City University of Hong Kong
Course Syllabus

offered by College/School/Department of Electrical Engineering
with effect from Semester B in 2019/2020

Part I Course Overview

Course Title:	Computer Controlled Systems
Course Code:	EE4045
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	B4
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)*	EE3114 Systems and Control or EE3210 Signals and Systems
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

This aim of this course is to equip students with various advanced analytical, applied and simulation methods and design techniques in computer control engineering.

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 control theory, modelling and analytical techniques, and system identification methods for discrete-time systems.		✓	✓	
2.	Describe controller design methods and implementation technologies.		✓	✓	
3.	Implement digital controllers and recognize their practical aspects.		✓	✓	
** 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				
Lectures	Lecture on the subject matter for the whole class	✓	✓	✓				2 hrs/wk
Tutorial and In-class exercises	Tutorial-like delivery on the examples on selected topics. In-class exercises would provide short questions for fostering the learning experience	✓	✓	✓				1 hr/wk

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					
Continuous Assessment: 50%								
Tests (min.: 2)	✓	✓	✓				30%	
#Assignments (min.: 3)	✓	✓	✓				20%	
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 course work and 30% in the examination.

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	Achieving all CILOs	High	Significant	Moderate	Margin	Not even reaching marginal
2. Coursework	Achieving all CILOs	High	Significant	Moderate	Margin	Not even reaching marginal

6. Constructive Alignment with Major Outcomes

Please state how the course contribute to the specific MILO(s)

MILO	How the course contribute to the specific MILO(s)
1, 3, 5	The application of mathematics, science and engineering is essential to this course' objectives which equip the students with the ability to identify, design and solve practical computer control problems.
10	A mini-project is scheduled to allow students to apply the theory learned to control a real engineering control problem using computer software.

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

1. 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.

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.	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)

2.2 Additional Readings

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

1.	Astrom & Wittenmark: Computer Controlled System: Theory and Design, 3/e, (Prentice-Hall, 1997)
	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)