MNE6002: COMPUTER CONTROLLED SYSTEMS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Computer Controlled Systems

Subject Code
MNE - Mechanical Engineering
Course Number
6002

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
Background knowledge in Control Principles or equivalent

Equivalent Courses
BME6002/MNE8116/BME8124 Computer Controlled Systems

Exclusive Courses
Nil

Part II Course Details

Abstract
This course aims to develop an in-depth understanding of real-time control of automated systems using digital computers. The objective is for students to learn how to apply control theory in implementation with computers. The mathematical

techniques will be introduced for discrete domain analysis and design. It will enhance students' skills for analysis, design and implementation of control systems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	to give an account of the fundamentals of digital control and to implementation advanced control methods using computers.		x	x	x
2	to analyze discrete-time systems using z-transform.		x	x	
3	to design discrete-time control systems using z-plane and frequency domain methods.			x	x
4	to apply state-space based controller design for discrete time systems.			x	x
5	to adapt advanced control methods for computer control of dynamic systems such as robots, industrial equipment and processes.			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	The main teaching activities will be in the form of lectures but the lectures are sometimes broken up with small group discussions where students work with their neighbors before feeding back the results to the class.	1, 2, 3, 4	2 hrs/week
2	Tutorial	Tutorials are problem-solving sessions and are sometimes broken up into small group discussions.	1, 2, 3, 4	1 hr/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mini-project	1, 2, 3, 4, 5	20	
2	Assignment/ Test	1, 2, 3, 4, 5	20	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2.5

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

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

Criterion

Written exam at the end of the semester.

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

Mid-term and In-class Quiz (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

To test students' understanding of the topics during the course of the lecture.

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

Criterion
Pass or fail to see student attitudes and ability.

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 from Semester A 2022/23 to Summer Term 2024)

Criterion
Written exam at the end of the semester.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Not even reaching marginal levels

Assessment Task
Mid-term and In-class Quiz (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
To test students' understanding of the topics during the course of the lecture.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Not even reaching marginal levels

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

Criterion
Pass or fail to see student attitudes and ability.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Digital control fundamentals, z-transform, z-plane analysis of discrete-time systems, design of discrete-time control systems, control implementation using computers, controller design using state feedback, intelligent control, robot control.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	K. Ogata, Discrete-Time Control Systems, Prentice Hall, Inc.
2	K. J. Astrom and B. Wittenmark, Computer Controlled Systems, Prentice Hall, Inc.
3	R. G. Jacquot, Modern Digital Control Systems, Marcel Dekker.

4	F. Franklin, J. J. Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley.
5	Jaulin, Luc, Automation for robotics, Hoboken, N.J.: Wiley, 2015.
6	Niku Saeed B, Introduction to Robotics : Analysis, Control, Applications, Hoboken: John Wiley Inc, 2015.
7	F. L. Lewis, C. T. Abdallah and D. M. Dawson, Control of robot manipulators, Macmillan Publishing Co.
8	Dinwiddie, Keith, Basic Robotics, Boston, MA: Cengage Learning, TJ211.D569 2015.