Course Code	CIVL2910 (Spring 22-23)
Course Title	Fundamental of green building
Class Time & Venue	Two 1.5-hour lectures per week
Instructor	Zhe Wang (<u>cezwang@ust.hk</u>)
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Course Credits	3
Class Quota	50
Prerequisites	None
Course Description	Urbanization process has significantly modified the environment we live in during the past decades. People spend more than 90% of lifetime in buildings and cities. The quality of built environment is critical to comfort, productivity, and health of city residents. Meanwhile, buildings consume 30%-40% of total energy consumption in cities. Reducing building energy consumption is crucial for the sustainable development of human beings. The goal of green building is to create comfort built environment with less energy consumption. On the building scale, this course will cover the two pillars of green building: the environment quality and energy consumption. On the city scale, the course will cover the basic principles of surface energy balance under the influence of anthropogenic activities. The fundamental knowledge about green building can help students better understand built environment, energy efficient building design, micro-climate of cities, and the interaction between buildings and micro-climate. Students plan to work in the building industry as civil engineer, urban planner, building services engineering will benefit from learning the fundamental knowledge of green building.
Course Objectives	At the end of this course, students will be able to:
	1. Understand the four major components of Indoor Environment Quality;
	2. Analyze building energy consumption and major heat source;
	3. Conduct passive design to reduce building load;
	4. Identify water, energy and climate problems in cities and their causes;
	5. Analyze water, energy and climate problems with the governing equations;
	 Quantify the impact of materials and buildings on urban environment through numerical simulations;
	7. Conduct urban neighborhood planning and sustainability analysis;
	8. Recognize the pathway towards smart cities and the role of civil engineering in the pathway.
Topics	Introduction to urbanization

	 Indoor environment quality Building load analysis Passive and environmental friendly building design Renewable energy sources in building Introduction to urban heat islands Formulation and solving of radiation exchange, surface energy balance and outdoor thermal comfort in the urban environment Numerical simulation of the urban thermal environment Formulation and solving of urban water budget Formulation and solving of air circulation and urban flow Interaction between cities and global environmental change 		
Intended Learning Outcomes (ILOs) of this course	On successful completion of this course, students are expected to be able to:		
	1. Understand four major aspects of indoor environment quality and how to evaluate the indoor environment quality		
	2. Learn energy efficient building design		
	3. Analyze the impact of buildings on outdoor environment with the governing equations		
	4. Describe the fundamental process and principle of indoor-outdoor thermal exchange		
Relationship to the program objectives	POE1 : Provide students with professional skills in the design, construction and management of the civil infrastructure, as well as an awareness of environmental sustainability. (ILO#1, 2)		
	POE3 : Challenge students with research-type and open-ended design problems to stimulate self-learning and innovative problem solving skills. (ILO#3, 4)		
	POE4 : Expose students to real world engineering projects as well as cutting edge research to improve their understanding of the profession and technological advancements that can improve current practice. (ILO#1)		
Relationship to program outcomes	PO1 : Acquire fundamental knowledge in mathematics and science on which civil and environmental engineering research and practice are based. (ILO#1, 3)		
	PO2 : Understand fundamental principles of engineering science relevant to civil engineering disciplines. (ILO#1, 3, 4)		
	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. (ILO#2, 3)		

	PO7 : Develop an appreciation of the breadth of civil and environmental engineering, and acquire basic knowledge in several disciplines to enable effective performance within a multidisciplinary work environment. (ILO#2, 4)
	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. (ILO#2, 3)
Textbook / Reference material	
Assessment of outcomes	This course contributes to the assessment of program outcomes as follows: Assignments (30%), Midterm exam (35%), Final exam (35%)
Last modified	13 th Jan., 2023

Course Outline

Week	No.	Lecture	Assignment
1	1	Introduction	
	2	The property of air	
2	3	Thermal environment	HW 1 released
	4	Indoor air quality and air flow management	
3	5	Lighting environment	HW 1 due
	6	Building energy consumption	HW 2 released
4	7	Building thermal load	
	8	Reduced load	HW 2 due
5	9	Passive design and energy recovery	
	10	Renewable energy and smart micro-grid	HW 3 released
6	11	Green building standard	
	12	First half course review	HW 3 due
7	13	In-class exam	
	14	Urban surface property	
8	15	Radiation exchange in cities	
	16	Radiation exchange in cities	HW 4 released
9	17	Surface energy balance	
	18	Surface energy balance	
10	19	Surface energy balance	HW 5 released
	20	Outdoor thermal comfort	
11	21	Building energy consumption	
	22	Urban observation and modelling	HW 6 released
12	23	Urban heat island	
	24	Urban heat island	
13	25	Second half course review	