

# MNE4217: AUTONOMOUS SYSTEMS AND NAVIGATION

## New Syllabus Proposal

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### Effective Term

Semester A 2024/25

## 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 (e.g. Parameter for GenAI use)	
1	Assignments	1, 2, 3, 4	30	2 assignments
2	Quizzes/Mid-term exams	1, 2, 3, 4	20	2 quizzes/mid-term exams

### Continuous Assessment (%)

50

### Examination (%)

50

### Examination Duration (Hours)

2

### **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 solving problems in assignments.

#### **Good (B+, B, B-)**

Significant ability of analyzing and solving problems in assignments.

#### **Fair (C+, C, C-)**

Moderate ability of analyzing and solving problems in assignments.

#### **Marginal (D)**

Basic ability of analyzing and solving problems in assignments.

#### **Failure (F)**

Not even reaching marginal levels.

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#### **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.

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**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.

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**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.