MNE6130: MODERN ROBOTICS

Effective Term
Semester A 2025/26

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
Robotics is a rapidly growing field with increasing applications in domestic, service as well as industrial environment. 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 and planning human-robot interactions robot sensors and vision, robot programming and applications. Students will be involved in robot programming projects to reinforce the basic principles introduced in lectures. The course will also expose students to the advanced applications and latest developments in service robots as well as industrial robots.

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	Test/Assignments	1, 2	10	-	Yes
2	Mini-projects	3, 4	40	-	Yes

Continuous Assessment (%)

50

Examination (%)

50

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

Test/Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to understand basic concepts related to microfluidics.

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 (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to explain in detail and apply the learned knowledge to the analysis and design of systems using microfluidic components for scientific research and practical applications.

Excellent

(A+, A, A-) Strong evidence of critical thinking; good capacity to analyze; superior grasp of subject matter; evidence of extensive knowledge of the project concerned.

Good

(B+, B, B-) Evidence of grasp of subject matter, some evidence of critical thinking and analysis; reasonable understanding of concepts; ability to develop the project.

Fair

(C+, C, C-) Student who is profiting from the project; understanding of the subject matter; evidence of familiarity with the project.

Marginal

(D) Basic familiarity with the subject matter to enable the student to use knowledge in the project.

Failure

(F) Little evidence of familiarity with the subject matter to accomplish the project.

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to understand the key concepts, principles, methods, and applications of microfluidic systems used in both scientific research and real-world products.

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

Test/Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Ability to understand the basic concepts related to robotics.

Excellent

(A+, A, A-) 75%-100%

Good
(B+, B) 65%-74%

Marginal
(B-, C+, C) 50%-64%

Failure
(F) <50%

Assessment Task
Mini-projects (for students admitted from Semester A 2022/23 to Summer Term 2024)

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

Good
(B+, B) Student who is profiting from the project; understanding of the subject matter; evidence of familiarity with the project.

Marginal
(B-, C+, C) Basic familiarity with the subject matter to enable the student to use knowledge in the project.

Failure
(F) Little evidence of familiarity with the subject matter to accomplish the project.

Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability of in-depth understanding of the key concepts, principles, methods, and applications of robotic systems.

Excellent
(A+, A, A-) 75%-100%

Good
(B+, B) 65%-74%

Marginal
(B-, C+, C) 50%-64%

Failure
(F) <50%

Additional Information for AR

Note: 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

Robot kinematics, inverse kinematics, dynamics, robot control, robot sensing and vision, motion planning, robot programming.

Reading List

Compulsory Readings

	Title
1	"Robotics, Vision and Control: Fundamental Algorithms", 2nd Ed., Peter Corke Springer, 2017.
2	"Modern Robotics: Mechanics, Planning, and Control", Kevin M. Lynch and Frank C. Park, Cambridge University Press, 2017.
3	"The Robotics Primer" Maja Mataric. MIT Press 2007.
4	"Robotics Modelling, Planning and Control", Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, Springer, 2009.

Additional Readings

	Title
1	"Robot modeling and control" Spong, Mark W. Hutchinson Seth Vidsayar M., Wiley 2007.
2	"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.
3	Students are encouraged to find out related publications to widen their knowledge in the subjects.