University of Victoria Engineering

Faculty of Engineering

COURSE OUTLINE

ECE 370 – Electromechanical Energy Conversion

Term – Fall 2018 (201809)

Instructor

Dr. Ashoka K.S. Bhat
Phone: 250-721-8682
E-mail: abhat@engr.uvic.ca

Office Hours

Days: Wednesday
Time: 2:00 to 3:00 PM
Location: EOW413

Course Objectives

- To introduce students to the principles of electromechanical energy conversion, transformers and electric machines.

Learning Outcomes

You will learn:
-Discuss the basic principles of magnetic circuits including magneto-motive-force and reluctance, how to draw equivalent circuits and how to analyze them to calculate different parameters like flux, energy density, etc.
-Discuss the Faraday's law for electromagnetic induction and its application in transformers; to study the effect of eddy currents and hysteresis in transformers; review concepts of self inductance and mutual inductances.
-Discuss the basic principles of operation and construction details of transformers and dc machines (as a generator and a motor); develop their practical equivalent circuits and use them in calculating performance parameters such as regulation and efficiency.
-Explain operation and use of autotransformers, instrument transformers and concept of per unit values.
-Discuss the basic principles of operation (including the concept of rotating magnetic field) and construction details of induction motors and synchronous machines (as a generator and as a motor); develop their equivalent circuits and use them in calculating performance parameters such as regulation and efficiency.
-Use of phasor circuits in calculating the performance parameters for transformers, induction machines and synchronous machines; also to draw phasor diagrams.
-Develop principles of electromechanical energy conversion – co-energy, forces and torques in magnetic filed systems, etc.
-Carry out measurements of the equivalent circuit parameters of transformer, dc machine and induction machine in the laboratory; also to predict and measure the performance parameters like efficiency, regulation, etc.
-Carry out measurements of the speed-torque characteristics of dc motors and induction motors and compare with predicted characteristics; learn how to control their speed.
-Use of synchronous machines in power factor correction.
-Demonstrate the ability to work in a group through experiential work carried out in the lab

-Demonstrate communication skills through lab reports documenting team-based experiential work carried out in the lab.

- Recall the basic principles of magnetic circuits, apply equivalent circuits analysis to calculate different parameters like flux, energy density, etc.
- Explain the basic principles of operation and construction details of transformers and dc machines (as a generator and a motor); use their phasor equivalent circuits to evaluate performance parameters such as regulation and efficiency.
- Explain the basic principles of operation and construction details of induction motors and synchronous machines (as a generator and as a motor); use their phasor equivalent circuits to evaluate performance parameters such as regulation and efficiency.
- Identify the speed-torque characteristics of dc motors and induction motors and explain how to control motor speed.

Syllabus (Approximate number of lectures)

Magnetic Circuits (5 lectures)
Transformers (8 lectures)
DC Machines (8 lectures)
Induction Motors (7 lectures)
Synchronous Machines (4 lectures)
Electromechanical Energy Conversion Principles (2 lectures)
Stepper Motor and Brushless DC Machines (1 lecture)
Introduction to Electric Drives (1 lecture)

A-Section(s): A01 / CRN 10982
Days: Tuesday, Wednesday, Friday
Location: BWC A104

Lab TAs:

B01: M (13:00 - 16:00)	TBD
B02: M (13:00 - 16:00)	TBD
B03: Tue (13:30 - 16:30)	TBD
B04: Tue (13:30 - 16:30)	TBD
B05: Wed (13:30 - 16:30)	TBD
B06 Wed (13:30 - 16:30)	TBD
B07: Th (13:00 - 16:00)	TBD
B08: Th (13:00 - 16:00)	TBD
B09: Fr (13:30 - 16:30)	TBD
B10: Fr (13:30 - 16:30)	TBD

Marker TAs: TBD

Required Text

1. A.K.S. Bhat, ELEC370 Course Notes, 2018: http://www.ece.uvic.ca/~bhat
   (will be available on the web during the semester).
2. P.C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 1996. (This is a suggested book for reference, not mandatory to buy). ISBN 978-1-118-07887-7, third edition 2013
3. A.K.S. Bhat, "Laboratory Manual for ECE 370 - Electromechanical Energy Conversion ", University of Victoria, 2018 (please buy the lab manual from the UVic book store).

References:

1. G.R. Slemon, "Electric Machines and Drives", Reading Mass., Addison-Wesley Publishing Company Inc., 1992.
2. S.A. Nasar, "Electric Machines and Transformers" Macmillan Publishing Company, 1984.

Assessment:

Assignments:	5%	Due Dates: As the course progresses (5 assignments)
Labs	24%	
Mid-term	21%	Date: October 5 (to be finalized)
Final Exam	50%	

Note: Failure to complete all laboratory requirements will result in a grade of N being awarded for the course.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

https://web.uvic.ca/calendar2018-09/undergrad/info/regulations/grading.html

There will be no supplemental examination for this course.

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

Accommodation of Religious Observance:
https://web.uvic.ca/calendar2018-09/undergrad/info/regulations/religious-observanc.html

Policy on Inclusivity and Diversity:
https://web.uvic.ca/calendar2018-09/general/policies.html

Standards of Professional Behaviour: You are advised to read the Faculty of Engineering document Standards for Professional Behaviour, which contains important information regarding conduct in courses, labs, and in the general use of facilities.
https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the entry in the current Undergraduate Calendar for the UVic policy on academic integrity.
https://web.uvic.ca/calendar2018-09/undergrad/info/regulations/academic-integrity.html

Equality: This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist

you in arranging for appropriate accommodation. Alternatively, you may want to contact the Resource Centre for Students with a Disability located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

Course Lecture Notes: Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.