Department of Civil and Environmental Engineering

The Hong Kong University of Science and Technology

Course code	**CIVL 2120**
Course title	**Mechanics of Materials**
Lectures	3:00PM - 5:50PM, every Tue & Thu, Jun 20, 2023 – Aug 3, 2023 (Rm 2463)
Tutorials	4:00PM - 5:50PM, every Wed, Jun 21, 2023 – Aug 2, 2023 (Rm 2463)
Midterm date	TBA
Final exam date	TBA
Instructor	Dr. Thomas W.C. Hu (thomashu@ust.hk) Office: 3585 (Lift 27/28) Phone: 2358-7179
Teaching Assistants	TBA
Prerequisite	Statics (CIVL 2110 or equivalent course)
Credits	3
Textbook (required)	Beer, *Mechanics of Materials* (newest), McGraw-Hill
Course objectives	Upon successful completion of this course, students should be able to: • understand basic concepts of stress, strain and their relations based on linear elasticity • calculate stresses and deformation in axially loaded members • calculate stresses and deformation for bars in torsion • produce shear and moment diagrams of a beam (efficiently!) • calculate normal and shear stresses in beams • select appropriate beam cross-sections for given loading conditions • calculate beam deflections using various methods such as superposition, energy approach, and direct ODE solving • use Mohr's circle to find principal stresses and angles for plane stress
Topics	1: Statics Review; Introduction 2: Stress and Strain; Axial Loading 3: Torsion 4: Pure Bending + Review: Beam analysis by singularity functions 5: Analysis and Design of Beams for Bending 6: Shearing Stresses in Beams 7: Transformation of Stress and Strain 8: Principal Stresses Under a Given Loading 9: Deflection of Beams Optional topics if time permits: Columns; Energy Methods + Truss analysis with matrix method
Computer usage	• CAS calculators are used for efficient equation solving, numerical work and graphing. • Free trial software & free loan of handhelds will be provided.
Lab work	---
Contribution to the professional component	100% engineering topics
Relationship to program objectives	*1. Provide professional skills in design, construction and management* This course provides students with the basic knowledge of mechanics of materials, which is essential in the analysis and design of engineering structures.

	3. *Stimulate self-learning and innovative problem solving skills* Various teaching innovations such as animation videos and CAS (computer algebra systems) are utilized in this class. These allow students to visualize and solve problems more effectively and efficiently, and explore further on their own (e.g. visualizing how differently a beam deflects as loading conditions are changed)
Relationship to CIVL and CIEV program outcomes	*1. Acquire fundamental knowledge in mathematics and science* Engineering mathematics and Newton's laws are applied throughout this course. *2. Understand fundamental principles of engineering science* Students will learn various engineering principles for stress analysis such as Hooke's Law, superposition and energy methods, etc. *4. Apply modern engineering and IT tools for analysis and design* Revolutionary methods utilizing CAS calculator and AutoCAD are taught to solve problems more efficiently and effectively than traditional methods allow. *5. Formulate problems and propose feasible solutions* Students will apply the theories learned in class to formulate stress analysis and simple design problems, and obtain solutions on their own. *6. Design civil engineering components* Students will learn to select proper size, shape and material for structural members to meet design requirements on stress, deflection and cost, etc.

Assessment of outcomes	Due to the tight summer schedule, assessment is somewhat different from regular semester's:
	➢ Midterm (30%) (closed book; one A4 formula sheet allowed)
	    • Midterm coverage: Ch. 1 - 3 (these 3 chapters will not be covered again on final exam)
	➢ Final exam (50%) (closed book; two A4 formula sheets allowed)
	    • Final coverage: Ch. 4 - everything taught thereafter <u>except</u> Ch. 9
	➢ Project (20%)
	    • Project will mainly cover Ch. 9: Apply CAS + singularity functions learned from this course to expedite tedious beam analysis problems done traditionally in CIVL-
	       i. 2110 (if that's all you've taken), or
	      ii. 2120 (if you just failed 2120 in spring), or
	     iii. 3310 (if you like more challenging problems)
	    • More details will be given before Ch. 9 starts
	    • Individual submission (PDF/PPT format) + YouTube presentation (link to be given on first page of report)

Prepared by	*Dr. Thomas Hu*
Updated	*June 12 2023*