

University of Macau
Undergraduate Civil Engineering Programme

Coordinating Unit:	Department of Civil and Environmental Engineering, Faculty of Science and Technology		
Supporting Unit(s):	Nil		
Course Code:	CIVL322	Year of Study:	3
Course Title:	Construction Materials		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	Nil		
Prerequisite Knowledge:	Nil		
Duration:	One semester	Credit Units:	3
Class/Laboratory Schedule:	2 hours of lecture and 4 hours of laboratory work per week.		
Laboratory/Software Usage:	Construction Materials Laboratory		
Course Description:	<p>This course is designed to provide undergraduate civil engineering students fundamental principles of the behavior, physical and engineering properties of various common civil engineering materials, including natural stones, sands, aggregates, cement, concrete and steel. Selection and design of materials based on their intended use in design and construction are emphasized. The laboratory sections are designed to provide students a hand-on experience on various material testing concepts and procedures. Written reports and oral presentation of experimental results will be required.</p>		
Course Objectives:	<ol style="list-style-type: none"> 1. To learn how to characterize and determine the basic mechanical and non-mechanical properties and behavior of commonly used construction materials. 2. To get familiar with standard quality laboratory testing procedures and proper control of testing equipment for determining the properties and behavior of common construction materials. 3. To understand and master the fundamental knowledge of construction materials. 		
Learning Outcomes (LO):	<p>Upon completion of this course, students should be able to:</p> <ol style="list-style-type: none"> 1. achieve mastery of the fundamental knowledge of construction materials. [POs: j]; 2. demonstrate ability to make selection of materials based on their properties, behavior and intended use in design and construction. [POs: a,j] 3. demonstrate understanding of the state-of-the-art concrete technology including analyze and design and produce concrete mixtures according to BS standard, concrete placing techniques, the use of different types of cement and admixtures for producing good quality concrete. [POs: a,b,j]; 4. conduct lab experiments for determining the properties and the behavior of construction materials for the use in civil engineering construction [POs: a,b,j,k]; 5. evaluate, analyze and interpret the data obtained through standard laboratory testing procedures. [POs: a,b]; 6. collaborate lab work in groups and divide responsibilities among group members. [POs: d] 7. improve writing, communication and presentation skills [POs: g]; 		

Texts & References: <i>(* recommended textbook(s))</i>	<ol style="list-style-type: none"> 1. Michael S. Mamlouk and John P. Zaniewski(2010)*, Materials for Civil and Construction Engineers,3rd Edition, Prentice Hall 2. Somayaji, Shan.(2001). Civil Engineering Materials, 2nd Edition, Prentice Hall. 3. A.M. Neville, Properties of Concrete (2002), Longman. 4. Handout provided by the instructor 																
Student Assessment:	<ul style="list-style-type: none"> • Laboratory work and Reports 30% • Oral presentations: 10%; • Midterm Exam: 30% • Final Examination: 30% 																
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Pedagogical Methods:	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"><input checked="" type="checkbox"/> Lecture</td> <td style="width: 50%; border: none;"><input type="checkbox"/> Service learning</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Guest speakers</td> <td style="border: none;"><input type="checkbox"/> Internship</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Case study</td> <td style="border: none;"><input type="checkbox"/> Field study</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Role playing</td> <td style="border: none;"><input type="checkbox"/> Company visits</td> </tr> <tr> <td style="border: none;"><input checked="" type="checkbox"/> Student presentation</td> <td style="border: none;"><input type="checkbox"/> e-learning</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Project</td> <td style="border: none;"><input checked="" type="checkbox"/> Independent study</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Simulation game</td> <td style="border: none;"><input type="checkbox"/> Others:_____</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Exercises and problems</td> <td style="border: none;"></td> </tr> </table>	<input checked="" type="checkbox"/> Lecture	<input type="checkbox"/> Service learning	<input type="checkbox"/> Guest speakers	<input type="checkbox"/> Internship	<input type="checkbox"/> Case study	<input type="checkbox"/> Field study	<input type="checkbox"/> Role playing	<input type="checkbox"/> Company visits	<input checked="" type="checkbox"/> Student presentation	<input type="checkbox"/> e-learning	<input type="checkbox"/> Project	<input checked="" type="checkbox"/> Independent study	<input type="checkbox"/> Simulation game	<input type="checkbox"/> Others:_____	<input type="checkbox"/> Exercises and problems	
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Major Assessment Methods: For each Major Assessment Method below, please indicate the specific pedagogical methods involved (by putting a ✓ in the relevant box(es) on the right-hand side).	Case Study	Role Playing	Student Presentation	Individual project/paper	Group project/paper	Simulation Game	Exercises & problems	Service learning	Internship	Field Study	Company visits	Written examination	Oral examination	Others (Lab Reports)
Class Participation/ Discussion (0%)														
Assignment(s) (0%)														
Midterm Exam (s) (30%)												✓		
Examination (30%)												✓		
Others <i>(please specify)</i> Reports&presentations (40 %)			✓											✓
Course Web: (if any)														

Course Content: (topic outline)	Week no.	Topics	Experiments no.	LO no.
	1	Course and Lab Introduction Syllabus review; introduction to traditional and new materials used in construction industry; introduction to construction materials lab; lab equipment and safety	--	--
	2,3	Constituent Materials of Concrete (aggregates and sands) Natural rocks; aggregate sources; geological classification; aggregate uses; types of aggregates and sands; aggregate properties; handling aggregates;	1,2	1,2,4,5 7
	4,5	Constituent Materials of Concrete (cement and water) Portland cement production; chemical composition of Portland cement; basic characteristics of Portland cements; types of Portland cement; mixing water; water-cement ratio;	3,4,5	1~7
	6,7	Portland cement concrete Proportioning of concrete mixes; introduction to mix design; factors affecting the Mix Design; mixing placing and handling fresh concrete;	3,4,5	1~7
	8,9	Properties of Fresh Concrete Workability; workability tests ; factors affecting workability; bleeding; segregation; curing concrete; admixtures for concrete;	6,7,8	1~7
	10	Midterm Exam	6,7,8	1~7
	11,12	Properties of Hardened Concrete Creep; compressive strength; factors influencing strength; deformation; permeability ;durability; shrinkage; non-destructive testing;	6,7,8	1~7
	13,14	Steel Steel production; heat treatment of steel; structural steel; cold form steel; reinforcing steel; Steel fastening products; mechanical testing of steel; welding; steel corrosion;	9	1,2

Percentage Content of:	Math	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total
	10	0	80	10	0	0	100
Timetabled work in hours per week:							
	Lecture	Tutorial	Laboratory	Other			Total
	2	----	4				6

Contribution to Program Outcomes:	Program Outcomes					Contribution to POs [#]				
						5	----->			1
						Significant Least				
						5	4	3	2	1
	(a) apply knowledge of mathematics, science, and engineering					✓				
	(b) design and conduct experiments, and analyze data									
	(c) design components, systems or processes in presence of constraints							✓		
	(d) Function in a multi-disciplinary team									
	(e) Engineering problem solving					✓				
	(f) Understand professional and ethical responsibility									
	(g) Communicate effectively									
	(h) Understand the impact of engineering solutions to the society									
	(i) Recognize the need and have the ability for lifelong learning									
	(j) Have knowledge of contemporary issues									
(k) Apply the skills, techniques, modern engineering tools										
(l) Use the computer/IT tools relevant to the discipline										
<i># Note</i> 5: Significant contribution; 4: Supporting contribution; 3: Moderate contribution; 2: Marginal support; 1: Least support										
Course Instructor(s):	Dr. Iok Tong Ng									