Course Outcomes [Related ME Program Outcomes in brackets]

1. Understand fatigue failure mechanisms. [A1, A2]
2. Analyze fatigue stresses in machine components. [A1, A2, A6]
3. Gain fundamental knowledge of indeterminate problems with and without preload. [A1, A2]
4. Apply Statics, Dynamics, and Strength of Materials to basic machine component design. [A1, A2, A5, A6]
5. Improve design communications in formal design projects. [B1]

Fatigue Failure Theories (5 wks)
- S-N Diagrams
- Endurance Limit
- High Cycle Fatigue
- Stress Concentration
- Fully Reversed Loading
- Non-Zero Mean Stress
- Combined Loading
- Application to Shafts

Bearings (2 wks)
- 1. Rolling Element Bearings
  - Types
  - Load/Life
  - Effects of axial loads
  - Cumulative Damage
- 2. Journal Bearings
  - Types/Materials
  - Petroff's Model
  - Reynolds Equations
  - Short/Long Brng. Solutions

Spur Gears (2 wks)
- 1. Geometry
- 2. Loads
- 3. Stresses
  - surface
  - bending
- 4. Strength
- 5. Safety factors
  - surface
  - bending

Helical Springs (2 wks)
- 1. Materials
- 2. Geometry
- 3. Stresses
- 4. Spring Rate
- 5. Static Failure
- 6. Fatigue Failure
- 7. Buckling
- 8. Surge

Indeterminate Problems - Bolted Joints (2 wks)
- 1. Geometry
- 2. Standards
- 3. Preload
- 4. Joint Constant
- 5. Static Failure
- 6. Fatigue Failure
- 7. Initial Torque
- 8. Gaskets

Design of Machine Components (Typical Projects)
- Design of a 2-speed transmission
- Valve spring and head bolt design for an engine

Indeterminate Problems - Brakes/Clutches
- Typical Projects (2 wks)
  - 1. Self-Energizing concept
  - 2. Self-Locking concept
  - 3. Materials
  - 4. Short Shoe Brake
  - 5. Long Shoe Brake
  - 6. Disk Clutch/Brake

Fatigue Failure (Typical Projects)
- Bicycle crank arm
- Wind turbine blade
- Engine crankshaft
- Tractor spindle
1. **COURSE NUMBER AND NAME:** ME 45200 Machine Design II

2. **CREDITS AND CONTACT HOURS:** 3 credits  
   a. Lecture – 3 days per week at 50 minutes for 16 weeks

3. **COURSE COORDINATOR OR INSTRUCTOR:** J.M. Starkey

4. **TEXTBOOK:**  

5. **SPECIFIC COURSE INFORMATION:**  
   **a. Catalog Description:** Design and analysis of mechanical systems for fluctuating loading. Fatigue analysis. Application of design fundamentals to mechanical components and integration of components to form systems. Typically offered in fall and spring.  
   **b. Prerequisites:**  
   ME 35200 – Machine Design I  
   MSE 23000 – Structure and Properties of Materials  
   **c. Status:** Restricted Elective

6. **SPECIFIC GOALS FOR THE COURSE**  
   **a. Course Outcomes:**  
   [Related ME Program Outcomes in Brackets]  
   1. Understand *fatigue failure mechanisms*. [A1, A2]  
   2. Analyze *fatigue stresses* in machine components. [A1, A2, A6]  
   3. Gain fundamental knowledge of *indeterminate problems* with and without *preload*. [A1, A2]  
   4. Apply Statics, Dynamics, and Strength of Materials to basic *machine component design*. [A1, A2, A5, A6]  
   5. Improve design communications in formal design projects. [B1]  

   **b. Related ME Program Outcomes:**  
   [Related ABET Outcomes Listed in Brackets]  
   A1. Engineering Fundamentals;  
   A2. Analytical Skills;  
   A3. Experimental Skills;  
   A4. Modern Engr Tools;  
   A5. Design Skills;  
   A6. Impact of Engr Solns;  
   B1. Communication Skills;  
   B2. Teamwork Skills  

   B3. Prof/Ethical Responsibility;  
   B4. Contemporary Issues;  
   B5. Life-Long Learning;  
   C1. Leadership,  
   C2. Global Engineering Skills;  
   C3. Innovation;  
   C4. Entrepreneurship

7. **LIST OF TOPICS:** See following page.

**PREPARED BY:** J.M. Starkey  
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