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*

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

■ The course contributes to this Major/~~Minor~~* Program: CIVL

(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:	same signature as below		

■ The course contributes to this Major/~~Minor~~* Program: CIEV

(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:	same signature as below		

4.2 *Approvals*

Department/Program unit level Recommendation

	Position / Name:	Signature	Date
☑ Offering Department/Program Unit: *(Please specify unit)*: CIVL	UG Coordinator / Jack CHENG		2 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
☐	IPO / DDP	UGC / Betty Lin		10 Nov 2020
☐				
☐				
☐				
☐				