EE4045: COMPUTER CONTROLLED SYSTEMS

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Computer Controlled Systems

Subject Code
EE - Electrical Engineering
Course Number
4045

Academic Unit
Electrical Engineering (EE)

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
EE3114 Systems and Control
or
EE3210 Signals and Systems

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

Students will gain knowledge about advanced analytical, applied, and simulation methods and design techniques in computer control engineering.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Analyze and explain basic control theory, modeling and analytical techniques, and system identification methods for discrete-time systems.		x	x	
2	Design and implement digital controllers using appropriate methods and technologies.		x	x	
3	Evaluate and demonstrate the practical aspects of digital controllers in real world scenarios.		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	Lecturers	Engage students in understanding control theory and digital controllers through interactive discussions and real-world examples.	1, 2, 3	2 hrs/wk
2	Tutorials	Provide hands-on practice with problem-solving exercises based on real-world scenarios to reinforce theoretical concepts.	1, 2, 3	1 hr/wk

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3	30	
2	#Assignments (min.: 3)	1, 2, 3	20	

Continuous Assessment (%)

50

Examination (%)
50

Examination Duration (Hours)
2

Additional Information for ATs
Remark: To pass the course, students are required to achieve at least 30% in course work and 30% in the examination. # may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)

Assessment Task
Examination

Criterion
Achieving all CILOs

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Margin

Failure (F)
Not even reaching marginal

Assessment Task
Coursework

Criterion
Achieving all CILOs

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Margin

Failure (F)
Not even reaching marginal

Part III Other Information

Keyword Syllabus

Basic Control Theory and Linear Systems
Review of classical control and computer control. Discrete-time systems: review of sample data systems, sampling of continuous-time systems and state-space systems, discrete system models, sampling rate selection. Process systems: A computer-controlled system and its building blocks, system responses and analysis.

Discrete-time system analysis: stability, controllability, reachability, observability, analysis of feedback systems. Robustness and disturbance rejection. System modeling and identification.

Design Methods
Translation of classical analogy design techniques: Digital PID controllers, state-feedback design, frequency response design. State-space design methods. Pole-placement and model reference methods. Optimal control methods. Fuzzy sets methods.

Implementation of Digital Controllers
Realization of digital controllers. Intelligent controllers and embedded systems, computer aided design techniques. Real-time controllers design, implementation and tuning techniques. Distributive systems and measurements. Practical design aspects. System simulations. Case studies.

Reading List

Compulsory Readings

	Title
1	Phillips & Nagle: Digital Control System Analysis and Design, 3/e, (Prentice-Hall, 1995)
2	K Ogata: Discrete-time Control Systems, 2/e (Prentice-Hall Int., 1995)

Additional Readings

	Title
1	Astrom & Wittenmark: Computer Controlled System: Theory and Design, 3/e, (Prentice-Hall, 1997)
2	MATLAB user manual, Mathworks Inc
3	D-azzo & Houpis: Feedback Control System Analysis and Synthesis, (McGraw-Hill, 1988)
4	Wiberg D: State Space and Linear Systems, Schaum’ s Outline Series, (McGraw-Hill, 1971)
5	M S Santina, A R Stubberud & G H Hostetter: Digital Control System Design, (Saunders College Publishing, Harcourt Brace College publishers, 1994)