CARLETON UNIVERSITY

Department of Mechanical & Aerospace Engineering

MAAE 2202 Mechanics of Solids I

Instructor: Professor R. Liu
Office Room: CB 6207, Telephone: 8397
E-mail: Rong.Liu@carleton.ca

Course Outline

This course is designed to introduce the fundamental concepts of Solid Mechanics and enable the students to solve general engineering problems in stress-strain analysis effectively. The course comprises the theoretical part and experimental part.

Chapter 1 Review of Statics and Friction Problems

(1) Force equilibrium analysis
(2) Free body diagram
(3) Friction concepts
(4) Various types of friction problems

Chapter 2 Concepts of Stress and Strain

(1) Normal stress and shear stress
(2) Deformation and strain
(3) Stress ~ strain relations

Chapter 3 Statically Determinate and Indeterminate Systems

(1) Principles of solid mechanics
(2) Various statically determinate systems
(3) Various statically indeterminate systems

Chapter 4 Torsion of Circular Sections

(1) Torsion of thin-walled cylinders
(2) Torsion of uniform solid circular shafts
(3) Torsion of non-uniform solid circular shafts
(4) Torque transmission by gear wheels

Chapter 5 Symmetric Bending of Beams (I) — Stresses

(1) Shear force diagram and bending moment diagram
(2) Relationships between load, shear force and bending moment
(3) Determination of bending stress
(4) Neutral axis, first moment of area and second moment of area
(5) Shear stresses in beam bending

Chapter 6 Symmetric Bending of Beams (II) — Deflection

(1) Moment ~ curvature relation
(2) Determination of deflections
(3) Macaulay's step function
(4) Superposition method
(5) Statically indeterminate beams

Chapter 7 Buckling Instability

(1) Stability of equilibrium
(2) Buckling of struts/slender columns (Euler theory)
(3) Buckling characteristics of real struts
(4) Applications of Euler theory

Course Materials

1. CULearn on-line files: Course Outline, Timetable of Lab and PA, Course Notes, Lab Manual, Samples of Mid-term and Final Exams, Exercises-Answers (Solutions are available in the Problem Analysis session.)

2. Reference book: It is available in the Bookstore of Carleton University.
Mechanics of Engineering Materials, P. P. Benham, R. J. Crawford and C. G. Armstrong, Second Edition, Longman, 1996, ISBN 0-582-25164-8.

Marking Scheme

Total marks: 100%

Mid-term examination: 15%
(It will be given during class time on October 21st, 1.5 hr; open Course Notes)

Final exam: 60%
(3.0 hr, open Course Notes)

Laboratory experiments: 25%

Note: Failure in either the final examination or the laboratory component will constitute failure in this course.

Requirements of the Experiments

Each student will complete **Three** experiments, A, B and C in the Lab. All students must submit their "log books' to their teaching assistant (TA) by the end of the laboratory session for grading. Penalty for absenteeism from each laboratory session is 25% of the total laboratory grade. Penalty for late submission of log book is 20% of laboratory grade for each day late.

Class Schedule and Classroom

Lectures:
Monday and Wednesday, 2:30 ~ 4:00 pm
Azrieli Theatre 101

Labs and Problem Analysis (PA): L1
Wednesday 8:30 am ~ 11:30 pm
Problem Analysis (PA): Troy Building 236
Lab: ME2332, Solid Mechanics and Vibration

Labs and Problem Analysis (PA): L2
Wednesday 11:30 am ~ 2:30 pm
Problem Analysis (PA): Southam Hall 501
Lab: ME2332, Solid Mechanics and Vibration

Labs and Problem Analysis (PA): L3
Friday 2:30 ~ 5:30 pm
Problem Analysis (PA): Southam Hall 409
Lab: ME2332, Solid Mechanics and Vibration

The group signing sheet is post on the door of ME2332 (Lab of Solid Mechanics and Vibration).

Office Hours: Monday, 9:00 ~ 11:00 am, Canal Building 6207