Department of Civil and Environmental Engineering

The Hong Kong University of Science and Technology

Course code Course title Lectures Tutorials Final exam date	**CIVL 2120** **Mechanics of Materials** 3:00PM - 5:50PM, every Tue & Thu, Jun 18, 2024–Aug 1, 2024 (Rm 4502) 4:00PM - 5:50PM, every Wed, Jun 18, 2024–Aug 1, 2024 (Rm 4502) In Aug (to be arranged with ARO)
Instructor Teaching Assistants	Prof. Thomas W.C. HU (thomashu@ust.hk) Office: 3585 (Lift 27/28) Phone: 2358-7179 TBA
Prerequisite Credits	Statics (CIVL 2110 or equivalent course) 3
Textbook (recommended)	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 Hooke's Law • calculate stresses and deformation in axially loaded members • calculate stresses and deformation for shafts under 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 • obtain beam deflection using different methods such as superposition 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 with 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, etc. • 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 beam deflections change as loading conditions vary)
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 unreasonably tight summer schedule (7 weeks to cover 13 weeks' material), 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 <u>not</u> be covered again on final exam) (closed book; one A4 formula sheet allowed) ➢ Final exam (50%) (closed book; two A4 formula sheets allowed) • Final coverage: Ch. 4 - end of course <u>except</u> Ch. 9 ➢ Group project (20%) (two students per group with similar background) • Your project will mainly concern Ch. 9, applying CAS + singularity functions methods from this course to expedite otherwise tedious beam problems from i. 2110 (if that's all you've taken), or ii. 2120 (if you just failed 2120 in spring), or iii. 3310 (if you prefer more challenging problems) • More details will be given before Ch. 9 starts • Each group to submit a report (PDF/PPT format) via canvas + your YouTube presentation (provide link on first page of report)
Prepared by	***Prof. Thomas Hu***
Updated	***June 11 2024***