HUMBER

Course Outline

Course Name: Communications and PLC Network Systems (ELEC 323)

Academic Period: 2023 - 2024

Faculty:

Faculty Availability:

Associate Dean:
Shaun Ghafari
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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:	Communications and PLC Network Systems (ELEC 323)
Pre-Requisites	ELEC 253
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.

- Systems Thinking
- Critical Thinking
- Communication
- Digital Fluency
- Professionalism

Course Description

The course deals with the communication between computers and programmable logic controllers and between programmable logic controllers for system operation and control. The function of and operation of reading and writing between PLCs for use in industrial applications is analyzed and implemented. Communications between PLCs and computers through serial communications, data highways and the ethernet with various programming techniques will be addressed and applied with reference to IEC 61131-3 programming standards. Programming with discrete and analog signals will be implemented. Communication and network details of a DeviceNet Network will also be covered in this course. Programmable logic controllers to be studied are Allen-Bradley Compact Logix and SLC series, Omron CJ1M.

Course Rationale

Machine condition monitoring and controlling, high-speed measurements, and custom vision applications are a few examples of typical communication between systems. This communication is extremely important to allow separate parts of a complex process to have individual control while allowing the subsystems to co-ordinate over the communication links.

Course Learning Method(s)

- Lecture

Learning Outcomes

- Analyze all outcomes to the Programming Standard IEC 61131-3 as applied to PLC's by demonstrating the various types and uses of communication systems.
- Specify data communications media used with PLCs including cables, connectors/interfaces, and terminators
- Determine PLC network topologies and configurations .
- Synthesize configuration procedures for data communications applications using networking software
- Calculate the number of subnetworks and the number of hosts per subnetwork .
- Analyze the difference between IP and Global (MAC) Addresses and the difference between Static and Dynamic IP Addressing.
- Examine maximum limits for data transfer rates, network segments and drop line lengths
- Select data communications equipment including hubs, bridges, switches, routers, and gateways
- Apply a variety of data communications protocols linking controllers with field devices and other controllers
- Configure communication software and equipment (PLCs) to collect industrial data from machines to be interpreted by business software systems

Assessment Weighting

Assessment	Weight
Quiz	
Quizzes	20%
Final Exam	
Final Exam	30%
In-class Activity	
Lab Experiments	30%
Midterm Exam	
Mid-term Exam	20%
Total	**100%**

Modules of Study

Module	Course Learning Outcomes	Resources	Assessments
Introduction to Networks	- Analyze all outcomes to the Programming Standard IEC 61131-3 as applied to PLC's by demonstrating the various types and uses of communication systems. - Specify data communications media used with PLCs including cables, connectors/interfaces, and terminators	Class notes, lab notes, and Blackboard course notes	- Mid-term Exam - Lab Experiments - Quizzes
Data Communications Basic Synchronization Concepts, Encoding Methods, Communication Standards	- Analyze all outcomes to the Programming Standard IEC 61131-3 as applied to PLC's by demonstrating the various types and uses of communication systems. - Synthesize configuration procedures for data communications applications using networking software	Class notes, lab notes, and Blackboard course notes	- Mid-term Exam - Lab Experiments - Quizzes

Module	Course Learning Outcomes	Resources	Assessments
Data Highways Communication Systems, Allen-Bradley RSLinx, Allen-Bradley DH485 and DH+ Protocols	• Determine PLC network topologies and configurations . • Synthesize configuration procedures for data communications applications using networking software • Examine maximum limits for data transfer rates, network segments and drop line lengths	Class notes, lab notes, and Blackboard course notes	• Mid-term Exam • Lab Experiments • Quizzes
Network Topologies	• Determine PLC network topologies and configurations . • Configure communication software and equipment (PLCs) to collect industrial data from machines to be interpreted by business software systems	Class notes, lab notes, and Blackboard course notes	• Mid-term Exam • Lab Experiments • Quizzes
DeviceNet Network, Features and advantages, Node Commissioning, Scan List, and I/O Mapping	• Specify data communications media used with PLCs including cables, connectors/interfaces, and terminators • Synthesize configuration procedures for data communications applications using networking software	Class notes, lab notes, and Blackboard course notes	• Mid-term Exam • Lab Experiments • Quizzes
Network Interface Cards. Tasks, principle of operation, MAC addresses	• Analyze the difference between IP and Global (MAC) Addresses and the difference between Static and Dynamic IP Addressing. • Examine maximum limits for data transfer rates, network segments and drop line lengths	Class notes, lab notes, and Blackboard course notes	• Lab Experiments • Final Exam • Quizzes
Ethernet Elements, Implementations, Access Methods, IEEE Standards. Medium, General Characteristics	• Analyze all outcomes to the Programming Standard IEC 61131-3 as applied to PLC's by demonstrating the various types and uses of communication systems. • Specify data communications media used with PLCs including cables, connectors/interfaces, and terminators • Examine maximum limits for data transfer rates, network segments and drop line lengths	Class notes, lab notes, and Blackboard course notes	• Lab Experiments • Final Exam • Quizzes
OSI Model, Description, Types of Protocol Stacks, Implementation to Industrial Networks	• Apply a variety of data communications protocols linking controllers with field devices and other controllers	Class notes, lab notes, and Blackboard course notes	• Lab Experiments • Final Exam • Quizzes

Module	Course Learning Outcomes	Resources	Assessments
Ethernet Protocols, TCP/IP, Ethernet PLC Modules. BOOTP and PING Protocols with PLC's.	• Analyze all outcomes to the Programming Standard IEC 61131-3 as applied to PLC's by demonstrating the various types and uses of communication systems. • Apply a variety of data communications protocols linking controllers with field devices and other controllers	Class notes, lab notes, and Blackboard course notes	• Lab Experiments • Final Exam • Quizzes
IP Addressing, Classes, Classless Addressing, Subnet Mask and Prefixes	• Synthesize configuration procedures for data communications applications using networking software • Calculate the number of subnetworks and the number of hosts per subnetwork . • Analyze the difference between IP and Global (MAC) Addresses and the difference between Static and Dynamic IP Addressing.	Class notes, lab notes, and Blackboard course notes	• Lab Experiments • Final Exam • Quizzes
Enlarging Networks, Repeater/Hub, Bridge/Switch, Router, and Gateway	• Select data communications equipment including hubs, bridges, switches, routers, and gateways	Class notes, lab notes, and Blackboard course notes	• Lab Experiments • Final Exam • Quizzes

Essential Skills

Section	Skills	Measurement	Details
Communication	• Writing • Speaking • Visual Literacy	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. • Tests, assignments, reports, presentations.
Numeracy	• Understanding and applying mathematical concepts and reasoning • Analyzing and using numerical data	Teach and measure	• Execute mathematical operations accurately. • Tests, assignments, reports, 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, presentations.

Section	Skills	Measurement	Details
Information Management	• Gathering and managing information • Selecting and using appropriate tools and technology for a task or project • Computer literacy	Reinforce and measure	• Locate, select, organize, and document information using appropriate technology and information systems. • Tests, assignments, reports, 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, presentations.
Personal Skills	• Managing self • Managing change and being flexible and adaptable	Reinforce and measure	• Manage the use of time and other resources to complete projects. • 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)
- Learning statement
- Current resume
- Skills Test
- Interview

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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See the **Humber Libraries website** for additional information regarding copyright and for details on allowable limits.

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