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]*

	Program of Study	As		
[x] Major	Integrative Systems & Design	[x] Required Course	[ ] Elective	[ ] Prerequisite
[ ] Minor		[ ] Required Course	[ ] Elective	[ ] Prerequisite
[ ] Common Core				
[ ] Others (pls specify):		[ ] 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

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

[x] The course contributes to this Major/~~Minor*~~ Program: *BSc Integrative Systems & Design*

(Delete as appropriate)*

[x] The relevant **program learning outcomes are attached**.

[x] On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.

	Position / Name:	Signature	Date
Program Director / Head of Department:	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020

[ ] The course contributes to this Major/Minor* Program: _____

(Delete as appropriate)*

[ ] The relevant **program learning outcomes are attached**.

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

4.2 Approvals

Department/Program unit level Recommendation

	Position / Name:	Signature	Date
[x] Offering Department/Program Unit: *(Please specify unit):ISD*	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020
[ ] Recommending School/IPO: *(Please specify):*			

School-level Concurrence

	Name of School/Unit	Position / Name	Signature	Date
[x]	*PHYS*			
[x]	*MAE*			
[x]	~~CEI~~			
[ ]				
[x]	CIVL			
	MATH			

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	Position / Name:	Signature	Date
Program Director / Head of Department:	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020

[ ]	The course contributes to this Major/Minor* Program:	
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	Position / Name:	Signature	Date
Program Director / Head of Department:			

4.2 *Approvals*

Department/Program unit level Recommendation

		Position / Name:	Signature	Date
[x]	Offering Department/Program Unit: *(Please specify unit):ISD*	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020
[x]	Recommending School/IPO: *(Please specify):* SENG	Prof. Philip K. T. MOK Assoc. Dean of Engineering		14 Dec 2020

School-level Concurrence

	Name of School/Unit	Position / Name	Signature	Date
[x]	*PHYS*			
[x]	*MAE*			
[x]	~~CEI~~			
[ ]				
[x]	CIVL			

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	Position / Name:	Signature	Date
Program Director / Head of Department:	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020

[ ] The course contributes to this Major/Minor* Program:			
	(Delete as appropriate)*		
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	Position / Name:	Signature	Date
Program Director / Head of Department:			

4.2 *Approvals*

Department/Program unit level Recommendation			
	Position / Name:	Signature	Date
[x] Offering Department/Program Unit: *(Please specify unit):ISD*	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020
[ ] Recommending School/IPO: *(Please specify):*			

School-level Concurrence			
Name of School/Unit	Position / Name	Signature	Date
[x] *PHYS*			
[x] *MAE*	UG Coordinator/Prof. Baoling Huang		7 Dec 2020
[x] ~~CEI~~			
[ ]			
[x] CIVL			

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(Delete as appropriate)*

[x] The relevant **program learning outcomes are attached**.

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	Position / Name:	Signature	Date
Program Director / Head of Department:	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020

[ ] The course contributes to this Major/Minor* Program: _____

(Delete as appropriate)*

[ ] The relevant **program learning outcomes are attached**.

[ ] On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.

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

4.2 *Approvals*

Department/Program unit level Recommendation

	Position / Name:	Signature	Date
[x] Offering Department/Program Unit: *(Please specify unit):ISD*	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020
[ ] Recommending School/IPO: *(Please specify)*:			

School-level Concurrence

	Name of School/Unit	Position / Name	Signature	Date
[x]	*PHYS*			
[x]	*MAE*			
[x]	~~CEI~~			
[ ]				
[x]	CIVL	CIVL UG Coordinator / Prof. Jack Cheng		4 Dec 2020

Section 4: Development, Concurrence and Approval

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	Position / Name:	Signature	Date
Program Director / Head of Department:	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020

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Program Director / Head of Department:			

4.2 *Approvals*

Department/Program unit level Recommendation			
	Position / Name:	Signature	Date
[x] Offering Department/Program Unit: *(Please specify unit):ISD*	Head of ISD / Prof. Chi Ying TSUI		30 Nov 2020
[ ] Recommending School/IPO: *(Please specify):*			

School-level Concurrence			
Name of School/Unit	Position / Name	Signature	Date
[x] *PHYS*	UG Coordinator/ Prof Bradley A FOREMAN	Bradley A. Foreman	16/12/2020
[x] *MAE*			
[x] CEI			
[ ]			
[x] CIVL			