HUMBER

Course Outline

Course Name: Variable Frequency Drives and Motor Controls (ELEC 355)

Academic Period: 2023 - 2024

Faculty:

Faculty Availability:

Associate Dean:
Shaun Ghafari
shaun.ghafari@humber.ca

Schedule Type Code:

Land Acknowledgement

Humber College is located within the traditional and treaty lands of the Mississaugas of the Credit. Known as Adoobiigok [A-doe-bee-goke], the "Place of the Alders" in Michi Saagiig [Mi-Chee Saw-Geeg] language, the region is uniquely situated along Humber River Watershed, which historically provided an integral connection for Anishinaabe [Ah-nish-nah-bay], Haudenosaunee [Hoeden-no-shownee], and Wendat [Wine-Dot] peoples between the Ontario Lakeshore and the Lake Simcoe/Georgian Bay regions. Now home to people of numerous nations, Adoobiigok continues to provide a vital source of interconnection for all.

Equity, Diversity and Inclusion Statement

Humber College and the University of Guelph-Humber (Humber) are leaders in providing a learning, working and living environment that recognizes and values equity, diversity and inclusion in all its programs and services. Humber commits to reflect the diversity of the communities the College serves. Students, faculty, support and administrative staff feel a sense of belonging and have opportunities to be their authentic selves.

Faculty or Department	Faculty of Applied Sciences & Technology
Course Name:	Variable Frequency Drives and Motor Controls (ELEC 355)
Pre-Requisites	ELEC 324
Co-Requisites	none
Equates	none
Restrictions	none
Credit Value	3
Total Course Hours	56

Developed By:	Prepared By:	Approved by:
		Shaun Ghafari

Humber Learning Outcomes (HLOs) in this course.

The HLOs are a cross-institutional learning outcomes strategy aimed at equipping Humber graduates with the employability skills, mindsets, and values they need to succeed in the future of work. To explore all the HLOs, please consult the Humber Learning Outcomes framework.

- Critical Thinking
- Digital Fluency
- Professionalism
- Strategic Problem-Solving

Course Description

This course teaches the principles of operation of the three phase Synchronous Machines (alternator and Motors), the three phase Induction Machines, fundamentals of electric drives, and their control by using Pulse Width Modulation, Sine Wave Converter and Generation of Sine Wave Techniques. Electronic control of DC and AC machines in terms of frequency, voltage, current and torque is studied in this course.

Course Rationale

This course aims to develop student knowledge and understanding of AC machines such as Synchronous, and Asynchronous machines. The Skills already learned about power semiconductor devices and power conversion techniques to be applied for speed control of the above mentioned motors. Students would apply their mathematical skills and knowledge of PWM techniques to analyze and solve power electronic circuits used to control the speed and torque of AC and DC motors in the Electrical Industry.

Course Learning Method(s)

- Lecture
- Inquiry Based Learning

Learning Outcomes

- Define voltage regulation of an alternator.
- Describe the major constructional features of a synchronous motor
- Describe the starting methods for synchronous motors
- Explain the power factor improvement using synchronous motors
- Describe the operation of an Induction Motor at standstill and at normal speed
- Discuss starting methods of Induction Motors
- Describe the operation of Two-quadrant and Four-quadrant control of DC machines
- Explain the types of AC drives used in the Industry
- Explain the speed and torque control of Induction Motors
- Demonstrate different breaking methods for induction motors
- Perform experiments on the operation and control of DC and AC machinery

Assessment Weighting

Assessment	Weight
Practical Exam	
Lab Test	10%
Report	
Lab Reports	10%
In-class Activity	
Performing an experiment	10%
Final Exam	
Final Exam	35%
Midterm Exam	
Mid Term Exam	35%
Total	**100%**

Modules of Study

Module	Course Learning Outcomes	Resources	Assessments
Synchronous Alternators - Construction and Analysis	• Define voltage regulation of an alternator. • Perform experiments on the operation and control of DC and AC machinery		• Mid Term Exam • Performing an experiment • Lab Reports • Lab Test
Synchronous Motors - Construction, operation and characteristics	• Describe the major constructional features of a synchronous motor • Describe the starting methods for synchronous motors • Explain the power factor improvement using synchronous motors • Perform experiments on the operation and control of DC and AC machinery		• Mid Term Exam • Performing an experiment • Lab Reports • Lab Test
Three-Induction Motors - Construction, operation and characteristics	• Describe the operation of an Induction Motor at standstill and at normal speed • Discuss starting methods of Induction Motors • Perform experiments on the operation and control of DC and AC machinery		• Final Exam • Performing an experiment • Lab Reports • Lab Test

Module	Course Learning Outcomes	Resources	Assessments
Fundamentals of Electric Drives	• Explain the types of AC drives used in the Industry • Perform experiments on the operation and control of DC and AC machinery		• Final Exam • Performing an experiment • Lab Reports • Lab Test
Fundamentals of Power Electronics	• Describe the operation of Two-quadrant and Four-quadrant control of DC machines • Perform experiments on the operation and control of DC and AC machinery		• Final Exam • Performing an experiment • Lab Reports • Lab Test
Electronic Control of DC and AC Machines	• Explain the speed and torque control of Induction Motors • Demonstrate different breaking methods for induction motors • Perform experiments on the operation and control of DC and AC machinery		• Final Exam • Performing an experiment • Lab Reports • Lab Test

Required Resources

Theodore Wildi, Electrical Machines, Drives and Power Systems, Prentice-Hall, Eaglewood Cliffs, N.J., USA 07632. 9780131776913, 6th edition.

Richardson, D.V., Caisse Jr., A. J., Rotating Electric Machinery and Transformer Technology, Prentice-Hall, Eaglewood Cliffs, N.J., USA 07632. ISBN 013409640-1, 4th edition.

Essential Skills

Section	Skills	Measurement	Details
Communication	• Reading • Writing • Speaking • Listening • Visual Literacy	Teach and measure	• In the course, the reading, speaking, listening, writing skills, and visual literacy will be reinforced through a combination of various instructional methods and activities such as reflection activities, collaborative learning, realistic tasks, written assignments, and problem-based learning. A balanced approach of teacher-led instruction, collaborative learning, and independent practice will be used to reinforce these skills. • To give students multiple ways to demonstrate the essential skills being assessed, the following types of assessments will be provided: written and online assessments, in-lab activity by performing experiments, lab report, lab tests, and examination.

Section	Skills	Measurement	Details
Numeracy	• Understanding and applying mathematical concepts and reasoning • Analyzing and using numerical data • Conceptualizing	Reinforce and measure	• In the course, the reading, speaking, listening, writing skills, and visual literacy will be reinforced through a combination of various instructional methods and activities such as reflection activities, collaborative learning, realistic tasks, written assignments, and problem-based learning. A balanced approach of teacher-led instruction, collaborative learning, and independent practice will be used to reinforce these skills. • To give students multiple ways to demonstrate the essential skills being assessed, the following types of assessments will be provided: written and online assessments, in-lab activity by performing experiments, lab report, lab tests, and examination.
Critical Thinking and Problem-Solving	• Analysing • Synthesizing • Evaluating • Decision-Making	Reinforce and measure	• In the course, the reading, speaking, listening, writing skills, and visual literacy will be reinforced through a combination of various instructional methods and activities such as reflection activities, collaborative learning, realistic tasks, written assignments, and problem-based learning. A balanced approach of teacher-led instruction, collaborative learning, and independent practice will be used to reinforce these skills. • To give students multiple ways to demonstrate the essential skills being assessed, the following types of assessments will be provided: written and online assessments, in-lab activity by performing experiments, lab report, lab tests, and examination.
Information Management	• Gathering and managing information • Selecting and using appropriate tools and technology for a task or project • Computer literacy • Internet skills	Reinforce and measure	• In the course, the reading, speaking, listening, writing skills, and visual literacy will be reinforced through a combination of various instructional methods and activities such as reflection activities, collaborative learning, realistic tasks, written assignments, and problem-based learning. A balanced approach of teacher-led instruction, collaborative learning, and independent practice will be used to reinforce these skills. • To give students multiple ways to demonstrate the essential skills being assessed, the following types of assessments will be provided: written and online assessments, in-lab activity by performing experiments, lab report, lab tests, and examination.

Section	Skills	Measurement	Details
Interpersonal Skills	• Teamwork • Relationship management	Teach and measure	• In the course, the reading, speaking, listening, writing skills, and visual literacy will be reinforced through a combination of various instructional methods and activities such as reflection activities, collaborative learning, realistic tasks, written assignments, and problem-based learning. A balanced approach of teacher-led instruction, collaborative learning, and independent practice will be used to reinforce these skills. • To give students multiple ways to demonstrate the essential skills being assessed, the following types of assessments will be provided: written and online assessments, in-lab activity by performing experiments, lab report, lab tests, and examination.
Personal Skills	• Managing self • Engaging in reflective practice • Demonstrating personal responsibility	Teach and measure	• In the course, the reading, speaking, listening, writing skills, and visual literacy will be reinforced through a combination of various instructional methods and activities such as reflection activities, collaborative learning, realistic tasks, written assignments, and problem-based learning. A balanced approach of teacher-led instruction, collaborative learning, and independent practice will be used to reinforce these skills. • To give students multiple ways to demonstrate the essential skills being assessed, the following types of assessments will be provided: written and online assessments, in-lab activity by performing experiments, lab report, lab tests, and examination.

Prior Learning Assessment & Recognition (PLAR)

Prior Learning Assessment and Recognition (PLAR) is the formal evaluation and credit-granting process whereby candidates may obtain credits for prior learning. Prior learning includes the knowledge competencies and skills acquired, in both formal and informal ways, outside of post-secondary education. Candidates may have their prior learning evaluated against the course learning outcomes as defined in the course outline.

To find out if this course is eligible for PLAR, and how this learning would be assessed, please contact the Program Coordinator for more details.

Academic Regulations

It is the student's responsibility to be aware of the College Academic Regulations. The Academic Regulations apply to all applicants to Humber and all current students enrolled in any program or course offered by Humber, in any location. Information about academic appeals is found in the **Academic Regulations**.

Anti-Discrimination Statement

At Humber College, all forms of discrimination and harassment are prohibited. Students and employees have the right to study, live and work in an environment that is free from discrimination and harassment. If you need assistance on concerns related to discrimination and harassment, please contact the Centre for Human Rights, Equity and Inclusion or the Office of Student Conduct.

Accessible Learning Services

Humber strives to create a welcoming environment for all students where equity, diversity and inclusion are paramount. Accessible Learning Services facilitates equal access for students with disabilities by coordinating academic accommodations and services. Staff in Accessible Learning Services are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. If you require academic accommodations, contact:

Accessible Learning Services

North Campus: (416) 675-6622 X5090

Lakeshore Campus: (416) 675-6622 X3331

Academic Integrity

Academic integrity is essentially honesty in all academic endeavors. Academic integrity requires that students avoid all forms of academic misconduct or dishonesty, including plagiarism, cheating on tests or exams or any misrepresentation of academic accomplishment.

Disclaimer

While every effort is made by the professor/faculty to cover all material listed in the outline, the order, content, and/or evaluation may change in the event of special circumstances (e.g. time constraints due to inclement weather, sickness, college closure, technology/equipment problems or changes, etc.). In any such case, students will be given appropriate notification in writing, with approval from the Dean (or designate) of the School.

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