HUMBER

Course Outline

Course Name: Sensors and Actuators (ELEC 255)

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:	Sensors and Actuators (ELEC 255)
Pre-Requisites	TECH 150 & 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

Course Description

This course provides an introduction to sensors and actuators used in electrical and pneumatic industrial applications. The topics include sensing principles for the measurement of motion, force, torque, pressure, flow, and temperature using analog and digital transducers as well as actuating principles for control valves, continuous drive actuators, and stepper motors. In addition, the students will become familiar with the basic fundamentals of pressure controlled ON-OFF valves and actuators. Various components will be experimentally tested and analyzed.

Course Rationale

The application of the electronic control devices along with the measuring devices of nonelectrical physical variables is an essential part of any engineering project. Based on the fundamentals of electric measurements and electronics basics, this course will provide the students with more practical experience in the field of instrumentation as well as allow them to use these devices in variety of process control applications.

Course Learning Method(s)

- Case Based Learning
- Lecture

Learning Outcomes

- Interpret the operation of a basic measuring instruments in control system
- Select analog and discrete measuring instruments for specific type of process control
- Select proper control relays, timers and counters for variety of applications
- Calibrate instruments designed to measure a force, pressure, position and velocity in industrial processes
- Use speed and position measurements instruments to the purpose of motion control
- Apply pressure measuring and regulating devices in control applications
- Perform scaling of different analog sensors based on the specifications
- Apply directional control valves in control applications
- Perform pneumatic and electrical actuator control by using PLC programming techniques
- Use Load Cells for pressure measurement

Assessment Weighting

Assessment	Weight
Final Exam	
Test#2	35%
Midterm Exam	
Test#1	35%
In-class Exercise	
Lab assignment	30%
Total	**100%**

Modules of Study

Module	Course Learning Outcomes	Resources	Assessments
Module 1: Instrumentation and Control Applications	• Interpret the operation of a basic measuring instruments in control system	Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Lab assignment • Test#1
Module 2: Relays; Multifunctional digital Timers and Counters	• Select analog and discrete measuring instruments for specific type of process control • Select proper control relays, timers and counters for variety of applications	Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Lab assignment • Test#1
Module 3: Proximity Sensors	• Select analog and discrete measuring instruments for specific type of process control • Perform pneumatic and electrical actuator control by using PLC programming techniques	Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Lab assignment • Test#1
Module 4: Motor Control, Rotary Speed and Position Measurements	• Use speed and position measurements instruments to the purpose of motion control • Perform scaling of different analog sensors based on the specifications	Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Lab assignment • Test#1

Module	Course Learning Outcomes	Resources	Assessments
Module 5: Linear Position Measurement	• Use speed and position measurements instruments to the purpose of motion control • Perform scaling of different analog sensors based on the specifications	Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Lab assignment • Test#1
Module 6: Fundamentals of Pneumatics	• Apply pressure measuring and regulating devices in control applications • Perform pneumatic and electrical actuator control by using PLC programming techniques	Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Test#2 • Lab assignment
Module 7: Pressure Measurement Instruments	• Calibrate instruments designed to measure a force, pressure, position and velocity in industrial processes • Apply pressure measuring and regulating devices in control applications • Perform scaling of different analog sensors based on the specifications	Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Test#2 • Lab assignment
Module 8: Pneumatic Actuators, ON/OFF Directional Valves	• Apply directional control valves in control applications • Perform pneumatic and electrical actuator control by using PLC programming techniques	Rehg, J.A., Sartori, G.J. (2006). Industrial Electronics. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Test#2 • Lab assignment
Module: 9 Tension and Force measurement	• Perform pneumatic and electrical actuator control by using PLC programming techniques • Use Load Cells for pressure measurement	Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.	• Test#2 • Lab assignment

Required Resources

Rehg, J.A., Sartori, G.J. (2006). *Industrial Electronics*. Upper Saddle River, New Jersey: Pearson Prentice Hall.

Supplemental Resources

Weedon, T.A., Kirk, Ph., Kirk, F.W. (2019). *Instrumentation and Process Control (7th Ed.)*. Orland Park, Illinois: American Technical Publishers.

Manufacturer's documentation, manuals and user guides.

Additional Tools and Equipment

- Not required

Essential Skills

Section	Skills	Measurement	Details
Communication	• Reading • Writing • Speaking • Presenting • Visual Literacy	Teach and measure	• Through lecturing and practical activities in the laboratory • Through lab assignments and tests
Numeracy	• Understanding and applying mathematical concepts and reasoning • Analyzing and using numerical data • Conceptualizing	Teach and measure	• Through lecturing, lab activities, discussions, case studies • Through lab assignments and tests
Critical Thinking and Problem-Solving	• Analysing • Evaluating • Decision-Making	Teach and measure	• Through lecturing, lab activities, discussions • Through lab assignments and tests
Information Management	• Gathering and managing information • Selecting and using appropriate tools and technology for a task or project • Computer literacy • Internet skills	Teach and measure	• Through lecturing, lab activities, discussions • Through lab assignments and tests
Interpersonal Skills	• Teamwork • Conflict resolution	Reinforce and measure	• Through lab activities • Through lab assignments
Personal Skills	• Managing self • Managing change and being flexible and adaptable • Engaging in reflective practice • Demonstrating personal responsibility	Reinforce and measure	• Through lab activities • Through lab assignments

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
- 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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