MNE6130: MODERN ROBOTICS

Effective Term
Semester A 2026/27

Part I Course Overview

Course Title
Modern Robotics

Subject Code
MNE - Mechanical Engineering
Course Number
6130

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Multivariable calculus, linear algebra, basic differential equations

Precursors
MNE6007 Advanced Automation Technology

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course provides an in-depth study on robotics at postgraduate level. The course covers the fundamental concepts and methods to analyse model, and control of robotic systems. The topics to cover include robot kinematics, inverse kinematics, dynamics, motion control. The course will also expose students to the advanced applications and latest developments.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basic concepts, classifications, and practical applications of robotic systems.		x		
2	Explain the principles of robot kinematics, dynamics, motion planning and control robotic sensing and programming.		x	x	
3	Identify the needs for suitable robots for domestic, service and industrial applications.			x	
4	Apply the concepts, principles, and methods learned for the design and development of robots for different applications.			x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	To take place in the classroom. The main teaching activities will be in the form of lectures, which will be given related to the topics in the keyword syllabus.	1, 2, 3, 4	2 hrs/week
2	Tutorial	To take place in the classroom. The tutorials are problem-solving and Q&A sessions for strengthening students' understanding of the contents of the lectures. The course project will also help in the learning practice.	1, 2, 3, 4	1 hr/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	In-course assessments	1, 2	20	-	Yes
2	Mini-project	3, 4	20	-	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

In-course assessments

Criterion

Ability of understand basic concepts related to the lecture

Excellent (A+, A, A-)

75%-100%

Good (B+, B, B-)

60%-74%

Fair (C+, C, C-)

45%-59%

Marginal (D)

40%-44%

Failure (F)

<40%

Assessment Task

Mini-projects

Criterion

Ability to understand and explain in details and apply the learned knowledge to the analysis and design of robotic systems for practical applications.

Excellent (A+, A, A-)

Strong evidence of critical thinking; good capacity to analyze; superior grasp of the subject matter; evidence of extensive knowledge of the project concerned.

Good (B+, B, B-)

Evidence of grasp of the subject matter; some evidence of critical thinking and analysis; reasonable understanding of concepts; ability to develop the project.

Fair (C+, C, C-)

Evidence of profiting from the project; understanding of the subject matter; evidence of familiality with the project.

Marginal (D)

Basic familiality with the subject matter to enable student to use knowledge in the project

Failure (F)

Little evidence of familiality with the subject matter to acoomplish the project.

Assessment Task

Examination

Criterion

Ability to understand the key concepts, principles, methods, and applications.

Excellent (A+, A, A-)

75%-100%

Good (B+, B, B-)

60%-74%

Fair (C+, C, C-)

45%-59%

Marginal (D)

40%-44%

Failure (F)

<40%

Additional Information for AR

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Part III Other Information

Keyword Syllabus

Configuration Space, Rogid-Body motion, Forward Kinematics, Velocity Kinematics and Statics, Inverse Kinematics, Dynamics, Trajectory Generation, Motion Control, Hybrid Motion-Force Control, Impedance Control.

Reading List

Compulsory Readings

	Title
1	"Modern Robotics: Mechanics, Planning, and Control", Kevin M. Lynch and Frank C. Park, Cambridge University Press, 2017.

Additional Readings

	Title
1	"Principles of Robot Motion: Theory, Algorithms, and Implementations", Howie Choset, Kevin M. Lynch, Seth Hutchinson, George A. Kantor, Wolfram Burgard, Lydia E. Kavraki and Sebastian Thrun, MIT Press, 2005.
2	"Robotics Modelling, Planning and Control", Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, Springer, 2009.