

Mechanics of Materials I (3 units)

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Chapter 1. Introduction

A brief review on Statics and the aim of Mechanics of Materials.

Chapter 2. Stress

General concept, Definition, Equilibrium equations, Stress analysis of axial loaded bar, Normal and shear stresses, Bearing stress, Single and double shear connections, Design criteria.

Chapter 3. Strain

Normal stress-strain relationship, Hook's law, Poisson's ratio, Shear stress-strain relationship, Generalized concept of strain and Hook's law, Statically indeterminate system.

Chapter 4. Torsion

Equilibrium equation for torsion problems, Torsion formula, Shear stress-torsion relationship for circular members, Design of circular member under torsion, Angle of twist of circular member, Statically indeterminate problems, Torsion of non-circular member, Torsion of thin walled member, Shaft coupling .

Chapter 5. Beams (pure bending moment)

Review of beam problem, Calculation of beam reactions, P, V, M diagrams, Calculation of moment of inertia, Stress of bending moment, Beams of composite cross section.

Chapter 6. Shear stresses

Review of differential equations of equilibrium for a beam element, Shear flow, Shear stress-shear force formulation for beam, Shearing flow in flange and web cross-section, Shear center.

Chapter 7. Combined stresses

Stress combination of axial loading, bending moment, torsion, and shear force, Unsymmetric beam bending, Bending of double symmetric cross section, Beams with arbitrary cross section.

Chapter 8. Stress transformation

Principal stresses, Maximum shearing stresses, Stress transformation, Mohr's circle of stress, Construction of Mohr's circle of stress.

Chapter 9. Inelastic and plastic material behavior

Stress-strain relationship, Hardening, softening, ideal plasticity, Statically indeterminate nonlinear problems, Application to inelastic axial members, torsion of inelastic circular bars, bending of inelastic beams.

References.

1. E.P. Popov, **Engineering Mechanics of Solids**, *Prentice Hall*, 2nd Edition, 1998.
2. F.P. Beer, E.R. Johnston, J.T. Dewolf, D.F. Mazurek, **Mechanics of Materials**, *McGraw Hill*, 6th Edition, 2012.

Evaluation.

Final exam 40%, Midterm (1) 25%, Midterm (2) 25%, H.W. 10%