CANADORE college

COURSE NAME: AMD220 Robotics and Automation

Credit Value:	3
Total Course Hours:	42
Prerequisite Course(s):	None
Corequisite Course(s):	None

COURSE DESCRIPTION

Students will be able to analyze, design, and implement robotic and automation systems, applying principles of kinematics, dynamics, trajectory planning, and programming to solve real-world industrial and manufacturing problems using both simulated and physical robotic platforms.

LAND ACKNOWLEDGEMENT

Canadore College resides on the traditional territory of the Anishinaabeg and within lands protected by the Robinson Huron Treaty of 1850. This land is occupied by the people of Nipissing First Nation since time immemorial.

PLAR INFORMATION

This course is eligible for Prior Learning Assessment and Recognition. Students are advised to discuss options with their program coordinator.

COURSE LEARNING OUTCOMES

Upon completion of this course, the student will have reliably demonstrated the ability to:

1.0 Apply the foundational concepts, classifications, and applications of robotic systems.

- 1.1 Describe the history, evolution, and applications of robotics in various application.
- 1.2 Identify and explain the main components of a robotic system, including manipulators, controllers, actuators, and sensors.
- 1.3 Classify different types of robots based on configuration.
- 1.4 Compare the advantages and limitations of different robot types for specific tasks.

2.0 Evaluate forward kinematics using transformation matrices for robotic manipulators.

- 2.1 Define and compute the forward kinematics of a manipulators using Denavit-Hartenberg (D-H) parameters.
- 2.2 Apply transformation matrices to represent position and orientation of robot end-effectors.
- 2.3 Analyze the workspace of robotic arms based on joint constraints and configurations.
- 2.4 Solve real-world position and orientation problems using forward kinematics equations.

3.0 Develop inverse kinematics problems using analytical and numerical methods to determine joint configurations for desired end-effector positions.

- 3.1 Apply the inverse kinematics problem for common robot configurations.
- 3.2 Apply analytical and numerical techniques to solve inverse kinematics equations.
- 3.3 Analyze multiple possible solutions and select the most appropriate configuration based on task constraints.
- 3.4 Identify and handle singularities and joint limits in inverse kinematics solutions.

4.0 Model robotic dynamics and plan trajectories for different applications.

- 4.1 Explain different approaches to modeling robot dynamics.
- 4.2 Derive equations of motion for simple robotic manipulators.
- 4.3 Plan and generate joint-space and Cartesian-space trajectories based on dynamic constraints.
- 4.4 Evaluate the performance of trajectory

plans in terms of velocity, acceleration, and smoothness of motion.

5.0 Develop, simulate, and debug robotic programs using software environments.

5.1 Write and simulate robot control programs using a robotics software platform.

5.2 Use graphical and code-based interfaces to configure robotic paths and tasks.

5.3 Debug and refine robotic programs to achieve desired precision and repeatability.

6.0 Develop and execute robot programs on physical robotic systems.

6.1 Connect and configure a real robot using industrial or academic platforms.

6.2 Upload and execute pre-tested simulation programs onto the robot hardware.

6.3 Ensure safe operational procedures during robot execution in a physical environment.

6.4 Assess and troubleshoot discrepancies between simulated and real-world performance.

7.0 Design and implement basic automation systems using control components such as PLCs, sensors, and actuators.

7.1 Explain the fundamental principles of automation and its role in manufacturing systems.

7.2 Describe the function of common automation components including PLCs, actuators, and sensors.

7.3 Interpret and design basic ladder logic diagrams for automation control tasks.

7.4 Demonstrate the integration of mechanical, electrical, and control systems in an automated setup.

8.0 Design and evaluate robotic and automated solutions to enhance productivity and flexibility in manufacturing environments.

8.1 Analyze the role of robotics and automation in modern manufacturing systems.

8.2 Design robotic work cells for tasks such as assembly, welding, and material handling.

8.3 Evaluate the impact of robotics on productivity, safety, and cost-effectiveness in manufacturing.

8.4 Propose automation solutions for real manufacturing problems using robotics and sensor systems.

GENERAL EDUCATION

This is not a General Education course.

PROGRAM OUTCOMES

This course contributes to the following Ministry of Colleges and Universities approved program learning outcomes (PLO):

Advanced Manufacturing, Design & Management

2. Use technology to optimize processes and ensure quality in the manufacturing industry by integrating advanced technologies.

3. Use Quality Assurance and Quality Control procedures to optimize advanced manufacturing processes and product design.

EXTERNAL COURSE ACCREDITATIONS AND CONDITIONS

There are no external accreditations or conditions identified for this course.

COURSE EVALUATION

Evaluation Item	Weight
Assignments	30%

Quizzes	20%
Project	20%
Exam	30%

COURSE PASS GRADE

50

GRADING SYSTEM

A+:	90-100%	B+:	77-79%	C+:	65-69%	D:	50-54%	S - Satisfactory
A:	85-89%	B:	73-76%	C:	60-64%	F:	0-49%	I - Incomplete
A-:	80-84%	B-:	70-72%	D+:	55-59%			F- Repeat Course, included in GPA
								FS- Failure Supplemental
								FR- Repeat course, excluded from GPA

*For a complete chart of grades and descriptions, please see the Grading Policy.

LEARNING RESOURCES

Course Textbooks:

Recommended:

Title:	Robotics and Automation Handbook
Author:	Thomas R. Kurfess
Publisher:	CRC Press
Edition:	1st Edition
Print ISBN:	0849318041
eBook ISBN:	978-0849318047

Title:	Introduction to Robotics Mechanics and Control
Author:	John Craig
Publisher:	Pearson
Edition:	4th Edition
Print ISBN:	0133489795
eBook ISBN:	9780133489798

Additional Learning Resources:

Solidworks, Robot programming software, ABB Robot

Please see the Campus Bookstore to verify the current textbook costs and your program page for additional program fees and/or learning material requirements (see the "Tuition Fees" and "What You Need" sections).

Resources listed on the course outline support the achievement of learning outcomes, and may be used throughout the course to varying degrees depending on the instructor's teaching methodology and the nature of the resource.

Technology requirements - https://www.canadorecollege.ca/BYOD

The Harris Learning Library's staff can help you find resources to support your learning - https://www.canadorecollege.ca/harris-learning-library.

LEARNING ACTIVITIES

Classroom teaching, group activities, software demonstration and hands-on practice, robot experimentation

DELIVERY MODE

This course may be delivered, in whole or in part, in a number of modalities, including In-Person, Remote (synchronous and/or asynchronous), hybrid, or Hyflex, as per accreditation and/or regulatory standards where appropriate. This information is identified on the course schedule (student and faculty).

RECORDING GUIDELINES

This class may be recorded by faculty of the College. Faculty will inform students when recording of the class commences and ceases. 'Recorded' means that the audio-visual and chat portions of the class will be recorded and then be stored on the College or vendor provider server. They will be made available to students, but only for the express and sole use of those registered in this course. If you have any questions or concerns about this recording, please contact your instructor or the College's privacy officer at privacy.officer@canadorecollege.ca. Full recording guidelines can be found at: https://cdn.agilitycms.com/canadore-college/academic-centre-of-excellence/Canadore%20Recording%20Guidelines.pdf. Recordings are to be managed (or removed) as per the College's Recording Guidelines following the completion of the course.

EXPERIENTIAL LEARNING

All full-time programs of study at Canadore College strive to provide students with the opportunity for experiential learning. This course provides students with an experiential learning opportunity through:

Workplace/Lab Simulation (EL)
Formal Course Projects (EL)

ACADEMIC POLICIES

Canadore College is committed to the highest standards of academic integrity, and expects students to adhere to these standards as part of the learning process in all environments. The College's Academic Integrity policy

seeks to ensure that all students understand their rights and responsibilities in upholding academic integrity and that students receive an accurate and fair assessment of their work. Please review the Academic Integrity policy (A-18) and other academic policies found on our website: https://www.canadorecollege.ca/about/policies.

COLLEGE POLICIES

- Protecting human rights in support of a respectful college community

For college policies please see: http://www.canadorecollege.ca/about-us/college-policies.

Accessibility Learning Services for Students with Disabilities - Student Success Services

Student Success Services provides comprehensive support to students. We aim to ensure that all students have equal access to educational opportunities and can succeed in their academic journey. Our services focus on reducing and eliminating barriers related to education through individualized accommodations and support. If you are a student with a disability, we encourage you to register with Accessible Learning by completing the Student Success – Accessible Learning Services Form (https://canadorecollege-accommodate.symplicity.com/public_accommodation/).

For more detailed information about the services offered, please visit our webpage: https://isucceed.canadorecollege.ca/students. To connect with Student Success Services email studentsuccessnow@canadorecollege.ca or call 705.474.7600 ext 5205.

FIRST PEOPLES' CENTRE:

A culturally supportive and comfortable environment where you can study, socialize, and access a wide range of resources and confidential student focused services.

- Counselling services
- Elders on Campus and Cultural Advisors
- Cultural and Spiritual Wellness
- Peer tutoring/Peer Mentorship
- wholistic support network
- Social events and workshops on study skills, self-care & life skills

Drop by our offices at C254 College Drive, W103 Commerce Court or Call 705-474-7600 Ext. 5961

https://www.canadorecollege.ca/first-peoples-centre

WAIVER OF RESPONSIBILITY

Every attempt is made to ensure the accuracy of this information as of the date of publication. The college

reserves the right to modify, change, add, or delete content.

HISTORICAL COURSE OUTLINES

Students use course outlines to support their learning. Students are responsible for retaining course outlines for future use in applications for transfer of credit to other educational institutions.