City University of Hong Kong
Course Syllabus

offered by Department of Architecture and Civil Engineering
with effect from Semester A 2021/22

Part I Course Overview

Course Title:	Earth Science and Physics behind Architecture
Course Code:	CA19505
Course Duration:	1 Semester (Some courses offered in Summer Term may start a few weeks earlier than the normal University schedule. Please check the teaching schedules with CLs before registering for the courses.)
Credit Units:	3
Level:	A1
Proposed Area: *(for GE courses only)*	[] Arts and Humanities [] Study of Societies, Social and Business Organisations [] Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

(A 150-word description about the course)

The course introduces to the students the earth science and physics related to buildings, such as the solar radiation, wind, sound wave, gravity, earthquake, and earth pressures. Through providing an overview of issues that have to be addressed to offer the occupants a functionally, physically and psychologically pleasurable living environment, students will be guided to learn the basic scientific principles underlying the natural phenomena, the constraints imposed by the natural forces, different building envelope and structural systems which can mitigate the undesirable effects of those forces, as well as how the forces and systems affect one another. Design alternatives will be presented from various standpoints, including strategies to climate, thermal comfort, lighting, topography, and structural systems. Without engaging in complex calculation, the course serves as an introduction to the physical processes lying behind the design of a building and as an initiation for a proper integration of technology in architecture.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs [#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Explain the sources and background physics of the natural forces that have to be addressed in building design.		✓		
2.	Enumerate the effects of various natural forces on buildings.		✓		
3.	Utilize appropriate design strategies and/or building techniques for mitigating the negative effects of natural forces on the built environment.			✓	
4.	Evaluate the advantages and disadvantages of different design strategies and/or building techniques against all of the considered natural forces.			✓	
5.	Identify the potential problems and/or possible improvements in a design proposal in relation to its functionality, spatial perception, and structural health.			✓	
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

[#] *Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.*

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.					Hours / week (if applicable)
		1	2	3	4	5	
Lecture	Consists of oral presentations by instructors intended to present information on a particular subject. Other forms of teaching and learning activities will also be used to stimulate your participation during a lecture.	✓	✓	✓	✓		
Tutorial	Activity complementary to the lecture classes to provide more opportunities for student-instructor and student-student interaction. Students will be engaged in more detailed discussions on the lecture materials and/or assessment tasks in a tutorial.			✓		✓	

Semester Hours:	3 hours per week
Lecture/Tutorial/Laboratory Mix:	Lecture (2); Tutorial (1)

4. Assessment Tasks/Activities

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks / Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 80%							
Assignments		✓	✓	✓	✓	60%	
Mid-term Test	✓	✓		✓		20%	
Examination: 20% (duration: 1.5 hour(s))							
Examination	✓	✓		✓		20%	
* The weightings should add up to 100%.						100%	

Students must attain a minimum mark of 30 in all assessment components AND an overall mark of 40 to pass the course.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)/ Pass (P) on P/F basis	Failure (F)
Assignment	1.1 Thorough understanding on the effects of various natural forces on buildings; 1.2 Skilful and innovative use of appropriate design strategies and/or building techniques for mitigating the negative effects of natural forces on the built environment; 1.3 Clear and comprehensive outline of the advantages and disadvantages of different design strategies and/or building techniques against all the considered natural forces; 1.4 Excellent discovery of solution to potential problems and/or possible improvements in a design proposal in relation to its functionality, spatial perception, and structural health.	High	Significant	Moderate	Basic	Not even reaching marginal level
Mid-term Test	2.1 Excellent understanding of the sources and background physics of the natural forces that have to be addressed in building design; 2.2 Thorough and correct explanation of the effects of various natural forces on buildings; 2.3 Clear and comprehensive outline of the advantages and disadvantages of different design strategies and/or building techniques against all the considered natural forces.	High	Significant	Moderate	Basic	Not even reaching marginal level
Examination	3.1 Excellent understanding of the sources and background physics of the natural forces that	High	Significant	Moderate	Basic	Not even reaching marginal level

	have to be addressed in building design; 3.2 Thorough and correct explanation of the effects of various natural forces on buildings; 3.3 Clear and comprehensive outline of the advantages and disadvantages of different design strategies and/or building techniques against all the considered natural forces.					

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus
(An indication of the key topics of the course.)

Understanding climate; Sun; Heat flow; Thermal comfort and insulation; Insulation materials; Thermal bridge; Wind; Air flow; Fundamentals of natural ventilation; Climate-responsive design; Passive controls; Solar heat gain through walls and roofs; Comparison of walls and windows; Window technologies & shading;

Physics of light; Overview on human vision and visual comfort (glare, contrast); Daylighting design principles; Design with natural light; Benefit of roof openings;

Integration of energy, air flow and lighting;

Sound and hearing; Noise insulation; Fundamentals of acoustics;

Vertical and horizontal forces acting on buildings (gravity, wind, earthquake, earth pressure); Roles and behaviors of structural elements: roofs, beams, columns, walls, floors and foundations; Structural systems and spatial perception; Design principles of structural systems (load-bearing wall system, moment-resisting frame system, high-rise buildings); Openings and weak story; Issues in design of glass house, roof garden, and long-span structures.

2. Reading List

2.1 Compulsory Readings
(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Nil

2.2 Additional Readings
(Additional references for students to learn to expand their knowledge about the subject.)

1.	Allen, Edward, and David Swoboda. *How Buildings Work: The Natural Order of Architecture*. New York, NY: Oxford University Press, 2005. ISBN: 9780195161984.

2.	Allen, Edward, and Joseph Iano. *Fundamentals of Building Construction: Materials and Methods*. New York, NY: John Wiley & Sons, 2003. ISBN: 9780471219033.
3.	Ching, F.D.K., Onouye, B.S., Zuberbuhler, D. *Building Structures Illustrated*. Patterns, systems and design. Hoboken, N.J.: John Wiley & Sons, 2019.
4.	Faherty, K. F., and T. G. Williamson. *Wood Engineering and Construction Handbook*. New York: McGraw-Hill, 1998. ISBN: 0070220700.
5.	Lechner, Norbert. *Heating, Cooling, Lighting: Design Methods for Architects*. New York, NY: John Wiley & Sons, 2000. ISBN: 9780471241430.
6.	MacGregor, J. G. *Reinforced Concrete, Mechanics and Design*. Upper Saddle River: Prentice Hall, 1997. ISBN: 0132339749.
7.	Philbin, T. *The Illustrated Dictionary of Building Terms*. New York: McGraw Hill Companies, Inc., 1997.
8.	Reinhart, Christoph. *Daylighting Handbook II*. Building Technology Press, 2018. ISBN: 9780578407098.
9.	Salmon, C. G., and J. E. Johnson. *Steel Structures*. New York: Harper Collins College Publishers, 1997. ISBN: 0673997863.
10.	Schodek, Daniel. *Structures*. 4th ed. Upper Saddle River, NJ: Prentice Hall, 2000. ISBN: 9780130278210.
11.	Szokolay, Steven. *Introduction to Architectural Science: The Basis of Sustainable Design*. Burlington, MA: Architectural Press, 2004. ISBN: 9780750658492.
12.	Zalewski, Waclaw, and Edward Allen. *Shaping Structures: Statics*. New York, NY: Wiley, 1998. ISBN: 9780471289968.