

MECH 360 Mechanics of Materials
The University of British Columbia
2019 – 2020 (Term 2)
January 06, 2020 to April 08, 2020

Course Calendar: Lecture: Mon, Wed, Fri, 16:00 - 16:50; Earth Sciences Building 1012.
Tutorial - 1: Mon 17:00 - 17:50; MacLeod 254;
Tutorial - 2: Fri 10:00 - 10:50; CEME 1204.
Tutorials include solving example problems and Q&A with TAs.

Instructor: Dr. Xiaoliang Jin, Assistant Professor;
Department of Mechanical Engineering, the University of British Columbia.
<http://mech.ubc.ca/xiaoliang-jin/>
Email: xjin@mech.ubc.ca, Phone: 604 827 3541.
Office Hour: Thursday 11:00 AM - 12:00 PM, Kaiser 3103, or appointments by email.

Teaching Assistants:

Mohammad Reza Fazlali (fazlali@mail.ubc.ca); Naresh Kumar Maroju (nareshkm@alumni.ubc.ca)
Office Hour: Friday 1:00-3:00 PM.

Objectives:

- (1) Calculate principal stresses in 2-D and 3-D for statically determinate and indeterminate members;
- (2) Calculate the stress distribution in beam bending and shearing problems;
- (3) Understand the concept of structure stability and solve column buckling problems;
- (4) Apply energy methods to determine displacements due to multiple loads;
- (5) Apply stress analysis to practical problems in mechanics and engineering design.

Prerequisites: MECH 224, or MECH 260, or its equivalent.

Textbook (optional):

- (1) ‘Mechanics of Materials’ by Ferdinand P. Beer, E. Russell Johnston, Jr., John T. DeWolf, David F. Mazurek;
or
- (2) ‘Mechanics of Materials: An Integrated Learning System’ by Timothy A. Philpot, Jeffrey S. Thomas.

Course Outline:

1. Stress Transformation

- Review on 2-D stress transformation, stress Mohr's circle.
- Mohr's circle for 3-D stress transformation, eigenvalues and eigenvectors solutions.
- Stresses in thin-walled pressure vessels.

2. Bending Stress

- Review of pure bending.
- Bending of composite materials.
- Plastic bending and residual stresses.
- Product of inertia and unsymmetrical elastic bending.
- Bending due to eccentric loading.

3. Shearing Stress

- Shear stress calculation in cross section.
- Shear flow in built up members.
- Shear stress and shear flow in thin-walled structures.
- Shear center determination.

4. Deflection of Beams

- Review of shear force and moment diagrams.
- Beam deflections, double integration and singularity functions.
- Superposition in beam deflections and statically indeterminate beams.

5. Buckling of Columns

- Euler buckling stress.
- Effect of boundary condition on column buckling.
- Buckling under eccentric loads.

6. Energy Method for Deflection

- Strain energy and structure deflection.
- Deflection for single and multiple loads using energy method.
- Castigliano's theorem and statically indeterminate structures.

Homework Assignments: Homework assignment will be posted every week, and students will need to submit the solutions to the drop slots at the MECH office (CEME 2054) before the deadline (usually one week after the post date). 10 students will be randomly selected and their homework will be graded.

Grading Scheme:

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|-------------------------|--|
| 2 Midterm Exams | 40% (20% each) |
| Final Exam and Homework | <u>60% (Each homework grade will be 1% of total grade)</u> |
| Total | 100% |

Examinations: Two Midterm exams will be given in class (50 minutes).

Midterm 1 – February 14, 16:00 – 16:50.

Midterm 2 – March 13, 16:00 – 16:50.

The schedule of the final exam will be released in February.

Professional Standards: All students in this course and in engineering at UBC are expected to conduct themselves in accordance with the high standards demanded of the profession of engineering. This includes, but is not limited to, acting in accordance with University policies on academic conduct. The UBC Calendar articulates what acceptable academic conduct is, and it is the responsibility of each student to inform themselves of the standards.

See: <http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,286,0,0>

- (1) Students who has to miss a lecture for medical or other legitimate reasons should report to the instructor and provide the documents for proof.
- (2) Students who must miss an exam for medical or other legitimate reasons must get approval by the instructor at least one day before the exam.
- (3) Please put cell phones in Silent mode during lectures.
- (4) Asking questions to the instructor is encouraged. Long discussions among the students are not encouraged.