MNE4217: AUTONOMOUS SYSTEMS AND NAVIGATION

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Autonomous Systems and Navigation

Subject Code
MNE - Mechanical Engineering
Course Number
4217

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MNE3049 Control Principles or equivalent AND
MNE2029 Electrical and Electronic Principles I or equivalent

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

The aim of the course is to provide the students with the understanding of the basic principles underlying the design, analysis, and synthesis of autonomous systems and navigation systems. This course will lay down the foundations of the engineering principles in such a way that the students can identify the appropriate concepts and apply them to formulate suitable solutions in given problems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Formulate and derive the basic principles for autonomous systems and navigation.			x	
2	Analyze mobile robot navigation and basic GPS concept and principles.			x	
3	Demonstrate the basic knowledge of autonomous systems and navigation.			x	
4	Apply autonomous systems and navigation knowledge to solve problems.			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	Large class activities mainly include lectures.	1, 2, 3, 4	3 hrs/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments	1, 2, 3, 4	30	2 assignments	Yes
2	Quizzes/Mid-term exams	1, 2, 3, 4	20	2 quizzes/mid-term exams	No

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

Assignments

Criterion

1. Ability to Analyze and Solve autonomous systems problems.
2. Ability to Analyze and Solve navigation problems.

Excellent (A+, A, A-)

High ability of analyzing and sovling problems in assignments.

Good (B+, B, B-)

Significant ability of analyzing and sovling problems in assignments.

Fair (C+, C, C-)

Moderate ability of analyzing and sovling problems in assignments.

Marginal (D)

Basic ability of analyzing and sovling problems in assignments.

Failure (F)

Not even reaching marginal levels.

Assessment Task

Quizzes/Mid-term exams

Criterion

1. Ability to Analyze the given problems with the learned knowledge.
2. Ability to Employ the learned knowledge to Solve the problems.

Excellent (A+, A, A-)

High ability to analyze the given problems with the learned knowledge, and the high ability to employ the learned knowledge to Solve the problems.

Good (B+, B, B-)

Significant ability to analyze the given problems with the learned knowledge, and the significant ability to employ the learned knowledge to Solve the problems.

Fair (C+, C, C-)

Moderate ability to analyze the given problems with the learned knowledge, and the moderate ability to employ the learned knowledge to Solve the problems.

Marginal (D)

Basic ability to analyze the given problems with the learned knowledge, and the basic ability to employ the learned knowledge to Solve the problems.

Failure (F)

Not even reaching marginal levels.

Assessment Task

Final Examination

Criterion

1. Ability to Analyze the given problems with the learned knowledge.
2. Ability to Employ the learned knowledge to Solve the problems.

Excellent (A+, A, A-)

High ability to analyze the given problems with the learned knowledge, and the high ability to employ the learned knowledge to solve the problems.

Good (B+, B, B-)

Significant ability to analyze the given problems with the learned knowledge, and the significant ability to employ the learned knowledge to solve the problems.

Fair (C+, C, C-)

Moderate ability to analyze the given problems with the learned knowledge, and the moderate ability to employ the learned knowledge to solve the problems.

Marginal (D)

Basic ability to analyze the given problems with the learned knowledge, and the basic ability to employ the learned knowledge to solve the problems.

Failure (F)

Not even reaching marginal levels.

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

Kinematic Models for Mobile Robots, Mobile Robot Path Planning, Mobile Robot Navigation, Basic GPS Concept, Satellite Constellation, Direction Cosine Matrix, Calculation of Satellite Position, Acquisition and Tracking of GPS Signals.

Reading List

Compulsory Readings

	Title
1	Fundamentals Of Global Positioning System Receivers: A Software Approach, 2nd Edition, James Bao-Yen Tsui, Wiley, 2018.

2	Mobile Robots: Navigation, Control and Sensing, Surface Robots and AUVs, 2nd Edition, Gerald Cook, Feitian Zhang, Wiley, 2019.

Additional Readings

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