City University of Hong Kong
Course Syllabus

offered by
Department of Biomedical Engineering
with effect from Semester A 2022/23

Part I Course Overview

Course Title:	Computer Controlled Systems
Course Code:	BME6002
Course Duration:	1 semester
Credit Units:	3 credits
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Background knowledge in Control Principles or equivalent
Equivalent Courses: *(Course Code and Title)*	MBE6002/MNE6002/BME8124 Computer Controlled Systems
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. 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.

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.	to **give** an account of the fundamentals of digital control and control implementation using digital computer.		✓	✓	
2.	to **analyze** discrete-time systems using z-transform.		✓	✓	
3.	to **design** discrete-time control systems using z-plane and frequency domain methods.			✓	✓
4.	to **apply** state-space based controller design for discrete time systems.			✓	✓
5.	to **adapt** digital control design methods to controller design for systems such as robots, industrial equipment and processes.			✓	✓
		N.A.			

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	
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.	✓	✓	✓	✓		2 hrs/week
Tutorial	Tutorials are problem-solving sessions and are sometimes broken up into small group discussions.	✓	✓	✓	✓		1 hr/week

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: 40%							
Mini-project	✓	✓	✓	✓	✓	20%	
Assignment/ Test	✓	✓	✓	✓	✓	20%	
Examination: 60%							
Examination	✓	✓	✓	✓	✓	60%	Duration: 2.5 hours
						100%	

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

5. Assessment Rubrics

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

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C,)	Failure (F)
1. Examination	Written exam at the end of the semester.	High	Significant	Basic	Not even reaching marginal levels
2. Mid-term and In-class Quiz	To test students' understanding of the topics during the course of the lecture.	High	Significant	Basic	Not even reaching marginal levels
3. Homework	Pass or fail to see students attitudes and ability.	High	Significant	Basic	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Written exam at the end of the semester.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Mid-term and In-class Quiz	To test students' understanding of the topics during the course of the lecture.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Homework	Pass or fail to see students attitudes and ability.	High	Significant	Moderate	Basic	Not even reaching marginal levels

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

1. Keyword Syllabus

(An indication of the key topics of the course.)

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, robot control.

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.)

N.A.

2.2 Additional Readings

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

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