Hong Kong University of Science and Technology
Department of Civil and Environmental Engineering

Rubric Title of course Instructor Teaching Assistant	**CIVL 4810 (Fall 23-24)** **Construction Materials Technology** Christopher Leung
Prerequisites Credit	CIVL 2810 3
Textbook(s) and/or Other materials	J.M. Illston and J.L. Domone, Construction Materials: Their Nature and Behavior, Third Edition, Spon Press 2001. Additional notes and hand-outs will be provided by the instructor.
Course Objectives	1. Provide students with the fundamental understanding on contemporary topics in concrete science and technology, including green concrete with low carbon emission, concrete rheology, concrete durability and non-destructive testing of concrete 2. Introduce students to non-conventional concrete such as lightweight concrete, high-performance concrete, self-compacting concrete, fiber reinforced concrete and strain-hardening cementitious composites. 3. Introduce students to the application of polymers and polymeric composites in civil engineering and the stress analysis of laminated composites. 4. Provide students with fundamental knowledge on the properties and durability of bituminous materials, as well as the design of bituminous pavements.
Topics	Green Concrete Concrete Rheology and Construction Processes Concrete Durability Non-destructive Evaluation of Concrete High Performance Concrete and Self-Compacting Concrete Lightweight Concrete Fiber Reinforced Concrete and Strain-Hardening Cementitious Composites Applications of Polymers and Polymeric Composites in Civil Engineering Anisotropic Mechanics of Laminated Polymeric Composites Basic Properties of Bituminous Materials Durability of Bituminous Materials Pavement Design
Compute usage	To be advised by the lecturer
Lab Projects	Lab 1: Rheology tuning, self-flow concrete and tests Lab 2: Demonstration of non-destructive evaluation techniques Lab 3: Preparation of high strength concrete and strain-hardening cementitious composites (SHCC) Lab 4: Mechanical testing of high strength concrete and PDCC
Class/lab schedule	Two 80-minute lecture sections per week One hour of tutorial/lab per week
Contribution to the professional component	100% engineering topics
Relationship to the program objective	This course contributes to the following program objectives: ***1. Provide professional skills in design, construction and management*** This course provides fundamental knowledge on the behavior and application of various construction materials including concrete, polymer, composites and bituminous materials, which is important for material design, selection and specification in civil engineering projects. ***3. Stimulate self-learning and innovative problem solving skills*** The course requires students to look for information in the literature and identify

	suitable analytical techniques to complete the homework and laboratory report. ***4. Expose students to real projects and cutting edge research.*** The course presents examples to illustrate the real-world applications of advanced construction materials. In addition, some of the covered topics are at the forefront of construction material research.
Relationship to program outcome	The course contributes to the following program outcomes: ***B. Understand fundamental principles of engineering science*** Students will learn the fundamental physics and chemistry behind the behavior of concrete, polymers, composites and bituminous materials. ***C. Conduct experiments and analyze results*** Students will conduct laboratory experiments on concrete and fiber reinforced cementitious composites and identify important trends from the results. ***E. Formulate problems and propose feasible solutions*** Students will apply knowledge obtained in lectures to solve engineering problems. ***G. Appreciate the breath of civil engineering*** Students will learn to appreciate the relation between structural design and material behavior, as well as the possibility to simplify construction processes with the innovative use of materials. ***H. Obtain in-depth knowledge in at least one specialized area*** Students will obtain in-depth knowledge in the science and engineering of construction materials, as well as their applications. ***J. Recognize the importance of seeking further specialization within civil and environmental engineering and the need for life-long learning*** Students will be introduced to the most recent developments on construction material research and applications. They will also be asked to conduct literature search from time to time to find relevant information. These can serve to highlight the importance of continued learning to stay ahead in the profession.
Assessment of Outcomes	1. A final exam (60%) to assess students' understanding of the subject matter (Outcomes B, E, G, H) 2. Five homework assignments (25%) (Outcomes B, E, H) 3. Two laboratory reports (15%) (Outcomes C and J)
Prepared by	Christopher K Y Leung
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Objectives of UG Programs of the Civil Engineering Department

1. Provide students with professional skills in the design, construction and management of the civil infrastructure, as well as an awareness of environmental sustainability
2. Train students with good communication skills so they can work effectively in large projects involving different parties and professions
3. Challenge students with research-type and open-ended design problems to stimulate self-learning and innovative problem solving skills
4. 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

Outcomes for the Civil Engineering Program

A. Acquire fundamental knowledge in mathematics and science on which civil engineering research and practice are based
B. Understand fundamental principles of engineering science relevant to civil engineering disciplines
C. Acquire an ability to conduct experiments, analyze and interpret results, and appreciate the importance of experimental data in establishing empirical relationships and parameters for analysis and design
D. Acquire an ability to apply modern engineering tools effectively and efficiently for engineering analysis, design and communication
E. 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
F. Develop technical competency to design civil engineering components and systems, with an understanding of the principles behind the design methodologies
G. 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
H. Obtain in-depth knowledge in at least one major area of specialization within civil engineering
I. 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
J. Recognize the importance of seeking further specialization within civil engineering and the need for life-long learning
K. Instill a deep sense of professional responsibilities and the importance of ethical and societal considerations, including public health, safety, environmental conservation, welfare etc.
L. Develop an ability to stay abreast of contemporary issues, both nationally and internationally, and the awareness of the impact of engineering in these areas.