

Mechanics of Materials: Course Syllabus

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1. **Course Number:** 2183213
2. **Course Credit:** 3 (3-0-6)
3. **Course Title:** Mechanics of Materials
4. **Faculty/Department:** International School of Engineering
5. **Semester:** First
6. **Academic Year:** 2024
7. **Instructors:**
 - Section 1: Asst. Prof. Tawan Paphapote
 - Section 2: Viggo Hansen
8. **Conditions:**
 - Prerequisite: 2183212
 - Corequisite: None
 - Concurrent: None
9. **Status:** Required
10. **Curriculum:**
 - B.E. in Automotive Design and Manufacturing Engineering
 - B.E. in Robotics and AI
11. **Degree:** Bachelor's Degree
12. **Total Number of Hours:** 45 hours
13. **Course Description:**

Concepts of stress and strain; stress and strain components; plane stress and plane strain; Mohr's circle for plane stress; Hooke's law and modulus of elasticity; engineering stress-strain diagrams; working stress; factor of safety; axial loading including statically indeterminate problems and temperature changes; thin-walled pressure vessels; torsion of circular shafts; statically indeterminate shafts; beam analysis including stress, deflection; Euler's formula for buckling; combined stress; theories of failure.
14. **Course Outline:**
 - **Objectives:**
 - (a) Determine stress and strain in simple mechanical components.
 - (b) Explain material behaviors based on mechanical properties.
 - (c) Analyze plane stress at a point, construct and apply Mohr's circle.

- (d) Determine stress and deformation under various load types including axial, torsional, flexural, pressure vessel, and combined loading.
- (e) Solve statically indeterminate problems using additional deformation equations.
- (f) Calculate beam deflection including elastic curve.
- (g) Determine buckling loads for columns with various boundary conditions.

Course Content:

Period	Topics	Remarks
1	Introduction, External and internal loads, Normal and Shear stress, Allowable stress, Deformation, Strain, Tensile/Compressive tests, Stress-strain behavior, Ductile vs. Brittle materials, Hooke's law, Poisson's ratio	Chapter 1
2	Plane stress, Stress transformation equations, Principal stress, Maximum in-plane shear stress, Mohr's circle, Absolute maximum shear stress	Chapter 2
3	Deformation under axial load, Thermal stress	Chapter 3
4	Statically Indeterminate Members	Chapter 4
5	Torsion, Torsion formula	Chapter 5
6	Power transmission, Angle of twist, Statically indeterminate torque-loaded members	Chapter 6
7	Shear and Moment Diagrams	Chapter 7
8	Shear and Moment Diagrams (Graphical Method), Geometric properties (centroid, Q, I)	Chapter 8
9	Bending, Flexural formula, Shear in beams, Shear formula	Chapter 9
10	Elastic curve, Slope and displacement by integration	Chapter 10
11	Statically Indeterminate Beams by Integration	Chapter 11
12	Thin-Walled Pressure Vessels	Chapter 12
13	Combined Loadings	Chapter 13
14	Buckling, Critical load, Columns with various supports	Chapter 14

Homework Notes:

- **Contributions:** Homework can be submitted as:
 - Python functions relevant to coursework (optimizations encouraged)
 - Jupyter Notebooks for textbook problems or student/instructor-created problems
 - Corrections to existing software or content

Assignments can also be submitted as PDF or Word documents.

- **Submission:** Use the Course GitHub Repository for code (MATLAB, Python, etc.). Refer to Code-First Learning slides for guidelines.
- **GitHub Access:** Email your GitHub username to <mailto:vkhsen@eng.chula.ac.th> for access.

Method of Teaching: Lectures, Code-first

Teaching Media: Class notes, GitHub Source Code

Assignment through Network System:

- Method: MyCourseville, GitHub
- LMS: MyCourseville, GitHub

Evaluation

- Weekly Quizzes (Paper-Based, 1 Note Page Allowed) based on topics from the Course Outline: 30%

- Homework Assigned Weekly via MCV (Submit as source code, PDF, to GitHub Repo): 20%
- Midterm: 20%
- Final Exam: 30%

Reading Lists:

- Required Textbook: Hibbeler, R.C., *Mechanics of Materials*, Prentice Hall.

Teacher Evaluation:

- Standard Chulalongkorn University Evaluation form: Lecture course (Form 04)
- Continuous improvement through Program Outcomes
- Discussions aimed at enhancing CU graduate qualifications.

Document History

- Version 1.0 - 01/26/2024 - Initial draft by Viggo Hansen