



**BAKER COLLEGE**  
**STUDENT LEARNING OUTCOMES**  
ME 3270 MECHANICAL DESIGN  
4 Semester Hours

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**Student Learning Outcomes & Enabling Objectives**

1. Explore the features of mechanical design
  - a. Describe the differences between analysis and design, design process, and design considerations
  - b. Examine design tools and resources, design engineers professional responsibilities, standards and codes, economics, and safety product liability
  - c. Distinguish stress and strength
  - d. Describe uncertainty, design factor, and factor of safety
  - e. Examine reliability and probability of failure, and relate design factor to reliability
  - f. Describe dimensions and tolerances
2. Analyze deflection, stresses, and stiffness
  - a. Solve for deflections using singularity functions, superposition, and Castigliano's theorem
  - b. Examine stress concentration
  - c. Solve for stresses in pressurized cylinders, rotating rings, press and shrink fits, and under temperature effects
  - d. Examine curved beams in bending
  - e. Determine contact stresses
  - f. Examine shock and impact
3. Investigate failures resulting from static loading
  - a. Solve problems using failure theories
  - b. Examine modes of fracture
4. Investigate fatigue failures resulting from variable loading
  - a. Describe fatigue in metals
  - b. Examine the three major approaches used in the design and analysis for fatigue loading
  - c. Describe S-N diagram, endurance limit, and endurance limit modifying factors
  - d. Examine stress concentrations under fatigue loading
  - e. Analyze fatigue failure for fluctuating stresses
  - f. Analyze fluctuating stresses under combinations of loading modes
  - g. Examine fatigue strength
5. Explore screws, fasteners, and the design of non-permanent joints
  - a. Describe thread standards and definitions, mechanics of power screws, and threaded Fasteners.
  - b. Analyze fastener and member stiffness's, and bolt strength
  - c. Analyze joints for preload, external tensile load, fatigue load, and shear
  - d. Relate bolt torque to bolt tension.
  - e. Examine gasketed joints, shear joints, setscrews, keys and pins

6. Investigate welded joints
  - a. Describe welding symbols, butt and fillet welds
  - b. Analyze stresses in welded joints in torsion and bending
  - c. Determine the strength of welded joints
  - d. Solve welded joints under static and fatigue loading
  - e. Examine resistance welding adhesive bonding
7. Analyze Rolling-Contact Bearings
  - a. Describe bearing types , bearing life, and bearing load life at rated reliability
  - b. Examine bearing survival: reliability versus life
  - c. Relate load, life, and reliability
  - d. Solve bearings for combined radial and thrust loadings
  - e. Examine variable loading, selection of ball, cylindrical, and tapered roller bearings
  - f. Describe design assessment for selected rolling-contact bearings
  - g. Examine lubrication, mounting and enclosure
  - h. Determine shear flow in built-up and thin-walled members
8. Explore lubrication and journal bearings
  - a. Examine types of lubrication
  - b. Describe viscosity, Petroff's equation, and hydrodynamic theory
  - c. Examine design considerations and the relations of the variables
  - d. Describe steady-state conditions in self-contained bearings
  - e. Examine clearance, pressure-fed bearings, loads and materials, thrust bearings, and Boundary-lubricated bearings
9. Investigate clutches, brakes, couplings, and flywheel
  - a. Solve static analysis problems
  - b. Examine internal expanding rim clutches and brakes
  - c. Examine external contracting rim clutches and brakes
  - d. Describe band-type clutches and brakes
  - e. Examine frictional-contact axial clutches, disk brakes
  - f. Describe cone clutches and brakes
  - g. Examine energy considerations, temperature rise, and friction materials
  - h. Examine miscellaneous clutches, couplings, and flywheels
  - i. Apply general equations of plane-strain transformation
  - j. Examine strain rosettes
  - k. Describe material property relationships for plane stress and plane strain

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These SLOs are not approved for experiential credit.

**Effective: Spring 2020**