EE3114: SYSTEMS AND CONTROL

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Systems and Control

Subject Code
EE - Electrical Engineering
Course Number
3114

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
MA1201 Calculus and Basic Linear Algebra II
Or
MA1301 Enhanced Calculus and Linear Algebra II

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

The aim of this course is to provide students with an understanding of the concepts/techniques/basic principles of classical and modern linear feedback systems to enable them to specialize in diverse areas like communication systems, control systems, power systems and signal processing within the disciplines of electronic engineering. Elementary analytical and design techniques for control systems are introduced.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe basic linear feedback system properties and the application of CAD tools for analysis and design		x	x	
2	Analyze feedback system behaviors in terms of frequency-domain methods		x	x	
3	Analyze feedback systems via state-space methods with the use of CAD tools		x	x	
4	Analyze and derive system models/equations for continuous-time feedback systems		x	x	
5	Design basic feedback control systems		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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Key concepts are described and illustrated. Key concepts are worked out based on problems.	1, 2, 3, 4, 5	3 hrs/wk
2	Labs	Key concepts are applied to analyze and design feedback systems	1, 2, 3, 4, 5	3 hrs/wk (4 weeks)
3	Assignments, self-study	Exercises	1, 2, 3, 4, 5	NA

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min: 2)	1, 2, 3, 4, 5	30	
2	#Assignments (min: 3)	1, 2, 3, 4, 5	10	
3	Lab Exercises/Reports	1, 2, 3, 4, 5	10	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Remarks:
To pass the course, students are required to achieve at least 30% in coursework and 30% in the examination. Also, 75% laboratory attendance rate must be obtained.

may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)

Assessment Task

Examination

Criterion

Achievements in CILOs

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

Coursework

Criterion

Achievements in CILOs

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

Part III Other Information

Keyword Syllabus

Introduction to Linear Time-Invariant (LTI) Systems
Basic mathematical tools and transforms. Modelling of linear dynamical systems by differential equations; Solution of linear differential equations; Block diagrams, Signal flow graphs and transfer functions; System simulations with CAD tools; Concept of feedback systems.

Analysis of Linear Feedback Systems
Frequency-domain Approach: Bode analysis, root locus, Nyquist technique; Stability analysis, Routh technique, stability margins; System performance analysis, steady state responses; Feedback and disturbance; Some practical issues.

State-space Approach: Concept of state, state-space modelling, solution of state equations, state transition equations, relationship between transfer functions and state equations, characteristic polynomials, eigenvalues and eigenvectors, stability, controllability and observability, state feedback design, closed-loop system characteristics.

Basic of Linear Feedback System Designs
Basic PID control schemes, designs and simulations; Frequency- and time-domain design schemes; System discretisation and digital implementation.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	K Ogata, Modern Control Engineering (5th edition, Prentice-Hall, 2010), available in CityU Library
2	B C Kuo, Automatic Control Systems (8th edition, Wiley, 2003), available in CityU Library