

Western University - Faculty of Engineering
Department of Civil and Environmental Engineering

CEE 2202a – Mechanics of Materials - Course Outline 2017/18

This first course in mechanics of materials introduces the fundamental principles used in the study of the engineering behaviour of structures and mechanical members subjected to slowly applied or steady state loading conditions. The general objectives are for the student to develop the ability to:

- apply the knowledge of statics, properties of materials and basic mathematics to analyse the stress-strain behaviour of structural members subjected to slowly applied or steady state loads.
- differentiate between various static loading conditions of simple structures and formulate progressive solutions to quantify their stress-strain behaviour.
- work individually or function in a team to analyse the stress-strain behaviour of simple structural elements under combined loading conditions, to design simple beams to meet specific design needs and effectively communicate the results of this work in coherent and legible design calculations.
- develop awareness of the applications of the skills and techniques introduced in this course in civil engineering practice.
- recognise the need for life-long learning to keep abreast of new developments in the engineering practice and to improve one's design abilities to solve more complex contemporary engineering problems.

Calendar Copy:

Concept of stress and strain; axially loaded members; second moment of area; elastic torsion of circular shafts; bending and shearing stresses in beams; transformation of stress and strain; stresses in thin-walled pressure vessels; design of beams and introduction to beam deflection. 3 lecture hours, 3 tutorial hours, 0.5 course.

Contact Hours:

3 lecture hours/week, 3 tutorial hours/week.
Attendance at the tutorial session is **mandatory**.

Pre-requisites:

ES 1022A/B/Y, Applied Mathematics 1413.

Anti-requisites:

MME 2202A/B.

Note: It is the **student's responsibility** to ensure that all Pre-requisite and Co-requisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the **student's responsibility** to ensure that they have not taken a course listed as an Anti-requisite. The students may be dropped from the course or not given credit for the course towards their degree if they violate the Pre-requisite, Co-requisite or Anti-requisite conditions.

Instructor:

Dr. M.L. Nehdi, P. Eng., Professor, Office: SEB 3083; mnehdi@uwo.ca.
Administrative support: SEB 3005.

Textbook and Notes:

- R.C. Hibbeler, Mechanics of Materials, SI Units Edition, Pearson Prentice Hall (purchase recommended).
- Course notes will be regularly posted on the OWL course website. It is the student's responsibility to print each chapter and bring it to the corresponding lectures.

Units:

SI units are used in lectures and examinations. Some problems and assignments may be in imperial units.

Course Delivery

The lectures emphasise the construction of meaning rather than information transmission. Hence, students shall study the notes for each chapter at home before it is presented by the instructor in class. The home study effort is crucial for the success of students in this course. The class time is dedicated to engaging students in exploring topics in greater depth and applying knowledge to create more meaningful learning opportunities. For instance, students are frequently invited to attempt solving problems on the board during lectures.

Specific Learning Objectives: At the completion of the course, the student should be able to:

1. Concept of Stress:

- a) Differentiate between normal, shearing and bearing stresses
- b) Analyse stresses in simple structures
- c) Identify the components of stress under general loading conditions

2. Stress and Strain – Axial Loading:

- a) Determine stress-strain relationships under axial loading using Hooke's Law
- b) Calculate deformations of axially loaded members
- c) Identify and solve simple statically indeterminate problems
- d) Analyse the effects of temperature changes in axial loading conditions
- e) Assess multi-axial loading cases and use the generalised Hooke's Law
- f) Determine the effect of shearing strain
- g) Apply the stress and strain distribution (Saint-Venant's Principle)

3. Torsion

- a) Define and calculate the polar moment of inertia
- b) Compute deformations and stresses in a circular shaft
- c) Analyse statically indeterminate shafts
- d) Determine torsion stresses in thin-walled hollow shafts

4. Pure Bending

- a) Define and calculate centroids and moments of inertia
- b) Discuss the basic assumptions of the engineering bending theory
- c) Compute deformations and stresses in symmetric members
- d) Compute deformations due to transverse loading

5. Transverse Loading

- a) Calculate and graphically represent normal stress distributions
- b) Analyse problems of shear on a horizontal plane
- c) Compute and graphically represent the distribution of shearing stresses in beams

6. Transformations of Stress and Strain

- a) Carryout transformation of plane stresses, define principal stresses and maximum shearing stresses and apply Mohr's circle for plane stress
- b) Carryout transformation of plane strain, define principal strains and maximum shearing strains and apply Mohr's circle for plane strain
- c) Analyse experimentally measured strain, discuss and interpret results

7. Design of Beams

- a) Determine bending moments and shear force diagrams for a given span and loading
 - b) Define relations among load, shear and bending moment
 - c) Identify and compute principal stresses in beams
8. Deflection of Beams (time permitting)
- a) Analyse the deformation of a beam under transverse loading
 - b) Analyse and design statically indeterminate beams
 - c) Apply superposition to assess deflections/stresses due to various load combinations

General Learning Objectives

E=Evaluate, T=Teach, I=Introduce

Problem Analysis	E	Team Work	T	Ethics and Equity	
Investigation		Communication	I	Economics and Project Management	
Design	I	Professionalism		Life-Long Learning	
Engineering Tools		Impact on Society			

Evaluation:

The final course mark will be determined as follows:

Quizzes:	30%
Mid-term test	20%
Final examination:	50%

Total:	100%

Note:

- **Students must pass the final examination to pass this course.** Students who fail the final examination will be assigned the aggregate mark, as determined above, or 48%, whichever is less.
- **Students who have failed an Engineering course (i.e.<50%) must repeat all components of the course.** No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories, if applicable, cannot be resubmitted for grading by the student in subsequent years.
- Should a quiz or test conflict with a religious holiday that a student wishes to observe; the student must inform the instructor of the conflict no later than one week before the scheduled test. For further information on Accommodations for Religious Holidays see:
<http://www.uwo.ca/univsec/handbook/appeals/religious.pdf>

1. Quizzes and Examinations

Weekly quizzes are scheduled **during the tutorial period**. One **mid-term test** is scheduled in the tutorial period of **October 25, 2017**. Students must attend quizzes and tests since make-up quizzes and tests are not offered. Quizzes, mid-term test and final examination will be **CLOSED BOOK**. Only approved calculators are permitted in the quizzes, midterm test and final exam. Students should consult the list of approved calculators posted outside the Civil and Environmental Engineering Department Office.

2. Weekly Assignments

Assignments consist of two parts. **Part A** of each weekly assignment will be solved in class **by each group of students** with the support of teaching assistants. **Part B** is assigned as **homework and should be solved individually or by student groups**. A solution for **both parts A and B** will be posted on the course website. Students are highly encouraged to solve all assignment questions to do well in the quizzes and midterm test. Assignments will not be marked.

3. Use of English:

In accordance with Senate and Faculty Policy, students may be penalised up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work, except for the final examination, may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Plagiarism Checking:

Western University uses software for plagiarism checking. Students are required to submit their Laboratory Reports (if applicable) in electronic form to Turnitin.com for plagiarism checking.

Cheating:

University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning.

For more information on scholastic offenses, please see:

http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Attendance:

Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Accessibility:

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Conduct:

Students are expected to **arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.** Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please **turn off your cell phone** before coming to a class, tutorial, quiz or exam and refrain from using electronic devices.

On the premises of Western University or at a University-sponsored program, students must abide by the **Student Code of Conduct:** <http://www.uwo.ca/univsec/board/code.pdf>

Sickness and Other Problems:

Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal. The attachment titled "INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED" is an integral part of this course outline.

Students that are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help

For more information concerning medical accommodations, please see: http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf

Notice:

Students are responsible for regularly checking their email, course website (<https://owl.uwo.ca>) and notices posted outside the Civil and Environmental Engineering Department Office.

Consultation:

Students are encouraged to discuss problems with their teaching assistant and/or instructor in tutorial sessions. Office hours will be arranged for the students to see the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the appropriate instructor.

Course breakdown:

Engineering Science = 100%.

The document “INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED” is part of this course outline.