Department of Civil Engineering

Course Name:

Mechanics of Materials II

Course Number: 20-112	**Credit:** 3
Program: Undergraduate	**Course Type:** Technical elective
Prerequisite: Mechanics of Materials I	**Corequisite:** -

Course Description (Objectives):
This course covers an extension of Mechanics of Materials I and introduce some new topics in this context.

Course Content (outline):

- **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, Principal 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:

- E.P. Popov, Engineering Mechanics of Solids, *Prentice Hall*, 2nd Edition, 1998.
- F.P. Beer, E.R. Johnston, J.T. Dewolf, D.F. Mazurek, Mechanics of Materials, *McGraw Hill*, 6th Edition, 2012.
- A.P. Boresi, R.J. Schmidt and O.M. Sidebottom, Advanced Mechanics of Materials, *John Wiley*, 5th Edition, 1993.