HUMBER

Course Outline

Course Name: Electrical Circuit Analysis (ELEC 250)

Academic Period: 2023 - 2024

Faculty:

Faculty Availability:

Associate Dean:
Shaun Ghafari
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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:	Electrical Circuit Analysis (ELEC 250)
Pre-Requisites	ELEC 211
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
Professionalism
Strategic Problem-Solving

Course Description

The operating principles of three-phase transformers and their construction will be explained. Various types of connections including phase shift, transformation ratio, and voltage ratio will be explained. Delta-wye connection and their applications will also be discussed with examples. Parallel operation of transformers to share the load will be explained. Circuit analysis techniques will be discussed by defining general nodes, principal nodes, branch and loop/mesh, and these terms will be applied to perform the mesh and nodal analysis. Finally, power factor correction studies for industrial power systems will be discussed with practical examples.

Course Rationale

This course provides expanded knowledge about the construction, connections, and functioning of three-phase transformers by addressing the challenges in the analysis of electrical circuits. Loop/mesh and nodal analysis together with power factor correction studies are discussed with practical examples. The course uses the skills and knowledge, which have been gained from DC Equipment and Control and Power Systems 1 courses in the program. The knowledge gained by students will be helpful in choosing and completing good capstone projects.

Course Learning Method(s)

- Action Learning
- Problem Based Learning (PBL)
- Lecture

Learning Outcomes

- Describe the basic properties, construction and KVA rating and transformation ratio to analyze the three-phase transformers.
- Sketch Delta and WYE connections of three-phase transformers windings by considering their combination.
- Perform calculation of line and phase currents of three-phase transformers by explaining appropriate vector diagrams.
- Identify the polarity markings of three-phase transformer windings by considering the transformer terminal markings and direction of the coil windings.
- Explain the difference between un-matching and matching transformer condition in parallel operation condition.
- Describe terminologies related to general nodes, principle nodes, branch and loop/mesh to perform circuit design and analysis techniques.
- Perform the mesh and nodal analysis of electrical circuits based on systematic application of Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL).
- Define the terms power factor, active and reactive power factor and related trigonometric functions to understand the concept of power factor correction in industrial power systems.

Assessment Weighting

Assessment	Weight
Final Exam	
Test 2	30%
In-class Activity	
Tutorial Assignments	20%
Quiz	
Quizzes	20%
Midterm Exam	
Test 1	30%
Total	**100%**

Modules of Study

Module	Course Learning Outcomes	Resources	Assessments
Three-phase Transformers Properties	• Describe the basic properties, construction and KVA rating and transformation ratio to analyze the three-phase transformers.	• Textbook (Alexander, Chapter 13) • Textbook (Wildi, Chapter 12) • Lecture Notes	• Test 1 • Quizzes • Tutorial Assignments
Three-phase Transformers Configurations	• Sketch Delta and WYE connections of three-phase transformers windings by considering their combination. • Perform calculation of line and phase currents of three-phase transformers by explaining appropriate vector diagrams.	• Textbook (Alexander, Chapter 12 & 13) • Textbook (Wildi, Chapter 12) • Lecture Notes	• Test 1 • Quizzes • Tutorial Assignments
Three-phase Transformers Operation	• Identify the polarity markings of three-phase transformer windings by considering the transformer terminal markings and direction of the coil windings. • Explain the difference between un-matching and matching transformer condition in parallel operation condition.	• Textbook (Alexander, Chapter 13) • Textbook (Wildi, Chapter 12) • Lecture Notes	• Quizzes • Tutorial Assignments • Test 2

Module	Course Learning Outcomes	Resources	Assessments
Basic Concepts of Electrical Circuits	• Describe terminologies related to general nodes, principle nodes, branch and loop/mesh to perform circuit design and analysis techniques.	• Textbook (Alexander, Chapter 2 & 13) • Lecture Notes	• Quizzes • Tutorial Assignments • Test 2
Methods of Analysis	• Perform the mesh and nodal analysis of electrical circuits based on systematic application of Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL).	• Textbook (Alexander, Chapter 3 & 13) • Lecture Notes	• Quizzes • Tutorial Assignments • Test 2
Power Analysis	• Define the terms power factor, active and reactive power factor and related trigonometric functions to understand the concept of power factor correction in industrial power systems.	• Textbook (Alexander, Chapter 11) • Textbook (Wildi, Chapter 7) • Lecture Notes	• Quizzes • Tutorial Assignments • Test 2

Required Resources

Alexander, C. K. & Sadiku, M. N. O. (2021) *Fundamentals of Electric Circuits*, (7th Ed.) McGraw-Hill

Wildi, T. (2006) *Electrical Machines, Drives and Power Systems*, (6th Ed.) Englewood Cliffs, N.J. Prentice-Hall.

Supplemental Resources

Richardson, D. V. & Caisse, A. J. (1997). *Rotating Electrical Machinery and Transformer Technology* (4th Ed.). Upper Saddle River, NJ: Prentice-Hall.

Glover, J. D. & Sarma, M. S. & Overbye, T. J. (2012) *Power System Analysis and Design – SI Units* (6th Ed.). Nelson Education Ltd.

Gungor, B. R. (1988). *Power Systems.* Harcourt Brace Jovanovich Inc.

Essential Skills

Section	Skills	Measurement	Details
Communication	• Reading • Writing • Speaking • Listening • Presenting	Reinforce and measure	• Communicate clearly, concisely, and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience. Respond to written, spoken, or visual messages in a manner that ensures effective communication. • A combination of summative and formative assessments, such as tests, quizzes, tutorial assignments, and presentations has been applied to evaluate the learners.
Numeracy	• Understanding and applying mathematical concepts and reasoning • Analyzing and using numerical data	Teach and measure	• Execute mathematical operations accurately. • A combination of summative and formative assessments, such as tests, quizzes, tutorial assignments, and presentations has been applied to evaluate the learners.
Critical Thinking and Problem-Solving	• Analysing • Synthesizing • Decision-Making	Reinforce and measure	• Apply a systematic approach to solve problems. Use a variety of thinking skills to anticipate and solve problems. • A combination of summative and formative assessments, such as tests, quizzes, tutorial assignments, and presentations has been applied to evaluate the learners.
Interpersonal Skills	• Teamwork • Relationship management • Conflict resolution	Reinforce and measure	• Show respect for diverse opinions, values belief systems, and contributions of others. Interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals. • A combination of summative and formative assessments, such as tests, quizzes, tutorial assignments, and presentations has been applied to evaluate the learners.
Personal Skills	• Managing self • Managing change and being flexible and adaptable • Engaging in reflective practice • Demonstrating personal responsibility	Reinforce and measure	• Manage the use of time and other resources to complete projects. Take responsibility for one's own actions, decisions, and consequences. • A combination of summative and formative assessments, such as tests, quizzes, tutorial assignments, and presentations has been applied to evaluate the learners.

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 knowledge, skills and competencies evaluated against the learning outcomes as defined in the course outline. Please review the Assessment Methods Glossary for more information on the Learning Portfolio assessment methods identified below.

The method(s) that are used to assess prior learning for this course may include:

- Challenge Exam (results recorded as a % grade and added to student's CGPA)
- Learning Portfolio (results reflected as SAT and not added to student's CGPA)
- Skills Test

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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