City University of Hong Kong
Course Syllabus

offered by Department of Electrical Engineering
with effect from Semester A in 2020/2021

Part I Course Overview

Course Title:	Systems and Control
Course Code:	EE3114
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	B3
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	MA1201 Calculus and Basic Linear Algebra II Or MA1301 Enhanced Calculus and Linear Algebra II
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. 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.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Describe basic linear feedback system properties and the application of CAD tools for analysis and design		√	√	
2.	Analyze feedback system behaviors in terms of frequency-domain methods		√	√	
3.	Analyze feedback systems via state-space methods with the use of CAD tools		√	√	
4.	Analyze and derive system models/equations for continuous-time feedback systems		√	√	
5.	Design basic feedback control systems		√	√	
	** If weighting is assigned to CILOs, they should add up to 100%.*	100%			

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5		
Lectures	Key concepts are described and illustrated	√	√	√	√	√		2 hrs/wk

Tutorials	Key concepts are worked out based on problems	√	√	√	√	√		1 hr/wk
Labs	Key concepts are applied to analyze and design feedback systems	√	√	√	√	√		3 hrs/wk (4 weeks)
Assignments, self-study	Exercises	√	√	√	√	√		NA

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5			
Continuous Assessment: 50 %								
Tests (min: 2)	✓	✓	✓	✓	✓		30%	
#Assignments (min: 3)	✓	✓	✓	✓	✓		10%	
Lab Exercises/Reports	✓	✓	✓	✓	✓		10%	
Examination: 50% (duration: 2 hrs , if applicable)								
Examination	✓	✓	✓	✓	✓		50%	
** The weightings should add up to 100%.*							100%	

Remark:

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

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Coursework	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels

6. Constructive Alignment with Major Outcomes

MILO	How the course contribute to the specific MILO(s)
1, 2, 5	The use of mathematical and engineering techniques is central to the aims of this course with ample opportunities to apply these techniques for solving some engineering problems in class, at home and in the laboratory.
4, 7, 10	Four laboratory sessions are scheduled to allow students to practice this type of work, which is directly linked to the skills learnt during the lectures. Students can adopt their learnt engineering tools in solving the designed laboratory tasks and practice their communication skills in report writing and project demonstrations.

Part III Other Information (more details can be provided separately in the teaching plan)

1. 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.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	N/A

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

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

Online Resources (if any)

LabView Programming http//www.ni.com/academic/lv_training/how_learn_lv.htm
MATLAB Programming