

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

CEE 2202a – Mechanics of Materials - Course Outline 2018/19

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 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

- Determine bending moments and shear force diagrams for a given span and loading
- Define relations among load, shear and bending moment
- Identify and compute principal stresses in beams

8. Deflection of Beams (time permitting)

- Analyse the deformation of a beam under transverse loading
- Analyse and design statically indeterminate beams
- 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 29, 2018**. 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.

INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

If, on medical or compassionate grounds you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

A. GENERAL REGULATIONS & PROCEDURES

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM TESTS

1. If you are in first year and you are unable to write a term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office is required when rescheduling term tests.

C. FINAL EXAMINATIONS

1. If you are unable to write a final examination, contact the Undergraduate Services Office **PRIOR TO THE SCHEDULED EXAMINATION TIME** to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department **and** the Associate Dean and in order to apply you must sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

D. LATE ASSIGNMENTS

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4.
 - i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.
 - ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

E. SHORT ABSENCES

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You may want to seek advice from your academic counsellor in the Undergraduate Services Office.

G. DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).
2. **You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your academic counsellor.

Calendar References: Check these regulations in your 2018 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Absences Due to Illness:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_12

Academic Accommodations for Students with Disabilities:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_10

Academic Accommodations for Religious or Holy Days:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_16

Course Withdrawals:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=6&SelectedCalendar=Live&ArchiveID=#Page_75

Examinations:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=5&command=showCategory&SelectedCalendar=Live&ArchiveID=#Page_75

Scheduling of Term Assignments:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#SubHeading_78

Scholastic Offences:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_20

Student Medical Certificate: <https://www.eng.uwo.ca/files/undergraduate/forms/smc.pdf>

Engineering Academic Regulations:

http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=4&SelectedCalendar=Live&ArchiveID=#Page_86

Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

Add Deadlines:

| | |
|---|--------------------|
| First term half course (i.e. “A” or “F”) | September 14, 2018 |
| Full courses and full-year half course (i.e. “E”, “Y” or no suffix) | September 14, 2018 |
| Second term half course (i.e. “B” or “G”) | January 15, 2019 |

Drop Deadlines:

| | |
|--|-------------------|
| First term half course (i.e. “A” or “F”) | November 12, 2018 |
| Full courses and full-year half courses (i.e. “E”, “Y” or no suffix) | November 30, 2018 |
| Second term half or second term full course (i.e. “B” or “G”) | March 7, 2019 |

Contact Information:

| | | | |
|--|----------|---------------------------|--|
| Undergraduate Services Office: | SEB 2097 | Telephone: (519) 661-2130 | E-mail: engugrad@uwo.ca |
| Dept. of Chemical and Biochemical Engineering & Green Process Engineering: | TEB 477 | Telephone: (519) 661-2131 | E-mail: cbeugrad@uwo.ca |
| Dept. of Civil and Environmental Engineering: | SEB 3005 | Telephone: (519) 661-2139 | E-mail: civil@uwo.ca |
| Dept. of Electrical and Computer Engineering, Software Engineering & Mechatronics Engineering: | TEB 279 | Telephone: (519) 661-3758 | Email: eeugrad@uwo.ca |
| Dept. of Mechanical and Materials Engineering: | SEB 3002 | Telephone: (519) 661-4122 | E-mail: mmeundergraduate@uwo.ca |