

MNE6114: CONTROL SYSTEMS AND INFORMATION PROCESSING

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Control Systems and Information Processing

Subject Code

MNE - Mechanical Engineering

Course Number

6114

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

Nil

Precursors

MBE3049/MNE3049 Control Principles or Equivalent course on Control Principles or Theory

Equivalent Courses

BME6114 Advanced Control Systems

Exclusive Courses

Nil

Part II Course Details

Abstract

The aim of this course is to introduce the fundamental concepts, principles, design, and applications of control systems and their integration with information processing techniques. The course begins with a review of linear time-invariant systems modeling. State space analysis and design will then be covered, mainly for continuous-time systems and briefly for discrete-time systems and digital signal processing basics. Stability analysis and related feedback control design tools will also be discussed. Advanced topics such as nonlinear system control, adaptive control, or optimal control will be briefly introduced. The content is mathematically oriented, with illustrative examples from general engineering systems and real-time information processing applications. A solid understanding of undergraduate-level calculus, differential equations, and linear algebra is required.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)		
1	Comprehend fundamental concepts of systems and control.			x
2	Analyze a given system using state space methods.			x
3	Design feedback control laws for engineering systems.			x
4	Apply advanced control theory to practical engineering 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	Weekly lectures	1, 2, 3, 4	2 hrs/ week
2	Tutorial	Case studies and practice / demonstration of solving problems	1, 2, 3, 4	1 hr/week

Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?	
1	Assignments	1, 2, 3, 4	25	-	Yes
2	Test	1, 2, 3	25	-	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 (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to model and analyze linear and nonlinear systems, and to design appropriate control laws for engineering systems;
Ability to explain the methodology and procedure in detail.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

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

Criterion

Ability to solve questions in advanced control theory.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

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

Criterion

Ability to model, analyze and control simplified engineering systems.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

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

Criterion

Ability to model and analyze linear and nonlinear systems, and to design appropriate control laws for engineering systems;
Ability to explain the methodology and procedure in detail.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Moderate

Failure

(F) Not even reaching marginal levels

Assessment Task

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

Criterion

Ability to solve questions in advanced control theory.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Moderate

Failure

(F) Not even reaching marginal levels

Assessment Task

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

Criterion

Ability to model, analyze and control simplified engineering systems.

Excellent

(A+, A, A-) High

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(B-, C+, C) Moderate

Failure

(F) Not even reaching marginal levels

Part III Other Information**Keyword Syllabus**

Linear system, state variable, state space model, stability, controllability, observability, differential equation, difference equation, digital signal processing, feedback control, observer, nonlinear systems, nonlinear control, adaptive control, optimal control

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
1	Control Systems Engineering, Norman S. Nise 7th Edition, John Wiley & Sons, Inc.
2	Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 2010
3	Applied Nonlinear Control, Jean-Jacques Slotine, Weiping Li, Prentice Hall, 1991
4	Robotics, vision and control: fundamental algorithms in MATLAB. Corke, Peter. Springer, 2011.