Mechanics of Materials: Course Syllabus

Version 1.1, Revised: January 26, 2025

Lecturer: Viggo Hansen
Faculty of Engineering, Chulalongkorn University

Academic Year: 2024
Semester: Second

Contents

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:** Second
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 vkhansen@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
- Version 1.1 - January 26, 2025- Revised by Viggo Hansen