



COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

Introduction to Robotics and Automation

Semester/Year: Summer 2025

Course Code: ELEC4160

Class meeting time(s) and location:

1. Monday, from 9:00 AM to 11:00 AM - Location:
2. Tuesday, from 9:00 AM to 11:00 AM - Location:
3. Thursday, from 9:00 AM to 11:00 AM - Location:

Laboratory/project time(s):

1. Wednesday, from 9:00 AM to 11:00 AM - Location: see the class schedule
2. Friday, from 9:00 AM to 11:00 AM - Location: see the class schedule

Instructors and Teaching Assistant (T.A.) Information

Instructor name:

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|-----------------------|--|
| 1. Dr. Thai Mai Thanh | Email: thanh.tm2@vinuni.edu.vn |
| 2. Dr. Nguyen Vu Linh | Email: linh.nv2@vinuni.edu.vn |
| 3. Dr. Do Tho Truong | Email: truong.dt@vinuni.edu.vn |

T.A. name:

Email:

Office Hours:

1. Tuesday, from 1:30 PM to 3:00 PM - Location: by appointment
2. Thursday, from 1:30 PM to 3:00 PM - Location: by appointment

1. Course Description

This course introduces fundamental concepts in robotics, automation, and its applications. Topics include the basics of manipulators, coordinate transformation, kinematics, sensors, actuators, controllers, practical training in Matlab, and robot applications in industrial automation.

- **Credit value:** 2 [Theory: 1, Practice: 1]
- **Required/Elective:** Elective – Control and Automation
- **Pre-requisites:** None

2. Course Learning Objectives

- Course Learning Goals:

Students will:

1. Learn the robotic systems with many types of manipulators.
2. Learn the coordinate transformation, the transformation arithmetic, and equations.
3. Learn fundamental knowledge of robotic systems and applications in the industry.
4. Understand the principles and applications of sensors, actuators, and controllers in robotic systems.
5. Understand the kinematics of robotic systems.
6. Learn to use Matlab for kinematics simulation.
7. Understand the robot applications and economics analysis.

- Specific Course Learning Objectives (CLO):

Upon completion of the course, students will be able to:

1. Define and manipulate mathematical quantities that represent position and orientation;
Represent a mathematical model in different coordinates using transformations;
2. Apply control laws and principles of devices and components to modern robotic systems;
3. Describe the kinematics and master the techniques to solve the kinematics problems;
4. Acquire experience in Matlab for kinematics simulation;
5. Seek, appreciate, and incorporate everyone's points of view and contributions;
6. Get hands-on experience in the lab, write quality engineering reports, and communicate effectively in a team.

3. Format and Procedures

- Teaching/ Learning methods:

This class includes lectures, labs, a midterm exam, three field trips, and a project.

Lectures: Three 120-min lectures per week

Labs: Two 120-minute Lab sections per week. There will be 7 labs (~2 hours each) over the semester.

Exam: One midterm exam.

Design Project: The course has a design project that will last throughout the semester.

- Procedures:

The class is primarily instructed using various active teaching/learning methods including Project-based Learning, small group discussions, in-class interactive quizzes...

- Course Logistics:

Offline class: Projector and computer, blackboard, and chalk.

Students will be expected to submit assignments electronically through VinUni LMS.

4. Course Requirements

4.1. Class attendance, participation, and etiquette policies:

Students are required to come to discussion hours on time regularly; and actively participate in lectures, discussions, and group sessions. All assignments must be submitted by the due date. Missed assignments due to illness or other emergencies may be made up; otherwise, zero points are assigned. This class requires a project report and one demonstration for the final design. Students must prepare carefully before showing their demonstrations. Grades for late assignments without an instructor or TA consent will be reduced by 25 %/day.

4.2. Course readings:

(a) Required readings:

Craig, John J. Introduction to Robotics: Mechanics and Control. Global edition. Pearson Education, 2021

Bolton, W., 2003. Mechatronics: electronic control systems in mechanical and electrical engineering. Pearson Education.

(b) Supplementary books:

1. Reza N. Jazar, Theory of Applied Robotics, Kinematics, Dynamics, and Control (2nd Edition), 2010.
2. Schilling Robert J, Fundamentals of Robotics: Analysis and Control, Prentice-Hall, 1990.
3. Niku Saeed B, An Introduction to Robotics Analysis, Systems, Applications, Prentice-Hall, 2001.

5. Grading Procedures

Assignment	Assessment Method	% Weighting	CLO
1. Quizzes, Attendance	In-class Quiz	20%	1, 2, 3
2. Laboratory Sessions	Lab reports and demonstration	20%	4, 6
3. Midterm Exam		30%	1, 2
4. Project	Written report, Oral presentation	30%	1, 2, 3, 4, 5, 6
Total		100%	

6. Academic Integrity

Each student in this course is expected to follow the VinUniversity Code of Academic Integrity. Students must submit their own work for receiving academic credit in this course. In the case of group assignments or projects, students must follow the instructions for co-operative work provided by faculty.

Students are encouraged to study together and to discuss information and concepts covered in the lecture and the sections with other students. However, no student may copy all or part of the work done by someone else.

If copying occurs, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Students may also receive a failing grade for the course and face further disciplinary action.

Students may not copy information from online sources, books, articles, any other public or private source, and submit it as your own work. When using someone else's work to support students' work, students must cite the appropriate reference. If students use someone else's work without properly citing it, it is considered Plagiarism. All submitted materials at VinUniversity are subject to Plagiarism check using Turnitin. The penalties for plagiarism are the same as those for copying.

During examinations, students must do their own work. Talking or discussion is not permitted during the examinations. Students may not compare papers or answers, copy from others, or collaborate in any way. If students fail to follow these rules, students will receive an automatic fail in the exam. Students may also receive a failing grade for the course and face further disciplinary action.

7. Accommodations for students with disabilities

If you have a disability-related need for reasonable academic adjustments in this course, provide (Instructors, TA, Course Coordinators) with an accommodation letter from Student Affairs. Students must declare the need for accommodations at least two weeks ahead of time or within the first two class meetings.

8. Inclusivity Statement

VinUniversity supports an inclusive learning environment that acknowledges, seeks to understand, and respects the differences among individuals, and welcomes diversity as a source of our individual and collective strength. Students and instructors in this class are expected to respect differences and demonstrate diligence in understanding how other peoples' perspectives and behaviors may be different from their own. Adapted from the inclusivity statement at Cornell University, found here <https://teaching.cornell.edu/resource/getting-started-constructing-syllabus>.

9. Class Schedule

Session #	Topic	Read & Do Prior to Class Session	In Class Activity	Assignment/Exam
Week 1 – class 1 - Monday	Class: Introduction to Robotics and Robot Applications	Read Lecture Slide Part 1	Topic Discussion	
Week 1 – class 2- Tuesday	Class: Coordinate Transformation	Read Lecture Slide Part 2	Topic Discussion	
Week 1 – class 2- Thursday	Class: Coordinate Transformation Introduction to the course project	Read Lecture Slide Part 2	Topic Discussion	Quiz 1
Week 1 – Lab 1 – Friday Room: H106	Lab 1: Robot Kinematics Simulation using MATLAB (Part 1)	Read Lab Manual 1	Topic Discussion	Post-lab report 1
Week 2 – class 1 - Monday	Class: Sensors	Read Lecture Slide Part 3	Topic Discussion	
Week 2 – class 2 - Tuesday	Class: Actuators	Read Lecture Slide Part 4	Topic Discussion	Quiz 2
Week 2 – class 3 - Thursday	Class: System Dynamics	Read Lecture Slide Part 5	Topic Discussion	
Week 2 – Lab 2 – Wednesday Room: G208	Lab 2: Communication between sensors and actuators (Part 1)	Read Lab Manual 2		Post-lab report 2
Week 2 – Lab 3 - Friday Room: G208	Lab 3: Communication between sensors and actuators (Part 2)	Read Lab Manual 3		Post-lab report 3
Week 2 - Friday	Hateco Hai Phong International Container Terminal (HHIT) (TBC)			
Week 3– class 1 - Monday	Midterm Exam			
Week 3 – class 2 - Tuesday	Class: Feedback Control Systems	Read Lecture Slide Part 6	Topic Discussion	
Week 3 – class 3 - Thursday	Class: Programmable Logic Controller (PLC)	Read Lecture Slide Part 7	Topic Discussion	Quiz 3
Week 3 – Lab 4 – Wednesday Room: H106	Lab 4: Feedback Control	Read Lab Manual 4		Post-lab report 4
Week 3 – Lab 5 - Friday Room: G209	Lab 5: SMC SIF-400 Automation	Read Lab Manual 5		Post-lab report 5

Field-trip	Heineken factory visit			
Week 4 – class 1 - Monday	Class: Forward Kinematics	Read Lecture Slide Part 8	Topic Discussion	
Week 4 – class 2 - Tuesday	Class: Inverse Kinematics	Read Lecture Slide Part 9	Topic Discussion	Quiz 4
Week 4 – class 3 – Thursday	Class: Project demo			
Week 4 – Lab 6 - - Tuesday	Lab 6: Robot Kinematics Simulation using MATLAB (Part 2)	Read Lab Manual 6		Post-lab report 6
Week 4 – Lab 7 - Wednesday	Lab 7: Robot Kinematics Simulation using MATLAB (Part 3)	Read Lab Manual 7		Post-lab report 7
Field-trip	VinFast Manufacturing Factory			