

**1. Department, Course Number, and Course Title:**

**MECHANICAL ENGINEERING**

**ME 323 MACHINE DESIGN I**

**2. Designation:** Required  Elective   
Lower Division  Upper Division

**3. Course Description:** Application of principles of mechanics, properties of materials, and fabrication processes to design simple machines and structural elements.

**4. Prerequisites:** ME 103 Introduction to Mechanical Design, CE/ME 205 Strength of Materials, ENGR 207 Materials Science and Engineering, and Math 208 Calculus III: Sequence Series and Coordinate Systems

**5. Text and Materials:** "Machine Design, An Integrated Approach" (2nd ed.) Robert L. Norton, Prentice Hall, 2000.

**6. Course Objectives:** The student will learn current engineering methods used to determine stress and deformation of machine elements and to design simple machine components under static and dynamic loading.

Course Outcomes

- the ability to determine the principal stresses and maximum shear stress in machine elements such as cylinders, curved members, beams, and columns.
- the ability to determine the deflection of machine members using various techniques and to design machine elements to satisfy the desired stiffness.
- the ability to predict failure of machine elements under steady loading using various theories of failure.
- the ability to predict failure of machine elements and their factor of safety under variable loading conditions using various theories of failure and to design machine elements to have a required factor of safety under variable loading conditions given.

**7. Topics Covered:** (in Order of Presentation)

- Introduction, Vibration Loading, Impact Loading Chapter 3
- Deflection of beams: Equations of deflection, Singularity Functions Chapter 3
- Mohr's Circle Chapter 4
- Normal, Shear, Bearing, Tearing, Bending, and Torsional Stresses; Combined Stresses Loading Chapter 4
- Stress Concentration Chapter 4
- Curved Beams Chapter 4
- Deflection of beams: Castigliano's method Chapter 4
- Axial Compression, Buckling of columns Chapter 4
- Stresses in Cylinders Chapter 4
- Static Failure Theories for ductile materials Chapter 5
- Static Failure Theories for brittle materials Chapter 5
- S-N Diagrams and fatigue life estimation Chapter 6
- Fatigue Failure theories, mechanisms, and models, Fatigue life & endurance limit Chapter 6
- Fatigue Stress Concentration Factors, Fracture mechanics Chapter 6
- Fully reversed stresses, Mean and alternating stresses Chapter 6
- Fluctuating stresses, multiaxial stresses Chapter 6

**8. Class Schedule:** Number of Sessions per week: 2  
Duration of each session: 1 hour 40 minutes

**9. Contribution of course to meeting the professional component:**

This course is one of the required courses in upper division required for the mechanical engineering program.  
Engineering Science 2 unit.

**10. Relationship of course to program objectives:**

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)
- a knowledge of current events and societal contemporary issues -- non-engineering related. (abet j)
- a knowledge of computer aided design and simulation software
- a knowledge of measurement and manufacturing techniques
- a knowledge of how mechanical engineering integrates into inter-disciplinary systems

Skill outcomes:

- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
- an ability to select materials and manufacturing processes
- an ability to think in a logical sequential process

Attitudes Outcome:

- an understanding of responsibility and accountability
- a recognition of the need for an ability to engage in lifelong learning (abet i)
- a desire to be a flexible and adaptable team player (collaborative attitude)

**11. Prepared by:** Adel A. Sharif

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