City University of Hong Kong
Course Syllabus

offered by Department of Advanced Design and Systems Engineering
with effect from Semester A 2022 / 23

Part I Course Overview

Course Title:	Process Modelling and Control
Course Code:	ADSE8204
Course Duration:	One semester
Credit Units:	3
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites:	Nil
Precursors:	Nil
Equivalent Courses:	SEEM8204 Process Modelling and Control (offered until 2021/22)
Exclusive Courses:	Nil

Part II Course Details

1. Abstract

This course is designed for research students to develop advanced knowledge of system engineering. The aim is to teach research students to analyse dynamics of industrial processes, design the proper method to model these processes, and control these processes using different kind of approaches. The fundamental contents include fundamental analysis of linear/nonlinear processes, process modelling and simulation, and advanced control methods for both linear and nonlinear processes.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	**Understand** fundamental theories for process analysis, basic techniques for process simulation, and process control.	15%	✓	✓	
2.	**Design** modelling methods for linear dynamic processes.	15%		✓	
3.	**Design** advanced modelling methods for nonlinear dynamic processes.	35%		✓	✓
4.	**Design** control methods for linear processes, and analyse the stability of the controlled system.	15%		✓	
5.	**Design** advanced methods to control nonlinear process and maintain the system stability	20%		✓	✓
		100%			

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)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Large Class Activities	Take place in classroom setting and consist of lecturing and student activities in between. Students will be grouped in the large classroom to work on mini-tasks.	✓	✓	✓	✓	✓	2 hours/week
Consultation Hours	Consultation hours will be set aside during the semester to allow student/professor one-on-one consultation.	✓	✓	✓	✓	✓	1 hour/week

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: *_100___*%							
Individual assignment Students need work independently to complete the exercises, which include understanding basic fundamentals, and applying learned knowledge for problems solving.	✓	✓	✓	✓	✓	80%	
In-class test Students will be assessed in the mid-term test for their understanding of fundamentals in the learned topics, and problems solving taught in the completed lectures.	✓	✓	✓	✓		20%	
Examination: __0__% (duration: , if applicable)							
						100%	

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

5. Assessment 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. Individual assignment	Each assignment has 5-10 big problems for students to complete. Each problem may include several small questions. Every questions and problems will be graded numerically in 100% scale.	Excellent	Good	Marginal	Failure
2. In-class test	Every CILO taught will be examined to have an immediate feedback of the learning performance. The results are marked numerically in 100% scale.	Excellent	Good	Marginal	Failure

Course work will be numerically marked and grades awarded accordingly.

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)
3. Individual assignment	Each assignment has 5-10 big problems for students to complete. Each problem may include several small questions. Every questions and problems will be graded numerically in 100% scale.	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. In-class test	Every CILO taught will be examined to have an immediate feedback of the learning performance. The results are marked numerically in 100% scale.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Course work will be numerically marked and grades awarded accordingly.

Part III Other Information

1. Keyword Syllabus

Dynamics of processes

- Linearization and state-space model representation
- Laplas transformation and transfer functions
- Ordinary differential equations and partial differential equations

Process modelling

- Linear regression method
- Nonlinear regression method including neural network modelling
- Space/time separation based intelligent method

Process control

- PID controller design and tuning rules
- Lyapunov stability analysis
- Sliding mode control
- Internal model control

2. Reading List

2.1 Compulsory Readings

1.	Lecture notes

2.2 Additional Readings

1.	B. Wayne Bequette, Process Control- modeling, design and simulation, Prentice Hall, 2003
2.	J.J. E. Slotine, & W. LI, Applied Nonlinear Control, Prentice Hall, 1991
3.	Richard C. Dorf, Modern Control Systems, Addision-Wesley, 2016