require documentation. Students must notify their faculty/contract lecturer once a request for academic consideration is submitted. See Senate [Policy 167: Academic Consideration](#).

Longer absences are not addressed through Policy 167 and should be discussed with your Chair/Director/Program to be advised on next steps.

- [FAQs Academic Considerations and Appeals](#)
- Information on Copyright for [Faculty/Contract Lecturers](#) and [students](#).

Lab Safety (if applicable)

Students are to strictly adhere and follow:

- a. The Lab Safety information/guidelines posted in the respective labs,
- b. provided in their respective lab handouts, and
- c. instructions provided by the Teaching Assistants/Course instructors/Technical Staff.

During the lab sessions, to avoid tripping hazards, the area around the lab stations should not be surrounded by bags, backpacks etc, students should place their bags, backpacks etc against the walls of the labs and/or away from their lab stations in such a way that it avoids tripping hazards.

Accessibility

- Similar to an [accessibility statement](#), use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
- Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
- Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

- Learn more about [Academic Accommodation Support](#).
- Learn [how to register with AAS](#).
- Learn about [Policy 159: Academic Accommodation of Students with Disabilities](#)

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about [Academic Accommodations versus Academic Consideration and how to access each](#).

Wellbeing Support

At Toronto Metropolitan University, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

- **Distress Line:** 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
- **Good2Talk:** 24/7-hour line for postsecondary students (phone: 1-866-925-5454)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via [My SSP app](#) or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- **Centre for Student Development and Counselling:** 416-979-5195 or email csdc@torontomu.ca
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email osvse@torontomu.ca
- **Medical Centre:** call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing](#) website.