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:	CIVL314	Year of Study:	3
Course Title:	Structures I		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	CIVL215 Strength of Materials I		
Prerequisite Knowledge:	Analysis of statically determinate structures such as trusses, beams and frames. Determination of stresses and strains/deformation in structural members due to axial force, bending moment, shear force and torque.		
Duration:	One semester	Credit Units:	4
Class/Laboratory Schedule:	Three hours of lecture and two hours of tutorial per week.		
Laboratory/Software Usage:	Experiment in deflections of beam, truss and frame. Use of structural analysis computer software.		
Course Description:	This first course in structures introduces structural design concept and process, structural analysis of statically determinate structures, and analysis of indeterminate structures by flexibility method.		
Course Objectives:	1. To introduce design concept and process of structures. 2. To review analysis of statically determinate structures. 3. To understand the deformations of structures under loading. 4. To introduce flexibility method for analysis of statically indeterminate structures. 5. To introduce influence lines for reactions and internal forces under moving load.		
Learning Outcomes (LO):	1. understand how to represent real structures by idealized structural systems [POs:a,e,h]; 2. be able to analyze various statically determinate structures including trusses, beams, frames, cables and arches [POs: a,e]; 3. understand the deformations of structures under loading and be able to apply various method to determine the deformations [POs: a,e]; 4. understand the concept of flexibility method and be able to apply it for analysis of statically indeterminate structures [POs: a,e]; 5. understand influence lines and be able to apply influence lines to determine maximum values of internal forces and reactions for structures under moving load [POs: a,e]; 6. understand basic experimental techniques for verifying deflections in structures [POs: a,b,e]; 7. understand how to use structural analysis computer programme to do structural analysis [POs: a,e,k,l];		

Texts & References: *(* recommended textbook(s))*	1. *Kenneth M. Leet, Chia-Ming Uang, Anne M. Gilbert, Fundamentals of Structural Analysis, Third Edition, McGrawHill 2. Harry H. West, Louis F. Geschwindner, Fundamentals of Structural Analysis, Second Edition, Wiley 3. R. C. Coates, M. g. Coutie, F. K. Kong, Structural Analysis, Third Edition, Chapman and Hall. 4. A. Ghali and A. M. Neville, Structural Analysis, A unified classical and matrix approach, Fourth edition, E & FN SPON 5. S. P. Timoshenko, D. H. Young, Theory of Structures, McGrawHill
Student Assessment:	• Tests and quizzes : 30%; • Assignments and Experiments : 20% • Final examination: 50%
Learning Outcome Assessment:	• Tests and final examination. • 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 : field observation

Major Assessment Methods	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 (please specify)
Class Participation/ Discussion (0%)														
Assignment(s) (20%)							✓							
Test(s) (30%)												✓		
Examination (50%)												✓		
Others *(please specify)*														
Course Web: (if any)	http://ummoodle.umac.mo/													

Course Content (topic outline)

Week no.	Topics	Assignment no.	LO no.
1	**Introduction of Structural Design Concept and Process** Basic structural design criteria. Structural analysis as part of structural design. Design load and idealized representation of structures.	--	1
2, 3, 4	**Analysis of Statically Determinate Structures** Analysis of Trusses, Beams and Frames, Arches and Cables	1, 2	2
5, 6, 7	**Deflections of Beams and Frames** Differential equation for elastic curve and its solution. Moment area method. Conjugate beam method.	3	3
7, 8, 9	**Energy Methods for Computing Deflections** Work and energy. Principle of virtual work. Unit load method. Deflections due to temperature, lack of fit and support settlement. Maxwell-Betti law of reciprocal deflections.	4	4
10, 11, 12	**Flexibility Method for Statically Indeterminate Structures** Redundant forces and released structures. Compatibility conditions. Flexibility coefficients and matrix. Application to trusses, beams and frames.	5	5
13, 14	**Influence Lines for Statically Determinate Structures** Influence lines for reaction, shear and bending moment in beams and member force in trusses. Use of influence lines to determine the maximum values under given moving load.	6	6

Percentage Content of:

Math	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total
0		80	20	0	0	100

Timetabled work in hours per week:

Lecture	Tutorial	Laboratory	Other		Total
3	2	---	---		5

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):	Professor Iu Vai Pan