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

CEE 2202a – Mechanics of Materials - Course Outline 2020/21

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 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. Course Weight: 0.50.

Anti-requisite(s): MME 2202A/B.

Pre-requisite(s): Engineering Science 1022A/B/Y, Applied Mathematics 1413.

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.

Contact Hours:

- 3 lecture hours/week: Lectures will be delivered asynchronously through pre-recorded videos posted to the course OWL site. Lectures will be organized into learning modules which students should review on a regular basis. Quizzes will be used to track participation. Review of lecture material and self-study should take approximately 6 hours per week.
- 3 tutorial hours: A 3-hour tutorial session will be delivered synchronously through Zoom each week during the scheduled tutorial hours. Students seeking assistance with weekly assignments or clarification on lecture material are strongly encouraged to attend. The link to the Zoom meeting will be posted to OWL.

Instructor:
Dr. M.L. Nehdi, P. Eng., FACI, FCSCE, Professor, Office: SEB 3083; mnehdi@uwo.ca.
Office hours: by appointment via Zoom (link can be found on the OWL course site)
Textbook and Notes:
- Course notes will be regularly posted on the OWL course website. It is the student’s responsibility to be up to date with the lectures.

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

Course Delivery
The asynchronously delivered lectures emphasise the construction of meaning rather than information transmission. Hence, students shall independently study the notes and the corresponding chapters in the textbook. This effort is crucial for student success in this course. The tutorial time is dedicated to engaging students in problem solving and applying knowledge.

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**

\[E=Evaluate, \; T=Teach, \; I=Introduce\]

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**Evaluation:**

The final course mark will be determined as follows:

- Quizzes: \(30\%\)
- Mid-term test: \(20\%\)
- Written Final Examination: \(40\%\)
- Oral Final Examination: \(10\%\)

\[\text{Total: } 100\%\]

**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:  

1. **Quizzes and Examinations**
   Three quizzes will be scheduled throughout the term during the tutorial period with one-week notice. These quizzes will be conducted using randomized questions via OWL or on the Pearson Mastering Platform with possible use of Proctor-track.

2. **Midterm Exam:** The midterm exam is tentatively scheduled during the tutorial period on **November 03 at 1:30 PM - 4:30 PM.** It will be conducted using randomized questions via OWL or on the Pearson Mastering Platform with possible use of Proctor-track.

3. **Weekly Assignments**
   Assignments are assigned as homework and should be solved individually. A solution will be posted on the course website. Students are highly encouraged to solve all assignment questions to do well in the quizzes, midterm test and final exam. Assignments will not be marked.
4. **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.

**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, has not engaged sufficiently in 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.

**Accommodation:**

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: Academic Accommodation for Students with Disabilities.

**Academic Consideration for Student Absence**

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student’s final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student’s final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are not met, students will need to provide a Student Medical Certificate if the absence is medical or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**
For Western University policy on Consideration for Student Absence, see

Policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs

and for the Student Medical Certificate (SMC), see:


Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar.

Use of Recordings:

All of the remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

Conduct:

Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- please “arrive” to class on time
- please use your computer and/or laptop if possible (as opposed to a cell phone or tablet)
- ensure that you are in a private location to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material
- to minimize background noise, kindly mute your microphone for the entire class until you are invited to speak, unless directed otherwise
- [suggested for classes larger than 30 students] In order to give us optimum bandwidth and web quality, please turn off your video camera for the entire class unless you are invited to speak
- [suggested for cases where video is used] please be prepared to turn your video camera off at the instructor’s request if the internet connection becomes unstable
- unless invited by your instructor, do not share your screen in the meeting

The course instructor will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

- if you wish to speak, use the “raise hand” function and wait for the instructor to acknowledge you before beginning your comment or question
- remember to unmute your microphone and turn on your video camera before speaking
- self-identify when speaking.
- remember to mute your mic and turn off your video camera after speaking (unless directed otherwise)

General considerations of “netiquette”:

- Keep in mind the different cultural and linguistic backgrounds of the students in the course.
- Be courteous toward the instructor, your colleagues, and authors whose work you are discussing.
- Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. “Flaming” is never appropriate.
• Be professional and scholarly in all online postings. Cite the ideas of others appropriately. Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.

**Contingency plan for an in-person class pivoting to 100% online learning:**

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online as determined by the course instructor.

**Online Proctoring Notice:**

1. If using Proctortrack or alternative remote proctoring solution only:

Tests and examinations in this course will be conducted using the remote proctoring service, Proctortrack. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. More information about this remote proctoring service is available in the Online Proctoring Guidelines at the following link:


Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. Information about the technical requirements are available at the following link:

https://www.proctortrack.com/tech-requirements/.

2. If using Zoom Only:

Tests and examinations in this course will be conducted using Zoom. You will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session will not be recorded.*

More information about the use of Zoom for exam invigilation is available in the Online Proctoring Guidelines at the following link:


Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom. Information about the system requirements are available at the following link:

https://support.zoom.us/hc/en-us.

* Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please discuss this with your instructor in advance of the test or examination.

3. If using both Zoom and Proctortrack or alternative remote proctoring solution:
Tests and examinations in this course will be conducted using both Zoom and the remote proctoring service, Proctortrack.

When Zoom is used for exam invigilation, you will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session using Zoom will not be recorded.*

Proctortrack will require you to provide personal information (including some biometric data). The session will be recorded. By taking this course, you are consenting to the use of this software. More information about remote proctoring is available in the Online Proctoring Guidelines at the following link:


Completion of this course will require you to have a reliable internet connection and a device that meets the system and technical requirements for both Zoom and Proctortrack. Information about the system and technical requirements are available at the following links:

https://www.proctortrack.com/tech-requirements/,
https://support.zoom.us/hc/en-us.

* Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please discuss this with your instructor in advance of the test or examination.

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 the Instructor in tutorial sessions. Office hours will be arranged for the students to meet with the Instructor and teaching assistants. Other individual consultation can be arranged by appointment with the instructor.

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

Course Breakdown: Engineering Science = 100%