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:	CIVL458	Year of Study	4
Course Title:	Structural Systems and Analysis		
Compulsory/Elective:	Elective		
Course Prerequisites:	CIVL314 Structure I		
Prerequisite Knowledge:	Structural analysis		
Duration:	One semester	Credit Units:	3
Class/Laboratory Schedule:	Three hours of lecture		
Laboratory/Software Usage:	Software for finite element analysis of structures		
Course Description:	This course covers the following topics: structures and the behavior of various types of buildings; structures and the behavior of various forms of bridges; structures and the behavior of catenary cable systems; suitability of a structural type under give conditions.		
Course Objectives:	1. To introduce to students the various types of buildings, bridges, and catenary cable systems. 2. To introduce to students the advantage and disadvantage of various buildings, bridges and catenary cable systems. 3. Let the students understand the behavior of various buildings, bridges, and catenary cable systems so that they can reasonably select and analyze a type of building, bridge, or catenary cable system in structural design.		
Learning Outcomes (LO):	Upon completion of this course, students should be able to: 1. understand various structural types and their modeling, such as frame structure, shear wall structure, wall-frame structure, braced structure, tube structure, tube-in-tube structure, outrigger-braced structure, suspension structure, space frame structure [POs: e, i]; 2. understand the behavior of the above various building structures and their suitability under different conditions [POs: a, c, e]; 3. understand various bridge types and their modeling, such as cable-stayed bridge, suspension bridge, and arch bridges [POs: e, i]; 4. understand the behavior of the above various bridges and their suitability under different conditions [POs: a, c, e]; 5. understand various catenary cable systems and their modeling, such as single layer systems, double layer systems, saddle systems, cable-arch systems, and complex systems [POs: e, i]; 6. understand the behavior of the above various catenary cable systems under different conditions [POs: a, c, e].		
Texts & References: *(* recommended textbook(s))*	1. Moore F. (1999), Understanding Structures, McGrew-Hill. 2. Stafford S. B. etc. (1991), Tall Buildings, Analysis and Design, John Wiley & Sons Inc. 3. Troitsky M. S. (1994), Planning and Design of Bridges, John Wiley & Sons Inc. 4. Walther R. etc. (1988), Cable-Stayed Bridges, 2nd Edition, Thomas Telford Ltd. 5. Troitsky M. S. (1988), Cable-Stayed Bridges, 2nd Edition, BSP Professional Books. 6. Gimsing N. J. (1998), Great Belt: East Bridge, A/S Storebæltsforbindelson. 7. Shen S. D., Xiu C. B., Zhao C., and Wu Y. (2005), Design of Cable Structures, China Building Industry Press.		

Student Assessment:	• Assignments and course evaluation 20% • Mid-term test: 30%; • Final exam: 50%
Learning Outcome Assessment:	• Test and exam • Assignments and course evaluation
Pedagogical Methods:	☑ Lecture ☐ Guest speakers ☑ Case study ☐ Role playing ☐ Student presentation ☐ Project ☐ Simulation game ☑ Exercises and problems ☐ Service learning ☐ Internship ☐ Field study ☐ Company visits ☐ e-learning ☑ Independent study ☐ Others: Computer software Lab.

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 (attendance)
Assignment(s) (15%)							✓							
Test(s) (30%)												✓		
Final exam (50%)												✓		
Class performance (5%)														✓
Course Web: (if any)	Course materials are available in UMMoodle (http://webcourse.umac.mo/).													

Course Content: (topic outline)

Week no.	Topics	Assignment no.	LO no.
1	**Structural Systems** Truss structures; frame structures; arch structures; cable structures.	1	1,2
2	**Tall Buildings** Why tall buildings? factors affecting height and structural forms; landmarks of tall buildings; design process of tall buildings.	2	1,2
3	**Shear Wall Structures** Shear wall classification; load redistribution in proportionate shear walls; load redistribution in non-proportionate shear walls; stress analysis of shear wall.	3	1,2
4	**Coupled Shear Wall and Wall-Frame Structures** Behavior of coupled shear wall structures; methods of analysis on coupled shear walls; modeling for computer analysis of coupled shear walls; behavior of wall-frame structures; methods of analysis on wall-frame structures; modeling for computer analysis of wall-frame structures.	4	1,2
5	**Tubular Structures** Behavior of tubular structures; types of tubular structures; formulation of tubular structures; finite element analysis of tubular structures.	5	1,2
6	**Outrigger-Braced Structures and Other Structures** Outrigger-braced structure and its behavior; approximate analysis of uniform outrigger-braced structures; generalized solution of forces and deflections; optimum locations of outriggers; finite element analysis of outrigger-braced structures; suspended structures and core structures; space structures and hybrid structures.	6	1,2
7,8	**Cable-stayed Bridges** Composition of cable-stayed bridges; types of cable-stayed bridges; girders; towers; types of stay systems; connections between cables and tower; linear analysis and preliminary design; nonlinear analysis; construction procedures.	7	3,4
9	Mid-term	--	--
10,11	**Suspension Bridges** Composition of suspension bridge; types of suspension systems; towers; stiffening girders or trusses; floor system; linear analysis and preliminary design; nonlinear analysis.	8	3,4
12,13	**Catenary Cable Structures** Classification of catenary cable structures; single layer systems; stiffened single layer systems; prestressed double layer systems; prestressed saddle systems; cable-arch systems; complex cable systems; analysis of catenary cable systems.	9	5,6
14	**Arch Structures** Arch and classification of arches; behavior of arch structures; typical arch buildings; typical arch bridges.	10	5,6

Percentage Content of:

Math	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total
10	0	80	0	10	0	100

Timetabled work in hours per week:

Lecture	Tutorial	Laboratory	Other		Total
3	---	---	---		3

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					

 # Note 5: Significant contribution; 4: Supporting contribution; 3: Moderate contribution; 2: Marginal support; 1: Least support

Course Instructor(s): Prof. Guokang Er