

# THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

## Approval of Undergraduate Course

### Section 1: Academic Administration <sup>(1)</sup>

#### 1.1 Catalog

- a) Course to be effective from: Academic Year 2020-21 Term Spring
- b) Department Code<sup>(3)</sup>: ECE Subject Area<sup>(3)</sup>: ELEC Course Number <sup>(4)</sup>: 4210  
 Previous Course Code<sup>(5)</sup>: ELEC4010G
- c) Full Title<sup>(6)</sup> (max. 100 characters): Control System Design
- d) Abbreviated Title<sup>(7)</sup> (max. 30 characters): Control System Design
- e) Course Credits<sup>(8)</sup>: ☒ Fixed: 3 ☐ Range: From \_\_\_\_\_ To \_\_\_\_\_

- f) Catalog Description<sup>(9)</sup> (word limit = 150):

In the lectures, the following topics will be covered: time-domain and frequency-domain system modeling and analysis, optimal control, robust control, computer aided control designs, digital control. In the experiments, the students will be asked to design and implement controllers for a magnetic suspension system, an inverted pendulum system, and a tower crane system.

- g) Grading Type<sup>(10)</sup>: ☒ Letter Grades ☐ Distinction/Credit/Pass/Fail ☐ Pass/ Fail  
☐ Distinction/Pass/Fail ☐ Others (please specify): \_\_\_\_\_

- h) ☒ Prerequisites<sup>(11)</sup>:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
ELEC3200 or	System Modeling, Analysis and Control
MECH3610	Control Principles

- i) ☐ Corequisites<sup>(12)</sup>:

Course Code	Course Title

- j) ☐ Exclusions<sup>(13)</sup>:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained

- k) ☐ Co-listing<sup>(14)</sup>: ☐ Multi-coding<sup>(14)</sup>:

Course Code	Course Title

- l) Other Enrollment Restrictions<sup>(15)</sup> ☒ No ☐ Yes

☐ Instructor's approval required

☐ Restricted to specified student group(s) \_\_\_\_\_

(please specify, e.g. year and program of study): \_\_\_\_\_

Others (please specify): \_\_\_\_\_

m) Medium of Instruction/Materials<sup>(16)</sup>: ☒ English ☐ Others, (Pls specify and provide a justification in Section 1.3): \_\_\_\_\_

n) Allow course repetition for credit<sup>(17)</sup>: ☒ No ☐ Yes

**1.2 Contribution of course to Programs of Study [Check all appropriate boxes below]**

<input checked="" type="checkbox"/> Major	<table border="1"><thead><tr><th>Program of Study</th><th colspan="3">As</th></tr></thead><tbody><tr><td>BEng(ELEC)</td><td><input type="checkbox"/> Required Course</td><td><input checked="" type="checkbox"/> Elective</td><td><input type="checkbox"/> Prerequisite</td></tr></tbody></table>	Program of Study	As			BEng(ELEC)	<input type="checkbox"/> Required Course	<input checked="" type="checkbox"/> Elective	<input type="checkbox"/> Prerequisite
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	<input type="checkbox"/> Required Course	<input type="checkbox"/> Elective	<input type="checkbox"/> Prerequisite						
<input type="checkbox"/> Common Core									
<input type="checkbox"/> Others (pls specify):	<table border="1"><thead><tr><th>Program of Study</th><th colspan="3">As</th></tr></thead><tbody><tr><td></td><td><input type="checkbox"/> Required Course</td><td><input type="checkbox"/> Elective</td><td><input type="checkbox"/> Prerequisite</td></tr></tbody></table>	Program of Study	As				<input type="checkbox"/> Required Course	<input type="checkbox"/> Elective	<input type="checkbox"/> Prerequisite
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**1.3 Rationale for Introducing this course and other relevant information <sup>(18)</sup>**

Control systems are an integral part of manufacturing industry. The new development in a smart society, including robotics and autonomous vehicle technology, calls for more advanced control systems. Control techniques are now even used to address social problems. There is a timely demand for this course.

This course has been offered for quite a few times in UST. It uses a textbook written by the course developer and uses some lab facility developed by the course developer. It has been well received by the students.

## Section 2A: Learning Outcomes and Alignment (for courses not proposed to be Common Core Courses)

### 2.1 Key Course Intended Learning Outcomes (Should not normally exceed six or eight outcomes)

Upon completion of this course, students are expected to be able to do the following:

	Course ILOs	Nature of the learning outcomes ( A - Knowledge/Content Related; B - Academic Skills/Competencies; C - Others )
1	Have an in-depth understanding of time-domain and frequency-domain methods as well as their relationships in dynamic system modeling, analysis and control.	A
2	Use several techniques for control system design.	B
3	Understand further the importance of feedback and its limitations.	A
4	Skillfully use CAD tools (such as MATLAB and SIMULINK) in control system modeling, analysis and control.	B
5	Equip themselves with experience in controlling real physical systems.	A
6		
7		
8		

### 2.2 Contribution of Learning Outcomes to Programs of Study identified in Section 1.2

(Please also complete Section 4.1)

	Program of study 1: _____ ELEC _____  Program ILOs	To be achieved through these course ILOs (Write CILO-1, CILO-2, etc.)
1	An ability to apply knowledge of mathematics, science and Electronic and Computer Engineering.	CILO-1, CILO-2, CILO-3
2	An ability to design and conduct experiments, as well as to analyze and interpret data.	CILO-4, CILO-5
3	An ability to design efficient and economical Electronic and Computer Engineering systems, components or process subject to practical constraints.	CILO-1, CILO-2, CILO-3, CILO-5
4	An ability to function in a multi-disciplinary environment through teamwork.	
5	An ability to identify, formulate and solve Electronic and Computer Engineering problems.	
6	An ability to understand professional practices and ethical responsibilities.	
7	An ability to communicate effectively.	
8	An ability to understand contemporary global, regional, economic, environmental, and social issues, and the corresponding role and the impact of Electronic and Computer engineers.	
9	An ability to recognize the need for, and to engage in life-long learning.	
10	An ability to use current techniques, skills and engineering tools necessary for solving Electronic and Computer Engineering problems.	CILO-4, CILO-5
11	An ability to use the computer/IT tools relevant to the Electronic and Computer Engineering along with an understanding of their processes and limitations.	CILO-4, CILO-5

## Section 2B: Additional Information<sup>(2)</sup> (for courses not proposed to be Common Core Courses)

### 2.3 Planned Teaching & Learning Arrangement

Teaching & Learning Arrangement		Weekly Scheduled Hours/ Estimated Weekly Learning Hours	Indicate which course ILOs this activity serves to achieve (Write CILO-1, CILO-2, etc.)	Additional Information (optional)
Face-to-face activities	<input checked="" type="checkbox"/> Lecture*	3	CILO-1, CILO-2, CILO-3	
	<input type="checkbox"/> Tutorial*			
	<input type="checkbox"/> Seminar/Small-class*			
	<input checked="" type="checkbox"/> Laboratory*	1	CILO-4, CILO-5	
	*Does the above scheduled component(s) involve structured active learning activities? <sup>(19)</sup> <input checked="" type="radio"/> No <input type="radio"/> Yes If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.			
	<input type="checkbox"/> Others (e.g. fieldtrip, visit, etc.), pls specify: _____			
Online activities	<input type="checkbox"/> Online lecture videos			
	<input type="checkbox"/> Other online learning tasks, pls specify: _____			
The total learning hours of the course# is equivalent to <u>120</u> hours <sup>(8)</sup> # including both scheduled instructional hours and hours for self-study activities & assessment				

- For course adopting a pedagogic approach other than lecture, tutorial and laboratory, please indicate the pedagogy used:

- ☐ Blended learning<sup>(20)</sup>
☐ Pure online delivery<sup>(21)</sup>  
☐ Experiential learning<sup>(22)</sup>
☐ Others, pls specify: \_\_\_\_\_

### 2.4 Planned Assessment Weightings

Assessment Task	Proportion of Final Grade (%)	Indicate which course ILOs this task is to assess (Write CILO-1, CILO-2, etc.)	Additional Information (optional)
<input type="checkbox"/> In-class test			
<input type="checkbox"/> Mid-term test			
<input checked="" type="checkbox"/> Final exam	40%	CILO-1, CILO-2, CILO-3	
<input checked="" type="checkbox"/> Written assignment	30%	CILO-1, CILO-2, CILO-3, CILO-4	
<input type="checkbox"/> Project report			
<input type="checkbox"/> Presentation			
<input type="checkbox"/> Learning portfolio			
<input type="checkbox"/> Course participation			
<input type="checkbox"/> Peer evaluation			
<input checked="" type="checkbox"/> Others (e.g. proctored online exam, etc.), pls specify: Lab	30%	CILO-4, CILO-5	

**2.5 Course Duration**

☒ 1 term      ☐ 2 terms      ☐ Others, pls specify: \_\_\_\_\_

**2.6 Planned Frequency of Offerings [Check all appropriate boxes]:**

- |   |                                       |
|---|---------------------------------------|
| <input type="checkbox"/> Every Fall                 | <input type="checkbox"/> Every Winter |
| <input checked="" type="checkbox"/> Every Spring    | <input type="checkbox"/> Every Summer |
| <input type="checkbox"/> No fixed pattern           |                                       |
| <input type="checkbox"/> Other (pls specify): _____ |                                       |

**2.7 Course outline attached**

☐ No      ☒ Yes

**• Internationalization:**

*Internationalization in a course refers to course content and/or pedagogic approaches which incorporate an intercultural and international perspective. Examples may include:*

- *Collaboration with overseas institutions to develop and adopt international course content, or to arrange international field trip*
- *Insertion of international theme as part of the course*
- *Integrating the course content with international material as examples or case studies*
- *Elements to provide global diversified perspectives and/or practices around the world*

*Please briefly list or summarize any component(s) in the course that contributes to internationalizing the curriculum:*

**2.8 Resources**

Request extra resources for teaching this course?

☒ No      ☐ Yes

## **ELEC4210: Control System Design**


### **Lecture Outline**

Week	Description
1	Stabilization
2	Regulation, 2DOF controllers
3	Case study 1
4	Performance analysis
5	Optimal control
6	Case study 2
7	Uncertain system analysis
8	Robust control
9	Case study 3
10	State-space analysis
11	State-space synthesis
12	Case study 4
13	Advanced topics

## Section 4: Development, Concurrence and Approval

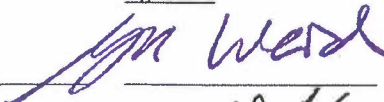

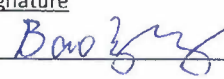
### 4.1 Contribution to the Program Learning Outcomes

(To be completed by EACH of the program(s) of study noted under Section 1.2)

<input checked="" type="checkbox"/>	The course contributes to this Major/Minor* Program:	<u>BEng(ELEC)</u>	
			(* Delete as appropriate)
<input checked="" type="checkbox"/>	The relevant <b>program learning outcomes</b> are attached.		
<input checked="" type="checkbox"/>	On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
Position / Name:		Signature	Date
Program Director / Head of Department: <u>Prof. Bertram SHI, DH</u>			<u>18 NOV 2020</u>

<input type="checkbox"/>	The course contributes to this Major/Minor* Program:		
			(* Delete as appropriate)
<input type="checkbox"/>	The relevant <b>program learning outcomes</b> are attached.		
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Position / Name:		Signature	Date
Program Director / Head of Department: _____		_____	_____

### 4.2 Approvals

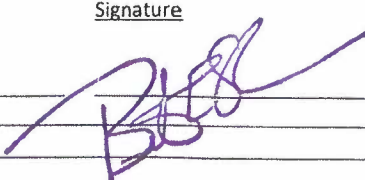
Department/Program unit level Recommendation			
<input type="checkbox"/>	Offering Department/Program Unit: (Please specify unit): <u>ECE</u>	Position / Name: <u>Prof. Weichuan YU</u> <u>UG coordinator</u>	Signature  Date <u>18 NOV 2020</u>
<input checked="" type="checkbox"/>	Recommending School/IPO: (Please specify): <u>SENG</u>	<u>Prof. Philip K. T. MOK</u> <u>Assoc. Dean of Engineering</u>	 Date <u>14 Dec 2020</u>
School-level Concurrence			
	Name of School/Unit	Position / Name	Signature
<input type="checkbox"/>	<u>MAE</u>	<u>Prof. Baoling Huang/UG Coord.</u>	 <u>18/11/2020</u>
<input type="checkbox"/>	<u>DDP</u>	_____	_____
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____



## Section 4: Development, Concurrence and Approval


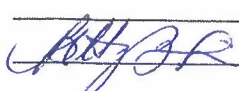
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Position / Name:		Signature	Date
Program Director / Head of Department: <u>Prof. Bertram SHI, DH</u>			<u>18 NOV 2020</u>

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Position / Name:		Signature	Date
Program Director / Head of Department: _____		_____	_____

### 4.2 Approvals

Department/Program unit level Recommendation			
	Position / Name:	Signature	Date
<input type="checkbox"/>	Offering Department/Program Unit: (Please specify unit): ECE _____	<u>Prof. Weichuan YU</u> <u>UG coordinator</u>	
<input type="checkbox"/>	Recommending School/IPO: (Please specify): <u>SENG</u>	_____	<u>18 NOV 2020</u>
School-level Concurrence			
	Name of School/Unit	Position / Name	Signature
<input type="checkbox"/>	<u>MAE</u>	_____	_____
<input type="checkbox"/>	<u>DDP</u>	<u>UGC/Betty Lin</u>	
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____