Faculty: Mehrdad Iravani, Ph.D., Saeid Khosravani, Ph.D., Livingston Chim

Program Coordinator(s): Savdulla Kazazi, Ph.D., P. Eng.

Associate Dean: Shaun Ghafari, Ph.D., P. Eng.

Course Outline

Academic Year: 2020/2021

Course Name: Introduction to Robotics (ELEC 108)

Land Acknowledgement

Humber College is located in Adobigok, known as "Place of the Black Alders" in the Ojibwe Anishinaabe language. It is uniquely situated along GabeKanang Ziibi, the Humber River providing an integral connection for Indigenous peoples between the northern shore of Lake Ontario and the Lake Simcoe Georgian Bay region. In Honouring the Land, we are walking in the moccasin tracks of our ancestors and leaving our footprints for the future generations to come.

Faculty	Faculty of Applied Sciences and Technology
Program	Electrical Engineering Technology – Control Systems
Course Name:	ELEC 108 - Introduction to Robotics
Pre-Requisite(s)	None
Co-Requisite(s)	None
Pre-Requisite(s) for	
Equates	None

Restrictions	None
Credit Value	3
Total Course Hours	42

Developed By: Mehrdad Iravani, Ph.D., **Approved by:** 

Course Description

This course covers robotics and industrial automation fundamentals, including system configurations, applications, methods of power transmission, and types of control, tooling and interfacing with peripherals. In addition, there are 'hands-on' assignments using industrial robots in the laboratory. Students get hands-on experience with common Industrial robots such as: Fanuc, Kuka, and ABB.

Course Rationale

This course gives students hands-on experience with industrial robots currently used in industry.

Program Learning Outcomes Emphasized in this Course:

Electrical Engineering Technician/Technology Program

1. Analyze, interpret, and produce electrical, electronic, and mechanical drawings and other related documents and graphics as necessary for electromechanical design.
2. Select and use a variety of troubleshooting techniques and test equipment to assess electromechanical circuits, equipment, processes, systems and subsystems.
3. Analyze, program, install, integrate, and troubleshoot automated systems including robotic systems.
4. Establish and maintain inventory, records and documentation systems.
5. Perform all work in accordance with relevant law, policies, codes, regulations, safety procedures, and standard shop practices.

Essential Employability Skills Emphasized in this Course:

Communication Skills	X
Critical Thinking and Problem Solving	X
Interpersonal	X
Numeracy	X
Information Management	X
Personal	X

Course Format(s)

This course is a face to face course, with three classroom hours per week. There is a lecture and laboratory component.

Course Learning Outcomes

Upon successful completion of this course, students will be able to

1. Explain the elements of automated manufacturing systems and Robotic role in industrial automation including Safety and general specifications which are commonly used in robotic industry.
2. Differentiate Industrial robotic arms and their classifications based on robotic joints, degrees of freedom, and redundancy.
3. Program the multiple industrial robots for simple and intermediate level of production tasks in the laboratory, including: Power up, Initialize, Manually Operate, and Shut down the Robot systems.
4. Describe the most common configurations of the robotic control system; identify each element of a robotic control system with their specifications.
5. Describe the Work Cell Interface subsystem, including types of sensors, vision system components, safety features, and using robot I/O to interface robots and other devices in the Work Cell.
6. Demonstrate the basic type of robotic sensors and their integration with robotic arm and as well as the cell environment; identify advantages and disadvantages of each type of sensors.
7. Classify different types of robotic actuators and their specifications to control the speed and direction of robotic arm; identify advantages and disadvantages of each type of actuators.
8. Describe most common configurations of the end-of-arm tooling subsystem; identify advantages and disadvantages of each configuration.
9. Describe the collaborative Robots and the basic features of collaborative robots including safety features and vision system.

10. Demonstrate the integration of robotic arms in advanced manufacturing; including robotic accuracy, resolution and repeatability

Assessment Weighting
Given the circumstances due to COVID-19, Humber reserves the right to alter the mode of delivery and examinations/assessments in this course.

Assessment	**Weight**
2 Practical Lab Exams	40%
Lab Performance- Lab Reports and Performance Evaluation During Labs	30%
In class Quizzes	10%
2 Theory Exams	20%
Total	**100%**

Modules of Study

Module and topic	**Resources**	**Assessments**
Module 1: Robotic Introduction Industrial Robots Type of Automation & Basic Terminologies	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Mid-Term Exam 2. Assessment by Evaluation of Lab Experiments
Module 2: Robots Fundamentals Parts of Robot Degrees of Freedom Type and Configuration	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Mid-Term Exam 2. Assessment by Evaluation of Lab Experiments
Module 3: Robotic Motion & Robot Programming	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Mid-Term Exam 2. Assessment by Evaluation of Lab Experiments
Module 4: Continue Robotic Motion & Robotic Control System	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Mid-Term Exam 2. Assessment by Evaluation of Lab Experiments
Module 5: Continue Robotic Control System	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Mid-Term Exam 2. Assessment by Evaluation of Lab Experiments

Module 6: Robotic Sensors	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Final Exam 2. Assessment by Evaluation of Lab Experiments
Module 7: Continue Robotic Sensors, Sensors Absolute and Incremental encoders	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Final Exam 2. Assessment by Evaluation of Lab Experiments
Module 8: Robotic Actuators Drive Actuators Rotary Motion Systems	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Final Exam 2. Assessment by Evaluation of Lab Experiments
Module 9: Continue Robotic Actuators Drive Actuators Rotary Motion Systems	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Final Exam 2. Assessment by Evaluation of Lab Experiments
Module 10: Tool Frames & End Effectors	Class notes, lab notes, and Blackboard course notes	1. Assessment by Examination through Final Exam 2. Assessment by Evaluation of Lab Experiments

Please note: this course schedule may change as resources and circumstances require.

Required Resources, Tools and/or Equipment:

Class notes and lab manual will be provided by professor.

Supplemental Resources:

- Information and required readings posted to Blackboard.
- Supplementary Book:

Title: Robotics (Theory and Industrial Applications)

- Authors: Larry T. Ross, Stephen W. Fardo, James W. Masterson, Robert L. Towers
- Publisher: The Goodheart- Willcox Company, Inc. Tinley Park, Illinois
- Edition: 3rd edition / 2nd Edition
- ISBN: 978-1-60525-321-3

Additional Tools and Equipment

None

Prior Learning Assessment and Recognition (PLAR)

Students who have prior learning in the material of this course may be eligible for a course credit in recognition of their prior learning. The following table indicates the method that is used to assess prior learning for this course, or it indicates that such an assessment is not

available. Students must apply for consideration for a prior learning assessment through the Office of the Registrar, and there is usually a fee associated with the application.

Portfolio	Challenge Exam	Skills Test	Interview	Other (Specify)	Not Available For PLAR
×	☐	☐	☐	☐	☐

Policies and Procedures
It is the student's responsibility to be aware of their obligations under Humber Policies and Procedures.

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.

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: http://www.humber.ca/student-life/swac/accessible-learning
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.

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