



ELEC 342: Electromechanical Energy Conversion and Transmission

Location & time: CEME 1204, Tue Thu 11:00 AM – 12:30 PM

Instructor: Zhi Jin (Justin) Zhang

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1. Course Content (tentative and subject to change)

- Review of AC circuits and phasors, real and reactive power. [Appendix B]. Basic principles of electromagnetism, magnetic circuits, and properties of magnetic materials [Chap. 1].
- Coupled magnetic circuits; ideal transformer dynamics and steady-state, equivalent circuits, three-phase transformers and connections, steady-state phasor relations. Per-unit system. [Chap. 2].
- Principle of electromechanical energy conversion, basic actuators, force and torque production [Chap. 3].
- DC Machines: basic principles, voltage and torque equations, basic types of DC machines, steady-state equations and characteristics, the performance of DC machines, elementary control, basic DC drives and DC-DC converters [Chap. 4, Chap. 10].
- Rotating Magnetic Field: windings, MMF, two-phase device, three-phase device, p-pole devices, etc. Induction Machines: basic construction and principle of operation, types, rotor slip, steady-state equivalent circuit analysis, derived torque and power, determination of parameters, the principle of speed control [Chap. 5].
- Synchronous Machines: the principle of operation, rotor types, stator & rotor inductances, basic equivalent circuit, steady-state power-angle characteristics, steady-state operating characteristics, synchronous motors, the effect of the salient pole on power-angle characteristics [Chap. 6].
- Permanent magnet synchronous machines, brushless DC motors, reluctance motors, stepper motors, single-phase motors, basics of operation [Chap. 7 & 8].

2. Textbook (assignments and lectures will be based on this book)

P. C. Sen, PRINCIPLES OF ELECTRIC MACHINES AND POWER ELECTRONICS, Third Edition (2013), ISBN: 978-1-118-07887-7.

Recommended Additional Reading:

- A.E. Fitzgerald, C. Kingsley, S.D. Umans, "Electric Machinery, 6th Edition," McGraw-Hill 2002, ISBN: 0-07-366009-4.
- J. Chapman, "Electric Machinery Fundamentals, 5th Edition," McGraw-Hill 2012.

3. Lectures

You are expected to attend all lectures in-person. The lectures will also be recorded and the video recordings will be made available on UBC's Panopto platform. The link will be provided on Canvas.

If you are unwell or sick, please refrain from attending class and do your best to keep up with the course remotely.



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4. Teaching Assistants (TAs)

We have 4 TAs for this course:

- Shadman Saqlain Rahman, email shadman0@ece.ubc.ca
- Fardin Sohel, email fardinsohel@ece.ubc.ca
- Tigran Hakobyan, email tigranh@ece.ubc.ca
- Maliha Ferdous, email mferdous@student.ubc.ca

The TAs are located in KAIS 3085. For questions regarding grading and logistics, please get in touch with TAs via their email (always include “**ELEC342_Your_Name**” in the subject line).

This term we will also be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Find our class signup link at: https://piazza.com/ubc.ca/winterterm22026/elec_v3422012025w2

5. TA Office Hours

Location & time: Wednesdays 4 PM – 5 PM in KAIS 3049.

Office hours will start in the week of Jan. 12. The TAs will also do their best to respond to questions posted on Piazza. For meeting outside of the office hours, send an email to arrange a meeting. Always include “**ELEC 342_Your_Name**” in the subject line.

6. Tutorials

Location & time: SWNG 122, Fri 12:00 PM – 2:00 PM

There will be one tutorial per week, starting in the week of Jan. 12. This large-group tutorial is intended for the whole class to join, during which the TAs will review key concepts and work through example problems. Sometimes we will use this time to have quizzes. It will be announced ahead of time.

7. Grading Scheme

The final grade will be based on the following weighting scheme:

Assignments – 5%
Quizzes – 20%
Lab Reports – 15%
Midterm Exam – 20%
Final Exam – 40%

Each student **must pass the Final Exam** (get 50% or more) in order to pass this course. If the mark for the Final Exam is less than 50%, then this failing mark becomes the mark for the whole course.

8. Assignments

There will be 5 to 6 assignments throughout the course. Assignment questions will be posted under the Modules tab on Canvas. The submission link will be open until **11:59 pm** on the due date. Assignments are counted but will not be marked. The solutions will be posted after the due date. Late submission of Assignments will not be accepted after the solutions have been posted. The assignments may be reviewed only at the end of the term if the student's grade is on the pass/fail borderline.

9. Quizzes

There will be 5 to 6 short quizzes (~15 minutes) during the course. The quizzes will be conducted in



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person **at the start of the tutorial time**. The quiz dates will be announced during lectures and posted on Canvas. Missed quizzes cannot be made up and will result in a zero mark. In case of illness or other legitimate reasons (with advanced notice and a doctor's note), the weight of the missed quiz may be added to the Final Exam.

10. Labs

Labs are conducted in **MCLD 1002, Electromechanical Devices Laboratory**. We have 3 sections (Mon 10:00 AM – 1:00 PM, Fri 8:30 AM – 11:30 AM, Fri 2:00 PM – 5:00 PM).

There are 1 safety/intro + 5 lab experiments in this course. The Lab Manuals will be posted on Canvas.

Laboratory experiments are an integral part of this course. To pass this course, all students are required to comply with the laboratory rules, complete all pre-labs, attend and conduct all laboratory experiments, and submit written reports for all labs. Laboratory experiments should be conducted in pairs (with a lab partner). Both lab partners should work jointly on a common Lab Report, but **each partner still needs to submit the report** separately on time.

Lab Reports are due exactly one week after the experiments are conducted. Lab reports are to be submitted on Canvas under the Labs section. The submission link will only be available until **11:59 pm** on the due date. Late submissions must be emailed to the TAs and will result in reduced marks (10% per day up to 3 days, and zero marks thereafter).

The labs are:

Lab Name	Week
Lab-0: Safety Training & Lab Introduction	Jan 26 – 30
Lab-1: AC/DC Circuits and Measurements	Feb 9 – 13
Lab-2: AC Transformers	Feb 23 – 27
Lab-3: Brushed DC Machines	Mar 9 – 13
Lab-4: Induction Motors & VFDs	Mar 23 – 27
Lab-5: Synchronous Machines	Apr 6 – 10

Each student **must** submit all 5 lab reports in order to be permitted to write the Final Exam.

11. Exams

There will be one Midterm Exam after we cover DC Machines: In-person during class, February 26, 2026.

There will be a Final Exam: In-person, location & time TBD.

Missed exams cannot be made up. In the case of illness (with advanced notice and a doctor's note), the weight of the Midterm Exam may be added to the Final Exam.

12. Policy on Academic Dishonesty

The academic enterprise is founded on honesty, civility, and integrity. This also means you should not cheat, copy, or mislead others about what is your work. Students are encouraged to discuss the problems in each assignment and lab experiment among themselves. However, the turned-in assignments and lab reports must demonstrate individual work and reflect each student's understanding of the material. **Reports suspected of cheating will not be graded (zero mark). Cheating on exams will result in a zero mark and may qualify for withdrawal from the course and/or suspension from the University.** Please see <https://academicintegrity.ubc.ca/> for university policy & guidance. All instances of cheating will be reported in accordance with this policy.



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13. Policy on AI-Based Tools

The use of AI-based tools is strictly prohibited in this class. Moreover, you cannot upload any course material to these online tools. Please consult <https://genai.ubc.ca/> for additional guidance.