THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2021-2022 Term Fall

b) Department Code[3]: CHEM Subject Area[3]: ***CHEM*** Course Number [4]: **2550**

Previous Course Code[5]:

c) Full Title[6] *(max. 100 characters)*: Synthetic Chemistry Laboratory I

d) Abbreviated Title[7] *(max. 30 characters)*:

e) Course Credits[8]: (X) Fixed: 2 ( ) Range: From To

f) Catalog Description[9] *(word limit = 150)*:

This is the laboratory course designed for students who enrolled in CHEM 2110 Organic Chemistry I and CHEM 2210 Inorganic Chemistry I. It includes a series of organic and inorganic experiments related to the theory learnt in the lecture courses. Students will be trained to perform a wide range of basic synthetic chemistry laboratory techniques, operate chemical instruments in laboratory, relate the physical and chemical principles and theory in practice and develop their data interpretation and analyzing skills. For CHEM students only.

g) Grading Type[10]: (X) Letter Grades ( ) Distinction/Credit/Pass/Fail ( ) Pass/ Fail ( ) Distinction/Pass/Fail [ ] Others *(please specify)*:

h) [x] Prerequisites[11]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
CHEM 1050	Lab for General Chemistry I

i) [x] Corequisites[12]:

Course Code	Course Title
CHEM2110	Organic Chemistry I
CHEM2210	Inorganic Chemistry I

j) [x] Exclusions[13]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
CHEM 2155	Fundamental Organic Chemistry Lab

k) [ ] Co-listing[14]: [ ] Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] ( ) No ( ) Yes

[ ] Instructor's approval required

[x] Restricted to specified student group(s) *(please specify, e.g. year and program of study)*: For CHEM Major students

[ ] Others *(please specify)*:

m) Medium of Instruction/Materials[16]: (x) English ( ) Others, (Pls specify and provide a justification in Section 1.3): _____

n) Allow course repetition for credit[17]: (x) No ( ) Yes

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

[x] Major

Program of Study	As		
BSc. in Chemistry	[x] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Minor

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Common Core

[ ] Others (pls specify):

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

1.3 *Rationale for Introducing this course and other relevant information* [18]

This course was designed and introduced to suit chemistry major students who are enrolling in Organic Chemistry I and Inorganic Chemistry I, in which it provides students some hands-on experience in organic synthesis and metal complexes formation. Various laboratory methods of characterization of organic and inorganic substances will be also introduced.

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	Describe the fundamentals of organic and inorganic chemistry.	A
2	Assess and manage the risks of organic and inorganic chemical substances and laboratory procedures.	A, B
3	Conduct analysis and interpretation of experimental data of synthetic chemistry.	B
4	Conduct standard laboratory procedures involved in fundamental chemical synthesis and instrumental work.	B
5	Operate a range of chemical instrumentation.	B
6	Work independently and collaborate in team work	C
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: B Sc in Chemistry **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Describe the fundamentals of chemistry including the structure, reactivity and properties of chemical substances and the states of matter	CILO 1
2	Assess and manage the risks and hazards associated with chemical substances and laboratory procedures and evaluate their potential impact on the environment.	CILO 2
3	Analyze and interpret experimental data, critically assess data from literature sources and extract and apply useful data from those sources.	CILO 3
4	Conduct the standard laboratory procedures involved in synthetic and instrumental work	CILO 4
5	Operate a range of chemical instrumentation demonstrating adequate hands-on experience.	CILO 5
6	Demonstrate self-awareness and the ability to work independently and collaborate effectively with other people in a team	CILO 6
7		
8		

	Program of study 2: _____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1		
2		
3		
4		
5		
6		
7		
8		

Section 2B: Additional Information[2] *(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	☐ Lecture*			
	☒ Tutorial*	1	CILO 1, CILO 2, CILO 3	
	☐ Seminar/Small-class*			
	☒ Laboratory*	3	CILO 4, CILO 5, CILO 6	
	*Does the above scheduled component(s) involve structured active learning activities?[19] ◉ No ○ Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	☐ Others (e.g. fieldtrip, visit, etc.), *pls specify:* _____			
Online activities	☐ Online lecture videos			
	☐ Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to 80 **hours**[8] *# 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[20] ○ Pure online delivery[21]

○ Experiential learning[22] ○ 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)*
☒ In-class test	20	CILO 1, CILO 2, CILO 3	
☐ Mid-term test			
☐ Final exam			
☒ Written assignment	35	CILO 1, CILO 2, CILO 3	
☐ Project report			
☐ Presentation			
☐ Learning portfolio			
☐ Course participation			
☐ Peer evaluation			
☒ Others (e.g. proctored online exam, etc.), *pls specify:* Lab performance	45	CILO 4, CILO 5, CILO 6	

2.5 *Course Duration*

(x) 1 term ( ) 2 terms ( ) Others, *pls specify:* _____

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

[x] Every Fall
[ ] Every Spring
[ ] No fixed pattern
[ ] Other *(pls specify):* _____
[ ] Every Winter
[ ] Every Summer

2.7 *Course outline attached*

(x) 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? (x) No ( ) Yes

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Dept of Chemistry	UG Coordinator	Prof Xuhui HUANG	28-Oct-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Dept of Chemistry	UG Coordinator	Prof Xuhui HUANG	28-Oct-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Science	Associate Dean	Prof Pak Wo LEUNG	9-Nov-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2021-2022 Term Fall

b) Department Code[3]: CHEM Subject Area[3]: ***CHEM*** Course Number [4]: **2555**

Previous Course Code[5]:

c) Full Title[6] *(max. 100 characters)*: Molecular Characterization Chemistry Laboratory I

d) Abbreviated Title[7] *(max. 30 characters)*:

e) Course Credits[8]: (X) Fixed: 2 ( ) Range: From To

f) Catalog Description[9] *(word limit = 150)*:

This is the laboratory course corresponding to the lectures of CHEM 2410 Physical Chemistry I and CHEM 2310 Fundamentals of Analytical Chemistry. The topic of experiments covered in this course are closely connected with the topics covered in the lecture courses, such as electrochemical equilibrium, chemical instrumental analysis, thermodynamics, etc. For CHEM students only.

g) Grading Type[10]: (X) Letter Grades ( ) Distinction/Credit/Pass/Fail ( ) Pass/ Fail ( ) Distinction/Pass/Fail [ ] Others *(please specify)*:

h) [x] Prerequisites[11]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
CHEM 1050	Lab for General Chemistry I
(CHEM 2409 OR MATH 2351)	Mathematical Methods for Physical Chemistry OR Introduction to Differential Equations

i) [x] Corequisites[12]:

Course Code	Course Title
CHEM 2310	Fundamentals of Analytical Chemistry
CHEM 2410	Physical Chemistry I: Equilibrium Thermodynamics and Statistical Mechanics

j) [x] Exclusions[13]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
CHEM 2355	Fundamental Analytical Chemistry Lab

k) [ ] Co-listing[14]: [ ] Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] ( ) No ( ) Yes

[ ] Instructor's approval required

[x] Restricted to specified student group(s) *(please specify, e.g. year and program of study)*: For CHEM Major students

[ ] Others *(please specify)*:

m) Medium of Instruction/Materials[16]: (x) English ( ) Others, (Pls specify and provide a justification in Section 1.3): _____

n) Allow course repetition for credit[17]: (x) No ( ) Yes

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

[x] Major

Program of Study	As		
BSc. in Chemistry	[x] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Minor

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Common Core

[ ] Others (pls specify):

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

1.3 *Rationale for Introducing this course and other relevant information* [18]

This is a practical course designed for students who are taking the lectures of Physical Chemistry I and Fundamentals of Analytical Chemistry, in which it provides students some hands-on experience, with the use of analytical instruments or physical equipment, to apply what they learned in lectures in practical term. The main topics include electrochemical equilibrium, GC-FID analysis, etc.

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	Apply the instrumental techniques to analytical chemical analyses.	A, B, C
2	Demonstrate physical chemical principles by practical experiments.	A, B, C
3	Conduct lab analysis following lab procedures independently.	B, C
4	Calculate, explain and interpret experimental data.	A, B
5		
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: B Sc in Chemistry **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Explain the essential facts, principles and theories across the four principal areas of chemistry, i.e. analytical, organic, inorganic and physical.	CILO 1, CILO 2, CILO 4
2	Analyze and interpret experimental data, critically assess data in literature and extract useful data from it.	CILO 4
3	Conduct standard laboratory procedures involved in synthetic and instrumental work.	CILO 1, CILO 2, CILO 3
4	Operate a range of chemical instrumentation with adequate hands-on experiences.	CILO 1, CILO 2, CILO 3
5	Assess and manage the risks of chemical substances and laboratory procedures by evaluating their potential impact on the environment.	CILO 1, CILO 2, CILO 3
6	Demonstrate self awareness, work independently and collaborate effectively with other people in a team.	CILO 1, CILO 2, 3 CILO
7		
8		

	Program of study 2: _____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1		
2		
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4		
5		
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7		
8		

Section 2B: Additional Information[2] *(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	☐ Lecture*			
	☒ Tutorial*	1	CILO 1, CILO 2, CILO 4	
	☐ Seminar/Small-class*			
	☒ Laboratory*	3	CILO 1, CILO 2, CILO 3, CILO 4	
	*Does the above scheduled component(s) involve structured active learning activities? [19] (x) No ( ) Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	☐ Others (e.g. fieldtrip, visit, etc.), *pls specify:* _____			
Online activities	☐ Online lecture videos			
	☐ Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to 30 **hours** [8] *# 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 [20] ( ) Pure online delivery [21]

( ) Experiential learning [22] ( ) 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)*
☒ In-class test	20	CILO 1, CILO 2, CILO 4	
☐ Mid-term test			
☐ Final exam			
☒ Written assignment	60	CILO 1, CILO 2, CILO 3, CILO 4	
☐ Project report			
☐ Presentation			
☐ Learning portfolio			
☐ Course participation			
☐ Peer evaluation			
☒ Others (e.g. proctored online exam, etc.), *pls specify:* Lab Performance	20	CILO 3	

2.5 *Course Duration*

(x) 1 term ( ) 2 terms ( ) Others, *pls specify:* _____

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

[x] Every Fall
[ ] Every Spring
[ ] No fixed pattern
[ ] Other *(pls specify):* _____
[ ] Every Winter
[ ] Every Summer

2.7 *Course outline attached* (x) 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? (x) No ( ) Yes

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Dept of Chemistry	UG Coordinator	Prof Xuhui HUANG	28-Oct-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Dept of Chemistry	UG Coordinator	Prof Xuhui HUANG	28-Oct-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Science	Associate Dean	Prof Pak Wo LEUNG	9-Nov-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2021-2022 Term Fall

b) Department Code[3]: CIVL Subject Area[3]: *CIVL* Course Number [4]: 4560

Previous Course Code[5]: CIVL4100H

c) Full Title[6] *(max. 100 characters)*: Urban Hydroclimate and the Built Environment

d) Abbreviated Title[7] *(max. 30 characters)*: Urban Hydroclimate

e) Course Credits[8]: ● Fixed: 3 ○ Range: From _____ To _____

f) Catalog Description[9] *(word limit = 150)*:

This course is a mixture of lecture, reading, and group project focused on urban hydroclimate and the built environment, particularly their interactions through the energy-water-climate nexus. Lectures will cover mathematical laws and physical concepts of heat, moisture and mass transport in the built environment, as well as implications of urban hydroclimate on smart city development in the 21st century. Through hands-on tutorials, students will learn a numerical model and use it to explore the impact of neighborhood design on urban thermal environment, including the usage of novel engineering materials, urban landscape and building technology.

g) Grading Type[10]: ● Letter Grades ○ Distinction/Credit/Pass/Fail ○ Pass/ Fail
○ Distinction/Pass/Fail ☐ Others *(please specify)*: _____

h) ☐ Prerequisites[11]:

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

i) ☐ Corequisites[12]:

Course Code	Course Title

j) ☐ Exclusions[13]:

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

k) ☐ Co-listing[14]: ☐ Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] ● 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[16]: ● English ○ Others, (Pls specify and provide a justification in Section 1.3):

n) Allow course repetition for credit[17]: ● No ○ Yes

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

■ Major

Program of Study	As		
CIVL, CIEV	☐ Required Course	■ Elective	☐ Prerequisite

☐ Minor

Program of Study	As		
	☐ Required Course	☐ Elective	☐ Prerequisite

☐ Common Core

☐ Others (pls specify):

Program of Study	As		
	☐ Required Course	☐ Elective	☐ Prerequisite

1.3 *Rationale for Introducing this course and other relevant information* [18]

Urbanization process has significantly modified the environment we live in during the past decades. Anthropogenic activities create unique hydroclimate over urban areas, which has important effects on human society. While global population is being increasingly urbanized, the fundamental knowledge of urban hydroclimate and its linkage with city development are not included in the existing curriculum. This course intends to fill this gap by teaching undergraduate students the physical principles governing the energy, water, and mass transport in cities. Students will learn the complex water-energy-climate nexus within the built environment and its interaction with urban hydroclimate. On this basis, group projects are designed to allow students to investigate the impact of various engineering materials/neighborhood design on the hydroclimate in different cities. Through this practice, students will have the opportunity to explore how scientific knowledge can be applied to moderate the undesirable consequences of urban development and help build sustainable and resilient cities.

The course has been offered twice as a special topic course in 2019 Spring and 2020 Spring. Students have shown great interest in the topic and provided positive feedbacks on the course content. And thus turning it into a regular course will be beneficial for the undergraduate programs.

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	Formulate and solve heat, moisture, and mass transport problems in the built environment using governing equations	A
2	Describe the water-energy-climate nexus in cities	A
3	Conduct neighborhood planning and sustainability analysis through numerical models	A, B
4	Identify the hydroclimate challenges cities face in the near future and their potential engineering solutions	A, B
5	Understand the broad impact of engineering infrastructure on urban development and environmental sustainability	A
6		

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: _____BEng in Civil Engineering_____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	**PO1:** Acquire fundamental knowledge in mathematics and science on which civil engineering research and practice are based.	*CILO-1, CILO-2*
2	**PO2:** Understand fundamental principles of engineering science relevant to civil engineering disciplines.	*CILO-2, CILO-4*
3	**PO5:** Develop an ability to identify and formulate civil engineering problems, and propose feasible solutions with an appreciation of their underlying assumptions, uncertainties, constraints, and technical limitations.	*CILO-1, CILO-3*
4	**PO7:** Develop an appreciation of the breadth of civil engineering, and acquire basic knowledge in several disciplines to enable effective performance within a multidisciplinary work environment.	*CILO-4, CILO-5*
5	**PO9:** Develop an ability to communicate and present ideas effectively, including oral, written, and technical writing skills, and to function effectively within and among teams with a variety of backgrounds and interests.	*CILO-3*
6		

	Program of study 2: ___ BEng in Civil and Environmental Engineering_____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	**PO1:** Acquire fundamental knowledge in mathematics and science on which civil and environmental engineering research and practice are based.	*CILO-1, CILO-2*
2	**PO2:** Understand fundamental principles of engineering science relevant to civil engineering disciplines.	*CILO-2, CILO-4*
3	**PO5:** Develop an ability to identify and formulate civil and environmental engineering problems, and propose feasible solutions with an appreciation of their underlying assumptions, uncertainties, constraints, and technical limitations.	*CILO-1, CILO-3*
4	**PO6:** Develop technical competency to design civil and environmental engineering components and systems, with an understanding of the principles behind the design methodologies	*CILO-2, CILO-3*
5	**PO7:** Develop an appreciation of the breadth of civil and environmental engineering, and acquire basic knowledge in several disciplines to enable effective performance	*CILO-4, CILO-5*

	within a multidisciplinary work environment.	
6	**PO9:** Develop an ability to communicate and present ideas effectively, including oral, written, and technical writing skills, and to function effectively within and among teams with a variety of backgrounds and interests.	*CILO-3*
7		
8		

Section 2B: Additional Information[2] *(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	■ Lecture*	**3/6**	*CILO-1, CILO-2, CILO-3, CILO-4, CILO-5*	
	☐ Tutorial*			
	☐ Seminar/Small-class*			
	☐ Laboratory*			
	*Does the above scheduled component(s) involve structured active learning activities? [19] ● No ○ Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	☐ Others (e.g. fieldtrip, visit, etc.), *pls specify:* _____			
Online activities	☐ Online lecture videos			
	☐ Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to ____120_____ hours [8] *# 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 [20] ○ Pure online delivery [21]

○ Experiential learning [22] ○ 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)*
☐ In-class test			
☐ Mid-term test			
☐ Final exam			
■ Written assignment	**30**	*CILO-1, CILO-4*	*Three homework assignments*
■ Project report	**40**	*CILO-2, CILO-3, CILO-4, CILO-5*	*Group project in 2 phases: Phase 1 requires each student to finish their own task (individual report 20%), Phase 2 is teamwork on comparing results from phase I (group report 20%)*
■ Presentation	**20**	*CILO-2, CILO-3, CILO-4, CILO-5*	
☐ Learning portfolio			
■ Course participation	**10**	*CILO-1, CILO-4, CILO-5*	
☐ Peer evaluation			

2.5 *Course Duration*

● 1 term ○ 2 terms ○ Others, *pls specify:* _____

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

- ■ Every Fall
- ☐ Every Spring
- ☐ No fixed pattern
- ☐ Other *(pls specify):* _____
- ☐ Every Winter
- ☐ Every Summer

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

Week	Topics	**Briefly outline what this topic will cover** *(Include reading assignments if available)*	**Indicate which course ILOs this topic is related to** *(Write CILO-1, CILO-2, etc.)*
1	History and future of urbanization	-Global trend of urbanization and its environmental impact -Heterogeneous urban surfaces in the built environment	*CILO-2, CILO-4*
2	Radiation exchange in the built environment	-What are the heat transfer mechanisms and surface radiation budgets in cities? -How thermal properties and building morphology affect urban radiation?	*CILO-1*
3	Urban surface energy balance	-Radiative trapping in the built environment and its controlling parameters -Difference in energy balance between urban and rural areas	*CILO-1, CILO-4*
4	Urban heat island	-Causes for different types of urban heat islands -Latest researches on urban heat island	*CILO-4, CILO-5*
5	Urban water cycle	-Urban water budget and its difference from rural water budget -Urban impacts on runoff hydrograph	*CILO-1*
6	Urban precipitation and stormwater management	-Urban drainage system design for stormwater management -Principles of precipitation generation and urban precipitation modification	*CILO-1, CILO-4*
7	Hands-on tutorial and group project discussion	-Tutorial on urban simulations using Matlab -Introduction on group projects and assign specific tasks to individual students	*CILO-3*
8	Water-energy-climate nexus in cities	-Interactions between urban hydroclimate and the built environment -Impact of water-energy-climate nexus on smart city development -Latest researches on engineering solutions and urban policies tackling environmental sustainability	*CILO-2, CILO-4, CILO-5*
9	Urban atmosphere	-What are the factors influencing urban hydroclimate? -Vertical structure and dynamic of urban boundary layer	*CILO-1*
10	Turbulent air flows in cities	-Air flow regimes under the interactions among different buildings -Key characteristics of turbulent flows	*CILO-1, CILO-4*
11	Urban air quality and multi-scale modeling	-Wind profiles in the built environment and their impacts on pollution dispersion -Multi-scale modeling of urban hydroclimate	*CILO-1, CILO-3, CILO-4*
12	Building Energy Consumption	-Interaction between building energy consumption and urban hydroclimate -Numerical simulations of building energy consumption	*CILO-2, CILO-4*
13	Course project presentation	-Group presentation on neighborhood design to enhance thermal environment and sustainability	*CILO-3, CILO-4, CILO-5*

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Dept of Civil and Environmental Engineering	UG Coordinator	Prof Jack CHENG	2-Nov-20
Dept of Civil and Environmental Engineering	UG Coordinator	Prof Jack CHENG	2-Nov-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Dept of Civil and Environmental Engineering	UG Coordinator	Prof Jack CHENG	2-Nov-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Engineering	Associate Dean	Prof Philip K. T. MOK	14-Dec-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*
Dual Degree Program in Technology and Management	UG Coordinator	Prof Betty LIN	10-Nov-20

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2021-22 Term Fall

b) Department Code[3]: CSE Subject Area[3]: COMP Course Number [4]: 2211

Previous Course Code[5]:

c) Full Title[6] *(max. 100 characters)*: Exploring Artificial Intelligence

d) Abbreviated Title[7] *(max. 30 characters)*: Exploring AI

e) Course Credits[8]: ● Fixed: 3 ○ Range: From To

f) Catalog Description[9] *(word limit = 150)*:

This course aims to give a gentle introduction to the basic elements of artificial intelligence (AI) through understanding examples from various applications and hands-on experimentation using AI software tools. In addition to covering the technical aspect of AI through such topics as search and problem solving, knowledge representation, probabilistic reasoning, machine learning, computer vision and image processing, speech and language processing, and robotics, this course will also study the historical perspective, social and ethical implications, as well as potential and limitations of AI.

g) Grading Type[10]: ● Letter Grades ○ Distinction/Credit/Pass/Fail ○ Pass/ Fail ○ Distinction/Pass/Fail ☐ Others *(please specify)*:

h) ■ Prerequisites[11]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
COMP 1021 OR	Introduction to Computer Science
COMP 1029P	Python Programming Bridging Course

i) ☐ Corequisites[12]:

Course Code	Course Title

j) ■ Exclusions[13]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
COMP 3211	Fundamentals of Artificial Intelligence
COMP 4211	Machine Learning
COMP 4221	Introduction to Natural Language Processing
COMP 4331	Data Mining
COMP 4332	Big Data Mining and Management
COMP 4421	Image Processing
COMP 4471	Deep Learning in Computer Vision
COMP 4901K	Machine Learning for Natural Language Processing
COMP 4901L	Foundations of Computer Vision
ELEC 4130	Digital Image Processing
ELEC 4230	Deep Learning for Natural Language Processing
IDPO 4110	Practical Machine Learning

ISOM 3360	Data Mining for Business Analytics
MATH 4336	Introduction to Mathematics of Image Processing
MATH 4432	Statistical Machine Learning
RMBI 4310	Advanced Data Mining for Risk Management and Business
COMP 5211	Advanced Artificial Intelligence
COMP 5331	Knowledge Discovery in Databases
COMP 5212	Machine Learning
COMP 5213	Introduction to Bayesian Networks
COMP 5221	Natural Language Processing
COMP 5222	Statistical Learning Models for Text and Graph Data
COMP 5223	Perception and Information Processing for Robotics
COMP 5421	Computer Vision

k) ☐ Co-listing[14]: ☐ Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] ● 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[16]: ● English ○ Others, (Pls specify and provide a justification in Section 1.3):

_____

n) Allow course repetition for credit[17]: ● No ○ Yes

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

■ Major

Program of Study	As		
COMP, COSC, COGBM, CPEG, CPGBM	☐ Required Course	■ Elective	☐ Prerequisite

☐ Minor

Program of Study	As		
	☐ Required Course	☐ Elective	☐ Prerequisite

☐ Common Core

■ Others (pls specify):

Program of Study	As		
Extended Major in AI (Major + AI)	☐ Required Course	■ Elective	☐ Prerequisite

1.3 *Rationale for Introducing this course and other relevant information[18]*

Although there is plenty of hype from mass media about artificial intelligence (AI), the unprecedented successes of AI in a number of real-world applications are undeniable. This 2000-level course serves to give a gentle introduction to both the technical and non-technical aspects of AI suitable for most if not all students at HKUST. No prerequisites will be required for students to understand the conceptual aspects of the course. However, prior experience in basic Python programming gained from an introductory course such as COMP 1021 (Introduction to Computer Science) or COMP 1029P (Python Programming Bridging Course) will allow students to make use of AI software tools to build interesting applications. Incorporating this practical facet as an integral part of the course will help students get more excited about the subject and practise AI thinking through realistic

examples. With this course serving to give a quick overview of some basic elements of AI, we hope to inspire and encourage students to learn more later by taking more specialized, advanced AI courses.
The reason of including the list of advanced courses as **one-way exclusion** is to prevent students who have taken advanced AI courses to take COMP2211 for easy credits, and we will not change exclusions of these advanced AI courses, so students who have taken COMP2211 can still go on to take these advanced courses. In addition, we intend to include COMP2211 as alternative required course in the curriculum of Major+AI after launching it at least once.

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	Demonstrate general understanding of the historical perspective and development of artificial intelligence (AI)	A
2	Demonstrate fundamental understanding of the basic elements of AI thinking	B
3	Demonstrate proficiency in applying basic principles and techniques of AI and using AI software tools to solve problems in a range of applications	B
4	Demonstrate awareness of the social and ethical implications as well as potential and limitations of AI	A
5		
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: COMP/COSC **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	#1 An ability to apply knowledge of computing and mathematics appropriate to the discipline	CILO-3
2	#2 An ability to apply knowledge of a computing specialization, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models	CILO-2, CILO-3
3	#3 An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution	CILO-2, CILO-3
4	#4 An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs	CILO-2, CILO-3
5	#6 An understanding of professional, ethical, legal, security and social issues and responsibilities	CILO-4
6	#7 An ability to communicate effectively with a range of audiences	CILO-3
7	#8 An ability to analyze the local and global impact of computing on individuals, organizations, and society	CILO-4
8	#10 An ability to use current techniques, skills, and tools necessary for computing practices	CILO-2, CILO-3

	Program of study 2: CPEG **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	#1 An ability to apply knowledge of mathematics, science, and computer engineering	CILO-3
2	#2 An ability to analyze an engineering problem and identify the hardware and/or software requirements appropriate to its solution	CILO-2, CILO-3
3	#3 An ability to design and implement a computer-based system including embedded systems encompassing hardware and/or software to meet desired needs	CILO-2, CILO-3
4	#5 An ability to identify, formulate and solve computer engineering problems subject	CILO-2, CILO-3

	to practical constraints	
5	#6 An ability to understand professional and ethical responsibility	CILO-4
6	#7 An ability to communicate effectively with a range of audience	CILO-3
7	#8 An ability to understand the local and global impact of computer engineering solutions on individuals, organizations, and society	CILO-4
8	#9 An ability to understand contemporary global, economic, environmental, and societal issues, and their potential connection with computer engineering	CILO-4
9	#11 An ability to use the techniques, skills, and modern engineering tools necessary for solving computer engineering problems	CILO-2, CILO-3
10	#12 An ability to use hardware and/or software tools to effectively solve engineering problems with an understanding of their processes and limitations	CILO-2, CILO-3

	Program of study 3: Major + AI **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Identify emerging technology and innovations that will create opportunities and values for people, business and society	CILO-1, CILO-2, CILO-4
2	Integrate knowledge and mindset drawn from different disciplines	CILO-2, CILO-3
3	Apply innovative knowledge and practical problem-solving skills to tackle real business, scientific or socio-economic problems relevant to their Major areas	CILO-3
4		
5		
6		
7		
8		

Section 2B: Additional Information[2] *(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	■ Lecture*	3	CILO-1, CILO-2, CILO-3, CILO-4	
	☐ Tutorial*			
	☐ Seminar/Small-class*			
	■ Laboratory*	1	CILO-3	
	*Does the above scheduled component(s) involve structured active learning activities? [19] ● No ○ Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	☐ Others (e.g. fieldtrip, visit, etc.), *pls specify:* _____			
Online activities	☐ Online lecture videos			
	☐ Other online learning tasks, *pls specify:* _____			

The total learning hours of the course# is equivalent to 120 hours [8]
 # 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 [20] ○ Pure online delivery [21]
○ Experiential learning [22] ○ 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)*
☐ In-class test			
■ Mid-term test	15%	CILO-1, CILO-2, CILO-3, CILO-4	
■ Final exam	40%	CILO-1, CILO-2, CILO-3, CILO-4	
☐ Written assignment			
■ Project report	30%	CILO-2, CILO-3	2-3 programming projects
■ Presentation	5%	CILO-2, CILO-3	
☐ Learning portfolio			
■ Course participation	5%	CILO-1, CILO-2, CILO-3, CILO-4	
■ Peer evaluation	5%	CILO-2, CILO-3	
☐ Others (e.g. proctored online exam, etc.), *pls specify:* _____			

2.5 *Course Duration*

● 1 term ○ 2 terms ○ Others, *pls specify:* _____

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

■ Every Fall ☐ Every Winter

■ Every Spring ☐ Every Summer

☐ No fixed pattern

☐ 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

COMP 2211: Exploring Artificial Intelligence

Catalog Description

This course aims to give a gentle introduction to the basic elements of artificial intelligence (AI) through understanding examples from various applications and hands-on experimentation using AI software tools. In addition to covering the technical aspect of AI through such topics as search and problem solving, knowledge representation, probabilistic reasoning, machine learning, computer vision and image processing, speech and language processing, and robotics, this course will also study the historical perspective, social and ethical implications, as well as potential and limitations of AI.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- Demonstrate general understanding of the historical perspective and development of artificial intelligence (AI).
- Demonstrate fundamental understanding of the basic elements of AI thinking.
- Demonstrate proficiency in applying basic principles and techniques of AI and using AI software tools to solve problems in a range of applications.
- Demonstrate awareness of the social and ethical implications as well as potential and limitations of AI.

Major Topics

Brief history
Search and problem solving
Knowledge representation
Probabilistic reasoning
Machine learning
Computer vision and image processing
Speech and language processing
Robotics
Social and ethical implications
Potential and limitations

An innovative approach will be adopted to cover some basic elements of the technical topics through interesting examples. Specifically, the topics will not be covered one-by-one separately. Instead, real-world examples that require integrative use of multiple topics will be chosen for illustration. For example, AI for games will be used to illustrate search and problem solving, knowledge representation, and machine learning; AI for autonomous vehicles to illustrate computer vision, machine learning, and robotics; AI for conversational agents (or chatbots) to illustrate speech/language processing and machine learning; AI for healthcare to illustrate image processing and machine learning; etc.

Reference Books

Hadelin de Ponteves. ***AI Crash Course****: A fun and hands-on introduction to machine learning, reinforcement learning, deep learning, and artificial intelligence with Python.* Packt Publishing. 2019.

Denis Rothman, Matthew Lamons, Rahul Kumar, Abhishek Nagaraja, Amir Ziai, and Ankit Dixit. ***Python: Beginner's Guide to Artificial Intelligence****: Build applications to intelligently interact with the world around you using Python.* Packt Publishing. 2018.

Online courses:

- AI for Everyone (https://www.coursera.org/learn/ai-for-everyone)
- AI Foundations for Everyone Specialization (https://www.coursera.org/specializations/ai-foundations-for-everyone)
- Machine Learning for All (https://www.coursera.org/learn/uol-machine-learning-for-all)
- Artificial Intelligence A-Z: Learn How to Build an AI (https://www.udemy.com/course/artificial-intelligence-az/)

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Dept of Computer Science and Engineering	UG Coordinator	Dr Qiong LUO	12-Nov-20
Computer Engineering Program	Program Director	Prof Wilfred NG	17-Nov-20
Interdisciplinary Programs Office	Chair of IUSC	Prof Jimmy FUNG	19-Nov-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Dept of Computer Science and Engineering	UG Coordinator	Dr Qiong LUO	12-Nov-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Engineering	Associate Dean	Prof Philip K. T. MOK	14-Dec-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*
Interdisciplinary Programs Office	Chair of IUSC	Prof Jimmy FUNG	19-Nov-20
Dual Degree Program in Technology and Management	UG Coordinator	Prof Betty LIN	13-Nov-20
Dept of Electronic & Computer Engineering	UG Coordinator	Prof Weichuan YU	16-Nov-20
Dept of Information Systems, Business Statistics & Operations Management - IS	Deputy Head of Dept	Prof Kai Lung HUI	20-Nov-20
Computer Engineering Program	Program Director	Prof Wilfred NG	17-Nov-20
Risk Management and Business Intelligence Program	UG Coordinator	Dr Jiying WANG	17-Nov-20
Dept of Mathematics	UG Coordinator	Dr Tsz Kin LAM	16-Nov-20

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2020-21 Term Spring

b) Department Code[3]: ECE Subject Area[3]: *ELEC* Course Number [4]: 4210

Previous Course Code[5]: ELEC4010G

c) Full Title[6] *(max. 100 characters)*: Control System Design

d) Abbreviated Title[7] *(max. 30 characters)*: Control System Design

e) Course Credits[8]: (X) Fixed: 3 ( ) Range: From _____ To _____

f) Catalog Description[9] *(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[10]: (X) Letter Grades ( ) Distinction/Credit/Pass/Fail ( ) Pass/ Fail ( ) Distinction/Pass/Fail [ ] Others *(please specify)*: _____

h) [x] Prerequisites[11]:

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

i) [ ] Corequisites[12]:

Course Code	Course Title

j) [ ] Exclusions[13]:

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

k) [ ] Co-listing[14]: [ ] Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] (X) 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[16]: (X) English ( ) Others, (Pls specify and provide a justification in Section 1.3): _____

n) Allow course repetition for credit[17]: (X) No ( ) Yes

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

[x] Major

Program of Study	As		
BEng(ELEC)	[ ] Required Course	[x] Elective	[ ] Prerequisite

[ ] Minor

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Common Core

[ ] Others (pls specify):

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

1.3 *Rationale for Introducing this course and other relevant information [18]*

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[2] *(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	[x] Lecture*	**3**	**CILO-1, CILO-2, CILO-3**	
	[ ] Tutorial*			
	[ ] Seminar/Small-class*			
	[x] Laboratory*	**1**	**CILO-4, CILO-5**	
	*Does the above scheduled component(s) involve structured active learning activities? [19] (X) No ( ) Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	[ ] Others (e.g. fieldtrip, visit, etc.), *pls specify:* _____			
Online activities	[ ] Online lecture videos			
	[ ] Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to _____120____ hours [8] *# 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 [20] ( ) Pure online delivery [21]

( ) Experiential learning [22] ( ) 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)*
[ ] In-class test			
[ ] Mid-term test			
[x] Final exam	**40%**	**CILO-1, CILO-2, CILO-3**	
[x] Written assignment	**30%**	**CILO-1, CILO-2, CILO-3, CILO-4**	
[ ] Project report			
[ ] Presentation			
[ ] Learning portfolio			
[ ] Course participation			
[ ] Peer evaluation			
[x] Others (e.g. proctored online exam, etc.), *pls specify:* _____*Lab*_____	**30%**	**CILO- 4, CILO-5**	

2.5 *Course Duration*

(X) 1 term ◯ 2 terms ◯ Others, *pls specify:* _____

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

☐ Every Fall ☐ Every Winter

☒ Every Spring ☐ Every Summer

☐ No fixed pattern

☐ 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? (X) 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

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Dept of Electronic & Computer Engineering	Head of Dept	Prof Bertram SHI	18-Nov-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Dept of Electronic & Computer Engineering	UG Coordinator	Prof Weichuan YU	18-Nov-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Engineering	Associate Dean	Prof Philip K. T MOK	14-Dec-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*
Dept of Mechanical & Aerospace Engineering	UG Coordinator	Prof Baoling HUANG	18-Nov-20
Dual Degree Program in Technology and Management	UG Coordinator	Prof Betty LIN	24-Nov-20

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2020/2021 Term Spring

b) Department Code[3]: SUSEE Subject Area[3]: ENEG Course Number [4]: 4210

Previous Course Code[5]: N/A

c) Full Title[6] *(max. 100 characters)*: Optimization of Energy Systems

d) Abbreviated Title[7] *(max. 30 characters)*:

e) Course Credits[8]: ◉ Fixed: 3 ○ Range: From ____ To ____

f) Catalog Description[9] *(word limit = 150)*:

Optimization practice, theory, and implementation with applications in energy. Topics include: foundations of linear and nonlinear programming; constrained and multiobjective optimization; optimization under uncertainty; multidisciplinary optimization; discrete optimization. The focus is on the application of optimization methods to solve energy engineering problems.

g) Grading Type[10]: ■ Letter Grades ○ Distinction/Credit/Pass/Fail ○ Pass/ Fail ○ Distinction/Pass/Fail ☐ Others *(please specify)*: ____

h) ■ Prerequisites[11]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
CENG 2210 or MECH 2310	Chemical and Biological Engineering Thermodynamics or Thermodynamics

i) ☐ Corequisites[12]:

Course Code	Course Title

j) ☐ Exclusions[13]:

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

k) ☐ Co-listing[14]: ☐ Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] ■ 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[16]: ■ English ○ Others, (Pls specify and provide a justification in Section 1.3): _____

n) Allow course repetition for credit[17]: ■ No ○ Yes

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

■ Major

Program of Study	As		
SUSEE CENG, CEEV	☐ Required Course	■ Elective	☐ Prerequisite
	☐ Required Course	☐ Elective (for Energy Option)	☐ Prerequisite

☐ Minor

Program of Study	As		
	☐ Required Course	☐ Elective	☐ Prerequisite

☐ Common Core

☐ Others (pls specify):

Program of Study	As		
	☐ Required Course	☐ Elective	☐ Prerequisite

1.3 *Rationale for Introducing this course and other relevant information [18]*

Optimization is needed in engineering to find the best or optimal designs. Therefore, it is critical to optimize processes so that a chosen quantity, the objective function, is maximized or minimized. For example, energy efficiency or profit may be maximized, while energy inputs or costs may be minimized. In turn, the energy industry's success and growth are strongly tied to the optimization of systems and processes.

Optimization in energy is particularly important as engineers need to find optimal design and operation leading to minimizing costs and maximizing efficiencies. In that context, it is critical that engineers formulate and solve optimization problems. To do that, the objective functions and constraints need to be formulated and understood not only in the context of a single optimization but also within the framework of large multidisciplinary teams that operate under uncertainty. In that context, multidisciplinary optimization and optimization under uncertainty play a critical role.

In short, the course aims to introduce techniques for the optimization modeling and the economic evaluation of industrial process and energy systems and to develop the skills required to identify the opportunity and implement optimization-based decision support tools in energy processes and systems. It covers the problem statement, modeling process and systems, solving methods for the simulation, and the single and multiobjective optimization strategies. Topics cover process systems engineering, process and system modeling and simulation, economic evaluation, optimization strategies, and data reconciliation.

Textbooks:

1. M.J. Kochenderfer, and T.A. Wheeler, Algorithms for Optimization, The MIT Press (2019)
2. I. Dincer, M.A. Rosen, and P. Ahmadi, Optimization of Energy Systems, Wiley, 1st Edition (2017).
3. O. Erdinc, Optimization in Renewable Energy Systems, Butterworth-Heinemann (2017)
4. L.T. Bielger, Nonlinear Programming: Concepts, Algorithms, and Applications to Chemical Processes, Society for Industrial and Applied Mathematics (2010)

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	Formulate optimization problems related to energy	A, B
2	Solve optimization problems	B
3	Visualize and present optimization results	B
4	Analyze heat and power production optimization	A, B
5	Optimize storage systems under uncertainty	A, B
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: _____SUSEE_____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Apply sustainable energy engineering principles in a wide range of settings;	CILO-1, CILO-4, CILO-5
2	Design processes and products in the realm of energy engineering to meet societal needs;	CILO-4, CILO-5
3	Develop an awareness of contemporary issues as they relate to engineering;	CILO-1, CILO-3
4	Solve energy and related problems critically and creatively;	CILO-1, CILO-2
5	Communicate clearly and concisely both in writing and orally;	CILO-3
6	Function effectively in multi-cultural and multidisciplinary teams;	
7	Pursue lifelong learning as self-regulated learners;	
8	Exercise integrity, high ethical standards, and care in their personal and professional lives; and	
9	Select and use appropriate engineering tools and data effectively.	CILO-1, CILO-2, CILO-3

	Program of study 1: _____CENG_____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Apply chemical engineering principles in a wide range of settings;	CILO-1, CILO-4, CILO-5
2	Design processes and products in the realm of chemical engineering to meet societal needs;	CILO-4, CILO-5
3	Develop an awareness of contemporary issues as they relate to engineering	CILO-1, CILO-3
4	Solve chemical engineering and related problems critically and creatively;	CILO-1, CILO-2
5	Communicate clearly and concisely both in writing and orally;	CILO-3
6	Function effectively in multi-cultural and multidisciplinary teams;	

7	Pursue lifelong learning as self-regulated learners;	
8	Exercise integrity, high ethical standards, and care in their personal and professional lives; and	
9	Select and use appropriate engineering tools and data effectively.	CILO-1, CILO-2, CILO-3

	Program of study 1: _____CEEV_____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Apply chemical and environmental engineering principles in a wide range of settings;	CILO-1, CILO-4, CILO-5
2	Design processes and products in the realm of chemical and environmental engineering to meet societal needs;	CILO-4, CILO-5
3	Develop an awareness of contemporary issues as they relate to engineering;	CILO-1, CILO-3
4	Solve chemical and environmental engineering and related problems critically and creatively;	CILO-1, CILO-2
5	Communicate clearly and concisely both in writing and orally;	CILO-3
6	Function effectively in multi-cultural and multidisciplinary teams;	
7	Pursue lifelong learning as self-regulated learners;	
8	Exercise integrity, high ethical standards, and care in their personal and professional lives; and	
9	Select and use appropriate engineering tools and data effectively.	CILO-1, CILO-2, CILO-3

Section 2B: Additional Information[2] *(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	■ Lecture*	3	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5	Activities will include frontal lectures and in-class coding exercises
	☐ Tutorial*			
	☐ Seminar/Small-class*			
	☐ Laboratory*			
	*Does the above scheduled component(s) involve structured active learning activities?[19] ◉ No ○ Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	☐ Others (e.g. fieldtrip, visit, etc.), *pls specify:* _____			
Online activities	☐ Online lecture videos			
	☐ Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to ____135_____ hours[8] *# 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[20] ○ Pure online delivery[21]

○ Experiential learning[22] ○ 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)*
☐ In-class test			
☐ Mid-term test			
☐ Final exam			
■ Written assignment	**40%**	CILO-1, CILO-2, CILO-4, CILO-5	**Individual project among those assigned**
■ Project report	**30%**	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5	**Individual project among those assigned**
■ Presentation	**30%**	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5	
☐ Learning portfolio			
☐ Course participation			
☐ Peer evaluation			
☐ Others (e.g. proctored online exam, etc.), *pls specify:* _____			

2.5 *Course Duration*

(■) 1 term ( ) 2 terms ( ) Others, *pls specify:* _____

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

[ ] Every Fall
[ ] Every Winter
[■] Every Spring
[ ] Every Summer
[ ] No fixed pattern
[ ] 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

Course Outline:

Week	Topic
1	Introduction to Modeling and Optimization of Thermal Systems
2	Introduction to Basic Optimization Concepts and Numerical Optimization Code
3	Bracketing and Local Descent
4	First- and Second-Order Methods
5	Direct Methods: Pattern Search and the Symplex
6	Stochastic Methods - Adam
7	Population Methods
8	Linear Constrained Optimization and Multiobjective Optimization – Concurrent Optimization of Battery Parameters
9	Optimization under Uncertainty
10	Bayesian Optimization and Probabilistic Methods
11	Discrete Optimization
12	Multidisciplinary Optimization in Engineering Design
13	Optimal Design of Hybrid Renewable Energy Systems

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Dept of Chemical and Biological Engineering	Program Director	Prof Ying CHAU	23-Oct-20
Dept of Chemical and Biological Engineering	Program Director	Prof Minhua SHAO	23-Oct-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Dept of Chemical and Biological Engineering	Program Director	Prof Minhua SHAO	23-Oct-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Engineering	Associate Dean	Prof Philip K. T. MOK	14-Dec-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*
Dual Degree Program in Technology and Management	UG Coordinator	Prof Betty LIN	30-Oct-20
Dept of Mechanical & Aerospace Engineering	UG Coordinator	Prof Baoling HUANG	3-Nov-20

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2021-2022 Term Fall

b) Department Code[3]: ISDN Subject Area[3]: ISDN Course Number [4]: 2601

Previous Course Code[5]: New Course

c) Full Title[6] *(max. 100 characters)*: Internet of Things: From Component Skills to System Integration

d) Abbreviated Title[7] *(max. 30 characters)*:

e) Course Credits[8]: (X) Fixed: 3 ( ) Range: From To

f) Catalog Description[9] *(word limit = 150)*:

This course introduces the fundamental concepts and skills on how to design an IoT (Internet of Things) system. The course includes fundamental theory and practical hands-on labs and projects for the student to acquire the basic knowledge on several key components for IoT systems, including circuits and sensors, signal processing, embedded systems, and communication and networking. The integration of different components is an important topic for this course. The students will acquire the knowledge through lectures, practical hands-on labs, and projects.

g) Grading Type[10]: (X) Letter Grades ( ) Distinction/Credit/Pass/Fail ( ) Pass/ Fail ( ) Distinction/Pass/Fail [ ] Others *(please specify)*:

h) [ ] Prerequisites[11]:

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

i) [ ] Corequisites[12]:

Course Code	Course Title

j) [x] Exclusions[13]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
ELEC1200	A System View of Communications: from Signals to Packets

k) [ ] Co-listing[14]: [ ] Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] (X) No ( ) Yes

Instructor's approval required

Restricted to specified student group(s) *(please specify, e.g. year and program of study):* See section 1.3

Others *(please specify):*

m) Medium of Instruction/Materials[16]: (X) English ( ) Others, (Pls specify and provide a justification in Section 1.3):

n) Allow course repetition for credit[17]: (X) No ( ) Yes

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

[X] Major

Program of Study	As		
Integrative Systems and Design (ISDN)	[X] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Minor

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Common Core

[ ] Others (pls specify)

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

1.3 *Rationale for Introducing this course and other relevant information* [18]

This proposed course is a required course for the second-year students in ISD. Students are going to learn about the component skills and system integration for Internet of Things (IoT). This course covers basic knowledge in several areas of electronic engineering including sensor and circuits, signal and system, communications, etc. After taking this course, student should be equipped with basic knowledge for IoT and ready to take higher level courses in related areas.

Before the official launching of ISDN2601, a pilot run of this course in special topic format (ISDN4000G) will be offered in Fall & Spring 20-21

For ISD students who completed ELEC1200, they would not be required to take ISDN2601. ISD would allow them to use ELEC1200 to replace ISDN2601 as course deviation.

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	Describe how an IoT system works	A
2	Identify the basic components of an IoT system	A
3	Learn how different components are integrated	A
4	Acquire hands-on experiment technique	B
5	Apply the knowledge in designing simple IoT system	B
6	Carry out performance analysis of an IoT system	B
7	Work and communicate effectively in a team	B
8	Conduct personal reflection from time to time	B

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: _____ISDN_____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Be capable to identify and formulate problems in a multidisciplinary environment with an understanding of science, engineering, technology, business and design issues and constraints	CILO-1, CILO-2, CILO-3, CILO-6
2	Develop innovative problem-solving skills through hands-on learning and application of knowledge of science, engineering and design in integrative systems	CILO-4
3	Integrate knowledge and skills using a team-based, project-based pedagogy to be experts in tackling challenging problems considering ethics and societal needs	CILO-7, CILO-8
4	Be able to communicate and perform as a design expert in individual and team-based environments	CILO-7
5	Be life-long learners	CILO-5
6		
7		
8		

	Program of study 2: _____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1		
2		
3		

Section 2B: Additional Information[2] *(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	[X] Lecture*	**2**	**CILO-1, CILO-2, CILO-3, CILO-5 and CILO-6**	
	[ ] Tutorial*			
	[ ] Seminar/Small-class*			
	[X] Laboratory*	**2**	CILO-4, CILO-7, CILO-8	
	*Does the above scheduled component(s) involve structured active learning activities? [19] (X) No ( ) Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	[ ] Others (e.g. fieldtrip, visit, etc.), *pls specify:* _____			
Online activities	[ ] Online lecture videos			
	[ ] Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to _____120____ hours [8] *# 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 [20] ( ) Pure online delivery [21]

( ) Experiential learning [22] ( ) 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)*
[x] In-class test	**10%**	**CILO-1, CILO-2, CILO-3, CILO-5, CILO-6, CILO-8**	
[x] Mid-term test	**25%**	**CILO-1, CILO-2, CILO-3, CILO-5, CILO-6, CILO-8**	
[ ] Final exam			
[x] Written assignment	**10%**	**CILO-1, CILO-2, CILO-3, CILO-4, CILO-5, CILO-6, CILO-8**	
[x] Project report	**20%**	**CILO-1, CILO-2, CILO-3, CILO-4, CILO-5, CILO-6, CILO-7**	
[x] Presentation	**5%**	**CILO-1, CILO-2, CILO-3, CILO-4, CILO-5, CILO-6, CILO-7**	
[ ] Learning portfolio			
[ ] Course participation			
[ ] Peer evaluation			
[x] Others (e.g. proctored online exam, etc.), *pls specify:* ___Lab_____	**30%**	**CILO-1, CILO-2, CILO-3, CILO-4, CILO-5, CILO-6, CILO-7**	

2.5 *Course Duration*

(X) 1 term ( ) 2 terms ( ) Others, *pls specify:* _____

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

[x] Every Fall
[ ] Every Winter
[ ] Every Spring
[ ] Every Summer
[ ] No fixed pattern
[ ] Other *(pls specify):* _____

2.7 *Course outline attached*

( ) No (X) 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? (X) No ( ) Yes

ISDN 2601: Internet of Things: From Component Skills to System Integration

Course Description:

The course introduces the fundamental concepts and skills on how to design an IoT (Internet of Things) system. The course includes fundamental theory and practical hands-on labs and projects for the student to acquire the basic knowledge on several key components for IoT systems, including circuits and sensors, signal processing, embedded systems, and communication and networking. The integration of different components is an important topic for this course. The students will acquire the knowledge through lectures, practical hands-on labs, and projects.

Intended learning outcomes (ILOs) of the course:

- Describe how an IoT system works
- Identify the basic components of an IoT system
- Learn how different components are integrated
- Acquire hands-on experiment technique
- Apply the knowledge in designing simple IoT system
- Carry out performance analysis of an IoT system

Coverage:

Part I: Circuits and Sensors

1. Introduction
2. Circuits
3. Amplifier
4. Sensor
5. Actuator

Part II: Signal Processing

1. Signals and systems
2. Analog to digital conversion
3. Impulse response
4. Frequency analysis
5. Analog Modulation

Part III: Communication and Networking

1. Communication systems
2. Source coding
3. Channel coding
4. Modulation
5. Networking, MQTT
6. Machine Learning and Data Analytics

Lab Arrangement

1. Lab1: Circuits and amplifier
2. Lab2: Sensor and actuator
3. Lab3: ADC
4. Lab4: Frequency analysis and analog modulation
5. Lab5: Source and channel coding
6. Lab6: Networking and MQTT

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Division of Integrative Systems & Design	Head of Division	Prof Chi Ying TSUI	30-Nov-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Division of Integrative Systems & Design	Head of Division	Prof Chi Ying TSUI	30-Nov-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Engineering	Associate Dean	Prof Philip K. T. MOK	14-Dec-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*
Dept of Electronic & Computer Engineering	UG Coordinator	Prof Weichuan YU	3-Dec-20

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2021-2022 Term Spring

b) Department Code[3]: ISDN Subject Area[3]: ISDN Course Number [4]: 2602

Previous Course Code[5]: New Course

c) Full Title[6] *(max. 100 characters)*: Mechatronic Systems Design with Embedded Computing

d) Abbreviated Title[7] *(max. 30 characters)*:

e) Course Credits[8]: (x) Fixed: 3 ( ) Range: From To

f) Catalog Description[9] *(word limit = 150)*:

This course provides an introductory experience into the design of mechatronic systems and the corresponding controller using embedded computing platform. The course includes fundamental theory and also practical hands-on labs and projects for the student to acquire the basic knowledge of designing mechatronic systems and using embedded system to control. In the lab sessions, students design and build a succession of mechatronic subsystems, leading to an integrated system in a final project. Lectures topics include embedded system design, basic electronics, use of sensors and actuators, system modelling, measurement and control, and appreciation of how mechatronic systems solve real-world problems.

g) Grading Type[10]: (x) Letter Grades ( ) Distinction/Credit/Pass/Fail ( ) Pass/ Fail ( ) Distinction/Pass/Fail [ ] Others *(please specify)*:

h) [ ] Prerequisites[11]:

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

i) [ ] Corequisites[12]:

Course Code	Course Title

j) [x] Exclusions[13]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
ELEC 1100	Introduction to Electro-Robot Design
MECH 2907	Mechatronic Design and Prototyping

k) [ ] Co-listing[14]: [ ] Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] (x) No ( ) Yes

Instructor's approval required

Restricted to specified student group(s) *(please specify, e.g. year and program of study)*: See section 1.3

Others *(please specify)*:

m) Medium of Instruction/Materials[16]: (x) English ( ) Others, (Pls specify and provide a justification in Section 1.3): _____

n) Allow course repetition for credit[17]: (x) No ( ) Yes

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

[x] Major

Program of Study	As		
Integrative Systems and Design (ISDN)	[x] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Minor

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Common Core

[ ] Others (pls specify):

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

1.3 *Rationale for Introducing this course and other relevant information [18]*

This proposed course is a required course for the second-year students in ISD. Students are going to learn about the basic design knowledge and skill to build a mechatronic system to solve real world problems. This course covers basic knowledge on how to build a mechatronic system and using embedded system to build the controller. The course covers several areas of electronic engineering and mechanical engineering including sensor and circuits, embedded processor, system modelling, control function, instrumentation and measurement, etc. After taking this course, student should be equipped with basic knowledge for mechatronic system design and ready to take higher level courses in related areas.

Before the official launching of ISDN2602, a pilot run of this course in special topic format (ISDN4000I) will be offered in Spring 20-21.

For ISD students who completed ELEC1100 or MECH2907, they would not be required to take ISDN2602. ISD would allow them to use ELEC1100 or MECH2907 to replace ISDN2602 as course deviation.

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	Describe how an embedded system work and Learn how to program an embedded system and how the software and hardware work together	A
2	Learn the basics of electrical circuits and electronic devices	A
3	Learn the basics of sensor and actuator theory and able to design sensor circuits for simple applications	A
4	Learn the theoretical and practical aspects of measurement system design, system modelling and control system design	A
5	Gain hands-on experience in designing and constructing basic mechatronic systems as well implementing the control algorithms using embedded system	B
6	Appreciate how mechatronic systems solve the real-world problem	B
7	Work as a team to prototype a system	B
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: _____ISDN_____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Be capable to identify and formulate problems in a multidisciplinary environment with an understanding of science, engineering, technology, business and design issues and constraints	CILO-1, CILO-6, CILO-7
2	Develop innovative problem-solving skills through hands-on learning and application of knowledge of science, engineering and design in integrative systems	CILO-2, CILO-3, CILO-4, CILO-5, CILO-7
3	Integrate knowledge and skills using a team-based, project-based pedagogy to be experts in tackling challenging problems considering ethics and societal needs	CILO- 1, CILO-6
4	Be able to communicate and perform as a design expert in individual and team-based environments	CILO-1, CILO-6, CILO-7
5	Be life-long learners	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5, CILO-7
6		
7		
8		

	Program of study 2: _____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1		
2		
3		
4		

Section 2B: Additional Information[2] *(for courses not proposed to be Common Core Courses)*

2.3 *Planned Teaching 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	[X] Lecture*	2	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5, CILO-6	
	[ ] Tutorial*			
	[ ] Seminar/Small-class*			
	[X] Laboratory*	2	CILO-1, CILO-2, CILO-3, CILO-5, CILO-7	
	*Does the above scheduled component(s) involve structured active learning activities?[19] (X) No ( ) Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	[X] Others (e.g. fieldtrip, visit, etc.), *pls specify:* *team work and meetings* *Course Project*	1	CILO-7	
Online activities	[ ] Online lecture videos			
	[ ] Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to _____120____ hours[8] *# 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[20] ( ) Pure online delivery[21]

( ) Experiential learning[22] ( ) 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)*
[x] In-class test	10%	CILO-1, CILO-2, CILO-3, CILO-4	
[x] Mid-term test	25%	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5	
[ ] Final exam			
[x] Written assignment	10%	CILO-1, CILO-2, CILO-3, CILO-4	
[x] Project report	25%	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5, CILO-6, CILO-7	
[x] Presentation	5%	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5, CILO-6, CILO-7	
[ ] Learning portfolio			
[x] Course participation	5%	CILO-6, CILO-7	
[ ] Peer evaluation			
[x] Others, *pls specify:* *_Lab reports*	20%	CILO-1, CILO-2, CILO-3, CILO-5, CILO-7	

2.5 *Course Duration*

(X) 1 term ( ) 2 terms ( ) Others, *pls specify:* _____

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

[ ] Every Fall
[ ] Every Winter
[x] Every Spring
[ ] Every Summer
[ ] No fixed pattern
[ ] Other *(pls specify):* _____

2.7 *Course outline attached* ( ) No (X) Yes

2.8 *Resources*

Request extra resources for teaching this course? (X) No ( ) Yes

ISDN 2602 Mechatronic Systems Design with Embedded Computing

Course Outline

Week #	Topic
1	Introduction to Mechatronics Systems and Embedded System
2	System Response modelling and analysis
3	Computer Organization – Embedded Processors and software
4	Embedded System Interface
5	Measurement and Manipulation principles
	Midterm
6	Sensors – Position Sensors, Drivers, Optical Encoder
7	Actuators – DC Motor, Servo Motor, Steppers
8	Data acquisition and conversion
9	Basic electronics and driver circuits
10	Control system design and tuning
11	Case studies in system integration
	Final Project Presentation

Textbook

Introduction to Mechatronics and Measurement Systems, 4th edition by D. Alciatore and M. Histand, McGraw-Hill, 2012.

Labs Outline

Five Labs will be held in the consecutive 5 weeks in group size of 2.

1. Embedded Systems Basic – Setting up and embedded programming
2. Implementing simple controller with embedded processors
3. Basic input and output system
4. Sensor modules, ADC
5. Pulse width modulation – PWM generation

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Division of Integrative Systems & Design	Head of Division	Prof Chi Ying TSUI	30-Nov-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Division of Integrative Systems & Design	Head of Division	Prof Chi Ying TSUI	30-Nov-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Engineering	Associate Dean	Prof Philip K. T. MOK	14-Dec-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*
Dept of Electronic & Computer Engineering	UG Coordinator	Prof Weichuan YU	3-Dec-20
Dept of Mechanical & Aerospace Engineering	UG Coordinator	Prof Baoling Huang	2-Dec-20

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2021-2022 Term Fall

b) Department Code[3]: ISD Subject Area[3]: ISDN Course Number [4]: 3601

Previous Course Code[5]: New course

c) Full Title[6] *(max. 100 characters)*: Mechanics and Materials

d) Abbreviated Title[7] *(max. 30 characters)*:

e) Course Credits[8]: ◉ Fixed: 4 ○ Range: From To

f) Catalog Description[9] *(word limit = 150)*:

An experiential learning course using lectures and project to introduce students to foundations of mechanics, mechanical properties and structures of materials. It covers the deformation and failure modes of solid mechanical objects when subjected to various types of loads. The behavior is linked to mechanical properties of materials, including metals, polymers and composites. Characterization methods of mechanical properties will also be covered.

g) Grading Type[10]: ◉ Letter Grades ○ Distinction/Credit/Pass/Fail ○ Pass/ Fail ○ Distinction/Pass/Fail ☐ Others *(please specify)*:

h) ☒ Prerequisites[11]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
(PHYS 1112 / PHYS 1111 / PHYS1312)	(General Physics 1 / General Physics I with Calculus/Honors General Physics I)
& MATH1014	& Calculus II

i) ☐ Corequisites[12]:

Course Code	Course Title

j) ☒ Exclusions[13]:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
MECH2040	Solid Mechanics 1
CIVL2120	Mechanics of materials

k) ☐ Co-listing[14]: ☐ Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] ◉ 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[16]: ◉ English ○ Others, (Pls specify and provide a justification in Section 1.3):

n) Allow course repetition for credit[17]: ◉ No ○ Yes

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

[x] Major

Program of Study	As		
Integrative Systems & Design	[x] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Minor

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

[ ] Common Core

[ ] Others (pls specify):

Program of Study	As		
	[ ] Required Course	[ ] Elective	[ ] Prerequisite

1.3 *Rationale for Introducing this course and other relevant information* [18]

Design of mechanical objects is fundamental to the design of integrative systems. This involves a good understanding of materials and their properties, and familiarity with how such properties are measured; it also requires a good understanding of how the design will behave mechanically in response to the loads that it will be subjected to, and the conditions under which it might fail mechanically (e.g. by plastic deformation, fracture, etc.)
In this course, students will be assigned design projects, which will require their investigation and learning about the theoretical foundations of these topics, as well as a practical application of them.

The course will introduce students to important types of materials, their atomic and crystal structure, as well as how this structure varies when subjected to external stimuli (e.g. loads, plastic deformation, heat, cooling etc.). Foundation topics include Atomic structure, Crystal structure, Defects and Dislocations, Elastic and plastic properties, Theories of failure, Diffusion, Phase transformations and Glass transition temperatures.

In understanding the behavior of parts under loading, students will learn about stress and strains, torsion, transformations of stresses, and various important stress conditions common in designs, including bending loads, deflection of statically indeterminate structures, buckling.

NOTE: Before the official launching of ISDN3601, a pilot run of this course in special topic format (ISDN4000J) will be offered in Spring 20-21, with Prof Ajay Joneja and Mitch Li as co-instructors.

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	To understand basic mechanical properties of materials	A
2	To be able to explain atomic structure of materials and how it changes under stimuli	A and B
3	To quantitatively and qualitatively understand the relationship between material properties and behavior under loads	A
4	To understand failure modes of materials under stress	A
5	To apply knowledge of material properties, their relationship between stresses and strains under loads, into practical product design	B
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: _____BSc in ISDN_____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Be capable to identify and formulate problems in a multidisciplinary environment with an understanding of science, engineering, technology, business and design issues and constraints	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5
2	Develop innovative problem-solving skills through hands-on learning and application of knowledge of science, engineering and design in integrative systems	CILO-4, CILO-5
3	Integrate knowledge and skills using a team-based, project-based pedagogy to be experts in tackling challenging problems considering ethics and societal needs	CILO-5
4	Be able to communicate and perform as a design expert in individual and team-based environments	CILO-4, CILO-5
5	Be life-long learners	CILO-5
6		
7		
8		

	Program of study 2: _____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1		
2		
3		
4		
5		
6		
7		
8		

Section 2B: Additional Information[2] *(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	[x] Lecture*	3	CILO-1, CILO-2, CILO-3, CILO-4, CILO-5	
	[ ] Tutorial*			
	[ ] Seminar/Small-class*			
	[x] Laboratory*	2	CILO-1, CILO-3, CILO-4, CILO-5	**Some structured labs, and a course project done in teams**
	*Does the above scheduled component(s) involve structured active learning activities? [19] ◯ No (X) Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	[ ] Others (e.g. fieldtrip, visit, etc.), *pls specify:* _____			
Online activities	[ ] Online lecture videos			
	[ ] Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to _____180____hours [8] *# 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 [20] ◯ Pure online delivery [21]

◯ Experiential learning [22] ◯ 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)*
[ ] In-class test			
[x] Mid-term test	**25**	**CILO 1, 2**	
[x] Final exam	**25**	**CILO 1, 2, 3, 4**	**Mostly CILO 3, 4**
[ ] Written assignment			
[x] Project report	**30**	**CILO 1, 2, 3, 4, 5**	**Assesses project work and report**
[ ] Presentation			
[x] Home work	**10**	**CILO 1, 2, 3, 4**	
[ ] Course participation			
[ ] Peer evaluation			
[x] Others (e.g. proctored online exam, etc.), *pls specify:* *LAB*	**10**	**CILO 1, 2, 3, 4, 5**	

2.5 *Course Duration*

(●) 1 term ( ) 2 terms ( ) Others, *pls specify:* _____

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

[ ] Every Fall
[ ] Every Winter
[ ] Every Spring
[ ] Every Summer
[x] No fixed pattern
[ ] 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

ISDN3601 Course outline

Week 1-5

Atomic structures, Crystals, Phase changes in metals and polymers

Amorphous and semicrystalline polymers, copolymers and composites

Elastic and plastic deformations, dislocations/slip and relationship with manufacturing processes

Failure modes and analyses in metals, polymers and composites

Week 6-11

Stress, strain and their relationship

Stress analysis, statically indeterminate problems

Torsion, shear

Stress transformations, Mohr circle

Bending, Transverse loading of beams

Stress analysis using software/FEM (Ansys, SolidWorks)

Plastic deformation and fracture

Columns, buckling

Energy method

Week 13

Project presentations

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Division of Integrative Systems & Design	Head of Division	Prof Chi Ying TSUI	30-Nov-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Division of Integrative Systems & Design	Head of Division	Prof Chi Ying TSUI	30-Nov-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Engineering	Associate Dean	Prof Philip K. T. MOK	14-Dec-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*
Dept of Physics	UG Coordinator	Prof Bradley A FOREMAN	16-Dec-20
Dept of Mechanical & Aerospace Engineering	UG Coordinator	Prof Baoling Huang	7-Dec-20
Dept of Civil and Environmental Engineering	UG Coordinator	Prof Jack C P CHENG	4-Dec-20
Dept of Mathematics	UG Coordinator	Dr Tsz Kin LAM	28-Dec-20

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Approval of Undergraduate Course

Section 1: Academic Administration [1]

1.1 Catalog

a) Course to be effective from: Academic Year 2021-22 Term Fall

b) Department Code[3]: ISD Subject Area[3]: ISDN Course Number [4]: ISDN 4330

Previous Course Code[5]:

c) Full Title[6] *(max. 100 characters)*: Ergonomics in Design

d) Abbreviated Title[7] *(max. 30 characters)*:

e) Course Credits[8]: ☑ Fixed: 2 ○ Range: From To

f) Catalog Description[9] *(word limit = 150)*:

Many of the products marketed today have the word "ergonomic" attached to them. How ergonomic are they? The course is designed to provide a basic understanding of ergonomics in design through the introduction of human anatomy, anthropometry, and modeling techniques with the aim of improving safety, productivity, comfort and health of people

g) Grading Type[10]: ☑ Letter Grades ○ Distinction/Credit/Pass/Fail ○ Pass/ Fail ○ Distinction/Pass/Fail ☐ Others *(please specify)*:

h) ☐ Prerequisites[11]:

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

i) ☐ Corequisites[12]:

Course Code	Course Title

j) ☐ Exclusions[13]:

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

k) ☐ Co-listing[14]: ☐ Multi-coding[14]:

Course Code	Course Title

l) Other Enrollment Restrictions[15] ☑ 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[16]: ☑ English ○ Others, (Pls specify and provide a justification in Section 1.3):

_____

n) Allow course repetition for credit[17]: ☑ No ○ Yes

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

☑ Major

Program of Study	As		
Integrative Systems & Design	☐ Required Course	☑ Elective	☐ Prerequisite

☐ Minor

Program of Study	As		
	☐ Required Course	☐ Elective	☐ Prerequisite

☐ Common Core

☐ Others (pls specify):

Program of Study	As		
	☐ Required Course	☐ Elective	☐ Prerequisite

1.3 *Rationale for Introducing this course and other relevant information* [18]

Many of the products marketed today have the word "ergonomic" attached to them. How ergonomic are they? Students in design ought to understand the capabilities and limitation of people so that they can be accommodated as and when necessary as it is critical for good usability and user experience.

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	Apply ergonomic principles for the creation of safer, healthier and more efficient and effective products and activities	A
2	Apply anthropometric tables for evaluation and design criteria for products	A
3	Design a workplace according to ergonomic principles	B
4	Identify engineering solutions to improve human performance and reduce the risk of discomfort and injury when interacting with products	B
5		
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: BSc Integrative Systems & Design **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1	Be capable to identify and formulate problems in a multidisciplinary environment with an understanding of science, engineering, technology, business and design issues and constraints	
2	Develop innovative problem-solving skills through hands-on learning and application of knowledge of science, engineering and design in integrative systems	CILO-3, CILO-4
3	Integrate knowledge and skills using a team-based, project-based pedagogy to be experts in tackling challenging problems considering ethics and societal needs	
4	Be able to communicate and perform as a design expert in individual and team-based environments	CILO-1, CILO_2
5	Be life-long learners	
6		
7		
8		

	Program of study 2: _____ **Program ILOs**	**To be achieved through these course ILOs** *(Write CILO-1, CILO-2, etc.)*
1		
2		
3		
4		
5		
6		
7		
8		

Section 2B: Additional Information[2] *(for courses not proposed to be Common Core Courses)*

2.3 *Planned Teaching 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	☒ Lecture*	**1**	**CILO-1, CILO-2, CILO-3, CILO-4**	
	☐ Tutorial*			
	☐ Seminar/Small-class*			
	☒ Laboratory*	**3**	**CILO-2, CILO-3, CILO-4**	
	*Does the above scheduled component(s) involve structured active learning activities? [19] ⊗ No ○ Yes *If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.*			
	☐ Others (e.g. fieldtrip, visit, etc.), *pls specify:* ___			
Online activities	☐ Online lecture videos			
	☐ Other online learning tasks, *pls specify:* _____			
	The total learning hours of the course# is equivalent to 52 hours (instruction) + 28 hours (preparation) = 80 hours [8] *# 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 [20]	○	Pure online delivery [21]
○	Experiential learning [22]	○	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)*
☑ In-class test: 5 tests	**60**	CILO-1, CILO-2, CILO-3, CILO-4	
☐ Mid-term test			
☐ Final exam			
☑ Written assignment: 4 reports	**40**	CILO-1, CILO-2, CILO-3, CILO-4	
☐ Project report			
☐ Presentation			
☐ Learning portfolio			
☐ Course participation			
☐ Peer evaluation			
☐ Others, *pls specify:* _____			

2.5 *Course Duration*

(✓) 1 term ( ) 2 terms ( ) Others, *pls specify:* _____

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

[ ] Every Fall
[ ] Every Winter
[ ] Every Spring
[ ] Every Summer
[x] No fixed pattern
[ ] Other *(pls specify):* _____

2.7 *Course outline attached* ( ) No (✓) Yes

2.8 *Resources*

Request extra resources for teaching this course? (✓) No ( ) Yes

ISDN 4330 Ergonomics in Design Course Syllabus

1. Overview and Introduction

   Introduction to Ergonomics
   Application of Ergonomics with real life examples.
   Definition and History of Ergonomics
   Ergonomics Awareness through one's own-self
   Human-centered design
   Case study
   Design objectives
   Learning activity (Short report): identify and report 5 misfits between equipment and people

2. Musculoskeletal system (3 hours + 3 hours supplementary materials)

   Musculoskeletal system basics
   Structures
   Muscles and their working principles.
   Human Spine, Vertebrae and Discs, Pelvis and pelvic tilt
   Spine range of motion
   Joint Range of Motion
   Reach and implications
   Vision and lines of sight
   Learning activity (Short report): find range of motion for hand, arm and shoulders and design a hand tool.

3. Hand held tool and equipment design

   Strength
   Blix curve (demos of bioefeedback device)
   Hand tool design basics
   Strength in varying postures (demos with hand dynamometer)
   Sports equipment design
   Postures during tool use
   Consequences of poor design
   Learning activity (Short report): Design a prototype handle for a hand tool.

4. Design for sitting

   Spine and sitting
   Critical dimensions for sitting/standing
   Seat design principles
   Seated work
   Workstation design hierarchy

5. Anthropometry for design

   Principles of measurement
   Measurement techniques
   Data reporting
   Statistical Analysis
   Use of Tables and percentiles for design
   Forecasting and Estimation
   Golden ratio
   Design Criteria using anthropometric data
   Human Foot and related dimensions
   Fitting feet to footwear
   Footwear design
   Learning activity (Short report): Measure the anthropometric dimensions of one person and design a workstation.

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

The course is confirmed by the following Major/Minor program department(s)/unit(s) as indicated in Section 1.2 that it would contribute appropriately to overall program learning outcomes.

Department/Program unit	*Position*	*Name*	*Date*
Division of Integrative Systems & Design	Head of Division	Prof Chi Ying TSUI	30-Nov-20

4.2 Approvals

Recommendation from offering department(s) and School(s)/IPO

Offering Department/Program Unit	*Position*	*Name*	*Date*
Division of Integrative Systems & Design	Head of Division	Prof Chi Ying TSUI	30-Nov-20

Recommending School/IPO	*Position*	*Name*	*Date*
School of Engineering	Associate Dean	Prof Philip K. T. MOK	14-Dec-20

Concurrence from other Schools or departments/units

School/Dept/Program Unit	*Position*	*Name*	*Date*