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:	CEEB211	Year of Study:	2
Course Title:	Mechanics of Materials		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	CEEB121 Statics		
Prerequisite Knowledge:	Analysis of statically determined structures, e.g., beam, simple truss and frame, etc; Shear force and moment diagrams.		
Duration:	One semester	Credit Units:	3
Class/Laboratory Schedule:	Three hours of lecture and one hour of tutorial/laboratory per week.		
Laboratory/Software Usage:	Experiment 1. Tensile coupon tests To illustrate tensile behavior of ductile and brittle specimens and to obtain the stress-strain relationship and important mechanical properties of the materials. Experiment 2. Torsion tests To obtain the shear modulus and proportional limit of the shear stress and to demonstrate the general characteristics of the "torque-angle of twist relationship". Experiment 3. Flexural bending tests To verify the "normal stress-bending moment formula" under pure bending using a steel beam. Experiment 4. Column buckling tests To illustrate the prediction of buckling load of compression member with different boundary conditions and compare the experimental results with theoretical results.		
Course Description:	This course introduces fundamental concepts of deformable bodies. It serves as a bridge between mechanics of rigid bodies and structural analysis. It introduces the behavior of structural members, both qualitatively and quantitatively, under different types of external loadings.		
Course Objectives:	1. To introduce the basic theory of deformable bodies. 2. To introduce the behavior and quantification methods of stress and strain in structural members, such as shaft and beams, under different external loads (axial load, torsion, and bending, etc.). 3. To prepare students for other advanced courses in structural analysis and engineering.		
Learning Outcomes (LO):	Upon completion of this course, students are expected to: 1. be able to compute the stresses of members subjected to axial force and torsion [POs: a,e]; 2. be able to calculate the stresses of statically determined beams and to analyze stress or strain state [POs: a,e]; 3. be able to the deflection of statically determinate beams [POs: a,e]; 4. calculate the critical load of compression members [POs: a,e]; 5. have basic understanding of experimental setup and procedures of structural mechanics and be capable in laboratory report writing [PO: b,g]		

Texts & References: ** recommended textbook*	1. Beer, F.P., Johnston, E.R., DeWolf, J.T. and Mazurek, D.F. (2011)*, Mechanics of Materials, 6th ed. in SI Units, McGraw Hill Companies (ISBN-10: 0073380288, ISBN-13: 978-0073380285) 2. Gere, J. M and Timoshenko, S. P., (1997) Mechanics of Materials, 4th Edition, PWS Pub. Co. 3. Geer, J.M., and Goodno, B.J. (2008), Mechanics of Materials, 7th ed., CL-Engineering.
Student Assessment:	• Quizzes: 15%; • Midterm examinations: 35% • Final examination: 35% • Laboratory reports: 15%
Learning Outcome Assessment:	• Quizzes, midterm 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: Experiments and reports

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)
Quizzes												✓		
Midterm Examines												✓		
Final Examine												✓		
Others *(please specify)* Lab reports				✓										
Course Web: (if any)	http://webcourse.umac.mo/													

Course Content: (topic outline)

Week no.	Topics	LO no.
1	**Introduction: Stress, Strain and Material Behavior** Normal stress and shear stress; normal strain and shear strain; stress-strain relations for ductile and brittle materials; yield stress and ultimate stress; elasticity and plasticity; Hooke's law; Poisson's effect	1
2	**Axially Loaded Members** Elongation of prismatic members under axial loads; stress on inclined planes	1
3	**Experiment 1**	5
4	**Torsion in Circular-Section Members** Torque and torsion; pure shear; displacement and deformation of circular bars under torsion; stress and strain; polar moment of inertia	1
5	**Normal Stress and Shear Stress in Beams** Pure bending; Euler's beam assumption; relationship between curvature and bending moment; normal stress in beams; second moment of inertia; shear stress in beams with rectangular cross sections; maximum shear stress in beams with circular or thin symmetric cross sections	2
6	**Midterm Examine 1**	
7	**Experiment 2**	5
8, 9	**Stress and Strain Analysis** Plane stress; principle stress and maximum shear stress; Mohr's circle for stresses; plane strain; principle strain and maximum shear strain; Mohr's circle for strains; general 3-D stress-strain relationship in isotropic elasticity	2
10	**Experiment 3**	
11	**Analysis of deflection of beams** Introducing the differential equations of the deflection curve; deflections by integration of the bending moment, shear force and load equations	3
12	**Midterm Examine 2**	
13	**Analysis of column buckling** Concept of buckling and stability; differential equations of compression member with different boundary conditions; eccentrically loaded columns	4
14	**Experiment 4**	5
TBA	**Final Examination**	

TBA: To be arranged by Registry

Percentage Content of:

Mathematics and Basic Science	Engineering Subjects	Complementary Studies	Total
5	95	---	100

Timetabled work in hours per week:

Lecture	Tutorial	Laboratory	Other	Total
3	0.7	0.3	---	4

Contribution to Programme Outcomes:

Programme Outcomes	Contribution to POs	
	Primary	Secondary
(a) an ability to apply knowledge of mathematics, science, and engineering appropriate to the degree discipline	✓	
(b) an ability to design and conduct experiments, as well as to analyse and interpret data		✓
(c) an ability to design a system, component or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability		
(d) an ability to function on multi-disciplinary teams		
(e) an ability to identify, formulate and solve engineering problems	✓	
(f) an ability to understand professional and ethical responsibility		
(g) an ability to communicate effectively		✓
(h) an ability to understand the impact of engineering solutions in a global and societal context, especially the importance of health, safety and environmental considerations to both workers and the general public		
(i) an ability to stay abreast of contemporary issues		
(j) an ability to recognise the need for, and to engage in life-long learning		
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice appropriate to the degree discipline		
(l) an ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations		

Course Instructor:

Dr. Chi Chiu Lam
(Please refer to the following link for the consultation hours of the course instructor: http://www.fst.umac.mo/cee/contacthour.html)