ENGR 0145: Statics & Mechanics of Materials II

SPRING, 2025 Section 02

INSTRUCTOR: Dr. Shijing Luo

OFFICE: Room 522 (New Building)

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OFFICE HOURS: Monday & Tuesday & Friday: 14:00-17:30, or by appointment

LECTURES: Tuesday 8:15-11:00
Room 3-102

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COURSE NUMBER: 312016030

CREDITS: 3-credits

TEXTBOOK:

- Statics and Mechanics of Materials: An Integrated Approach (2nd Edition), W. F. Riley, L. D. Sturges, and D. H. Morris, Wiley, ISBN – 978-0-471-43446-7
- Additional references and supplementary materials will be posted on Blackboard.

PREREQUISITE:

- ENGR 0145 Statics and Mechanics of Materials I

COURSE DESCRIPTION:

This course is 3 credits.

The course builds on the fundamental theory of mechanics of materials and demonstrates how this theory is put into practice to analyze structural elements. Techniques are presented to analyze deformation/strains as well as forces/stresses for beams. Advanced topics including flexural loadings, beam deflection, stress/strain transformation, Mohr's circle, generalized Hook's Law, combined loading, and column buckling will be explored. Methods to both statically determinate and indeterminate beams will be presented. Buckling and combined loading configurations will be

analyzed through stress, strain, and deformation. Students will develop the logical thinking skills to analyze and design structural components and systems, ensuring safety, efficiency, and reliability through problem-solving exercises, case studies, and hands-on projects.

COURSE OBJECTIVES:

This course is designed to equip students with the knowledge and skills to analyze and design structural components subjected to static loadings. It will be demonstrated with the following parts:

1) Flexural loadings in beams: Determine internal shear forces, bending moments, and stress distributions in beams under various loading conditions, and apply these concepts to design beams for strength and stiffness;
2) Beam deflections: Use methods such as integration, superposition, and energy-based approaches to predict and analyze beam deflections, ensuring compliance with design specifications and serviceability requirements;
3) Combined loading scenarios: Analyze structural elements subjected to combined loads, and apply stress transformation techniques (including Mohr's circle) to determine principal stresses and failure criteria.
4) Failure theories and buckling: Apply failure theories to analyze failures under static loading as well as analyze the buckling of columns under different boundary conditions.

LEARNING OUTCOMES:

After the successful completion of this course, students should develop:

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3) an ability to communicate effectively with a range of audiences.
4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

6) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

GRADE DETERMINATION:

5%: Participation (including attendance and in-class performance)

10%: In-class quizzes

20%: Homework

30%: 1 midterm exam

35%: 1 final exam

Participation:

On-time attendance at all class activities is expected. Meanwhile, students are encouraged to join all kinds of class activities, including attending each class, asking/answering questions in classes, and giving presentations in the classes, etc.

Quizzes:

Quizzes will be assigned to students during class hours, the topics are usually related to the latest class or new theories/techniques introduced in the same class to check students' understanding of the basic knowledge. Generally, **no** make-up quizzes will be allowed for absences from the class, unless prior approval has been granted by the instructor or a valid emergency, supported by appropriate documentation, is provided.

Homework:

To be assigned after the lectures. Submission requirements (including due dates) for all assessments will be announced to students in class or on Blackboard. Late assignments will be deducted 30% per day and will not be accepted after 4 days (including the 4th day) or after the solutions are distributed, whichever is earlier.

GRADE POLICY:

A: 90 – 100	B+: 80 – 84	B−: 73 – 75	C: 66 – 69	D: 60 – 62
A−: 85 – 89	B: 76 – 79	C+: 70 – 72	C−: 63 – 65	F: < 60

If students have any concerns regarding their grades, they may submit a rebuttal within **5 days** of the grade announcement. No rebuttals will be accepted after this period.

MATERIAL COVERED/INTENDED SCHEDULE:

The intended sequential contents covered in this class are shown in the following table and might be adjusted according to the class schedule.

Week	Contents	Descriptions
1 (02/25)	Introduction	Course introduction and revision, centroid, 2nd moment of area
2 (03/04)	Chp. 8	Flexure stress & strain, elastic flexure formula
3 (03/11)	Chp. 8	Shear force and bending moment diagrams
4 (03/18)	Chp. 8	Shear stress in beams
5 (03/25)	Chp. 9	Beam deflection by integration
6 (04/01)	Chp. 9	Singularity functions & superposition
7 (04/08)	Handout	Castigliano theorem.
8 (04/15)	Chp. 9	Statically indeterminate beam
9 (04/22)	Review	Review for Chp. 8~9, Midterm Exam Week
10 (04/29)	Chp. 10	Plane stress & Moore circle for plane stress
11 (05/06)	Chp. 10	Plane strain & Moore circle for plane strain
12 (05/13)	Chp. 10	Generalized Hooke's law and strain analysis
13 (05/20)	Chp. 10	Thin-walled vessel Combined loadings
14 (05/27)	Chp. 10	Failure theory
15 (06/03)	Chp. 11	Columns – Buckling
16 (06/10)	Chp. 11	Columns buckling, Fracture theory, & final review
17 (06/17)		Final Exam Week

Copyrights:

Academic Integrity:

All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty would be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include but is not limited to the confiscation of the examination of any individual suspected of violating the University Policy.