

Mechanics of Materials II (3 units)

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Chapter 1. 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.

Chapter 2. Plastic limit analysis

Collapse of beams, Plastic limit analysis of simple beams, continuous beams, and frames, Plastic modulus.

Chapter 3. Curved beams

Flexure theory for curved beams, Axial (circumferential) stress and radius stress in curved beams.

Chapter 4. Yield and failure criteria

Maximum shear-stress theory (Tresca criterion), Maximum distortion-energy theory (von-Mises criterion), Maximum normal-stress theory (Coulomb criterion), Mohr-Coulomb criterion, Drucker-Prager criterion.

Chapter 5. Pressure vessels

Thin-walled cylindrical and spherical pressure vessels, Hoop and longitudinal stresses, Thick-walled cylindrical pressure vessels, Circumferential and radial stresses.

Chapter 6. Energy methods

Elastic strain energy for normal and shearing stresses, Principle of potential energy, Virtual displacement, Virtual work, Energy due to axial loading, bending moment, shear force, and torsion.

Chapter 7. Deflection of beams

Deformation of beam under transverse loading, Equation of elastic curve, Deflection of statically indeterminate beams.

Chapter 8. Columns

Column buckling theory, Euler formula for columns with different boundary conditions, Eccentric load and Secant formulation, Beam-column.

Chapter 9. Beams on elastic foundation

Infinite beams with a point load, point moment, and distributed loading, Semi-infinite beams subjected to different loading conditions.

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.
3. A.P. Boresi, R.J. Schmidt and O.M. Sidebottom, **Advanced Mechanics of Materials**, *John Wiley*, 5th Edition, 1993.

Evaluation.

Final exam 40%, Midterm 35%, Project 15%, H.W. 10%