HUMBER

Course Outline

Course Name: Advanced Programmable Logic Controllers (ELEC 253)

Academic Period: 2023 - 2024

Faculty:

Faculty Availability:

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

Schedule Type Code:

GREEN COURSE

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:	Advanced Programmable Logic Controllers (ELEC 253)
Pre-Requisites	ELEC 209
Co-Requisites	none
Equates	none
Restrictions	none
Credit Value	3
Total Course Hours	42

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
- Communication
- Digital Fluency
- Professionalism
- Strategic Problem-Solving

Course Description

This course is designed to expand the studentsâ□□ knowledge and use of advanced addressing and features of PLCs referenced to IEC 61131 programming standards. The course will introduce students to the use of multiple user files within the processor memory, data manipulation and analog signals complete with scaling. The students will program, monitor and troubleshoot application programs in the discrete and analog configurations. Computer software will be used throughout the course for configuration, development, editing, documentation and monitoring of the application programs. Programming logic controllers to be studied are Allen-Bradley Compact Logix and SLC series, Omron CJ1M.

Course Rationale

PLC's are designed to operate with digital as well as analog inputs and outputs applied to control industrial processes including sequential relay control, motion control, process control, and distributed control systems. Because of their popularity in industry applications, it becomes increasingly more important to learn skills related to different manufacturers devices.

Course Learning Method(s)

- Lecture

Learning Outcomes

- Analyze all outcomes to the Programming Standard IEC 61131-3 as applied to PLC's.
- Interpret the differences between File (Table) Shifting instructions, FIFO Load and Unload instructions, and Sequencer instructions in simple discrete programs
- Comply the documentation regarding the programming software for communication with PLC's, the common operating modes found in PLC's, and the layout of the processor memory
- Demonstrate the user application program files within the processor memory by designing simple programs using multiple application program files
- Study analog signals when applied to PLC's
- Compare the Input and Output PLC modules available for analog signals, wiring, and power requirements for analog input and output signals
- Evaluate the relationship of the decimal representation to the analog signal in the processor and the memory storage areas for analog input and output signals.
- Calculate scaling as applied to analog input and output signals

- Apply the configuration procedures for an analog signal for different PLC manufacturers
- Compare other PLC programming languages in compliance with IEC 61131-3 such as structured text, sequential chart and function block diagram
- Evaluate the preventative procedures to be undertaken with PLC systems

Assessment Weighting

Assessment	**Weight**
Final Exam	
Final Exam	35%
In-class Activity	
Lab - In process Evaluation	30%
Midterm Exam	
Mid-term Exam	35%
Total	**100%**

Modules of Study

Module	**Course Learning Outcomes**	**Resources**	**Assessments**
Review of PLC programming standards, architecture, and configuration. Introduction to the Analog signals processed by PLCs	• Analyze all outcomes to the Programming Standard IEC 61131-3 as applied to PLC's. • Comply the documentation regarding the programming software for communication with PLC's, the common operating modes found in PLC's, and the layout of the processor memory	Class notes, lab notes, and Blackboard course notes	• Mid-term Exam • Lab - In process Evaluation
Sequencers instruction(s)	• Interpret the differences between File (Table) Shifting instructions, FIFO Load and Unload instructions, and Sequencer instructions in simple discrete programs • Comply the documentation regarding the programming software for communication with PLC's, the common operating modes found in PLC's, and the layout of the processor memory	Class notes, lab notes, and Blackboard course notes	• Mid-term Exam • Lab - In process Evaluation

Module	Course Learning Outcomes	Resources	Assessments
File (Table) shifting, FIFO, and LIFO instructions	• Interpret the differences between File (Table) Shifting instructions, FIFO Load and Unload instructions, and Sequencer instructions in simple discrete programs • Comply the documentation regarding the programming software for communication with PLC's, the common operating modes found in PLC's, and the layout of the processor memory	Class notes, lab notes, and Blackboard course notes	• Mid-term Exam • Lab - In process Evaluation
Multiple program files and configuration of analog signals with PLCs	• Comply the documentation regarding the programming software for communication with PLC's, the common operating modes found in PLC's, and the layout of the processor memory • Demonstrate the user application program files within the processor memory by designing simple programs using multiple application program files	Class notes, lab notes, and Blackboard course notes	• Mid-term Exam • Lab - In process Evaluation
Analog signal scaling in engineering unit and wiring diagrams	• Study analog signals when applied to PLC's • Compare the Input and Output PLC modules available for analog signals, wiring, and power requirements for analog input and output signals • Evaluate the relationship of the decimal representation to the analog signal in the processor and the memory storage areas for analog input and output signals.	Class notes, lab notes, and Blackboard course notes	• Mid-term Exam • Lab - In process Evaluation
Introduction to CompactLogix PLCs	• Compare the Input and Output PLC modules available for analog signals, wiring, and power requirements for analog input and output signals • Evaluate the relationship of the decimal representation to the analog signal in the processor and the memory storage areas for analog input and output signals. • Apply the configuration procedures for an analog signal for different PLC manufacturers	Class notes, lab notes, and Blackboard course notes	• Lab - In process Evaluation • Final Exam

Module	Course Learning Outcomes	Resources	Assessments
Analog signal configuration with CompactLogix PLCs	• Compare the Input and Output PLC modules available for analog signals, wiring, and power requirements for analog input and output signals • Evaluate the relationship of the decimal representation to the analog signal in the processor and the memory storage areas for analog input and output signals. • Calculate scaling as applied to analog input and output signals	Class notes, lab notes, and Blackboard course notes	• Lab - In process Evaluation • Final Exam
Introduction to Function Block and Sequential Chart Programming with PLCs	• Comply the documentation regarding the programming software for communication with PLC's, the common operating modes found in PLC's, and the layout of the processor memory • Compare other PLC programming languages in compliance with IEC 61131-3 such as structured text, sequential chart and function block diagram • Evaluate the preventative procedures to be undertaken with PLC systems	Class notes, lab notes, and Blackboard course notes	• Lab - In process Evaluation • Final Exam
Introduction to Structured Text Programming with PLCs.	• Comply the documentation regarding the programming software for communication with PLC's, the common operating modes found in PLC's, and the layout of the processor memory • Compare other PLC programming languages in compliance with IEC 61131-3 such as structured text, sequential chart and function block diagram • Evaluate the preventative procedures to be undertaken with PLC systems	Class notes, lab notes, and Blackboard course notes	• Lab - In process Evaluation • Final Exam

Module	Course Learning Outcomes	Resources	Assessments
Introduction to Omron PLCs	• Compare the Input and Output PLC modules available for analog signals, wiring, and power requirements for analog input and output signals • Evaluate the relationship of the decimal representation to the analog signal in the processor and the memory storage areas for analog input and output signals. • Apply the configuration procedures for an analog signal for different PLC manufacturers	Class notes, lab notes, and Blackboard course notes	• Lab - In process Evaluation • Final Exam

Essential Skills

Section	Skills	Measurement	Details
Communication	• Reading • Listening • Presenting	Reinforce and measure	• Respond to written, spoken, or visual messages in a manner that ensures effective communication. • Tests, assignments, reports, and presentations.
Numeracy	• Understanding and applying mathematical concepts and reasoning • Analyzing and using numerical data	Teach and measure	• Execute mathematical operations accurately. • Tests, assignments, reports, and presentations.
Critical Thinking and Problem-Solving	• Synthesizing • Decision-Making • Creative and Innovative Thinking	Reinforce and measure	• Use a variety of thinking skills to anticipate and solve problems. • Tests, assignments, reports, and presentations.
Information Management	• Gathering and managing information • Selecting and using appropriate tools and technology for a task or project	Reinforce and measure	• Locate, select, organize, and document information using appropriate technology and information systems. • Tests, assignments, reports, and presentations.
Interpersonal Skills	• Teamwork • Conflict resolution • Networking	Reinforce and measure	• Interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals. • Tests, assignments, reports, and presentations.

Section	Skills	Measurement	Details
Personal Skills	• Engaging in reflective practice • Demonstrating personal responsibility	Reinforce and measure	• Take responsibility for one's own actions, decisions, and consequences. • Tests, assignments, reports, presentations.

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:

- Learning Portfolio (results reflected as SAT and not added to student's CGPA)

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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