

**ME 410  
Statics  
(4 credit hours)**

**Objectives**

1. Obtain a thorough understanding of the fundamental concepts of vector mechanics of bodies at rest (vectors, forces, couples, moments, Newton's laws, free body and equilibrium analysis)
2. Learn how to determine: Reactions at the supports of bodies in static equilibrium, external and internal forces acting in structural members, geometric and inertial properties of solid bodies
3. Develop a systematic approach to solving problems, including careful sketching, precise mathematical notation, clear presentation of solution, and computer generated plotting of results

**Prerequisites**

En Graph 167, Problem Solving through Programming for Engineering Calculations and Computer Graphics, or Cptr/Inf 201, Elementary Computer Programming (or equivalent)  
Physics 131, Introductory Physics: Particles and Motion  
Math 254, Calculus and Analytic Geometry (prerequisite or concurrent)

Before taking this class, the students should specifically know:

1. Algebra and Trigonometry
2. Vectors (graphical representation, components, dot product, and cross product)
3. Calculus of a single variable
4. Physics (mechanics of a particle, Newton's laws, and energy)

**Topics**

1. Equilibrium of a Particle
2. Equilibrium of Rigid Bodies
3. Analysis of Structures, and Internal Forces and Moments
4. Dry Frictional Contact
5. Geometric and Inertial Properties of Bodies
6. Computer Mini-Projects

**Basis of Grading**

1. Midterm
2. Final
3. Homework
4. Quizzes
5. Computer Projects

**Equilibrium of a Particle**

1. Force vectors and resultants
2. Free body diagrams of particles
3. 2D and 3D equations of equilibrium of a particle at rest (Newton's 1st law applied to translation)
4. Determine forces acting on particles using equations of equilibrium

**Equilibrium of Rigid Bodies**

1. Moments due to forces and couples
3. Equivalent force-couple systems
4. Free body diagrams of rigid bodies
5. 2D and 3D equations of equilibrium of a rigid body (translation and rotation)
6. Determine forces and couples acting on rigid bodies using equations of equilibrium
7. Two and three-force members

**Analysis of Structures  
Internal Forces and Moments**

1. Determine forces in plane truss members (method of joints and method of sections)
2. Determine reaction and connection forces in frames and machines
3. Determine internal forces and moments in structural members
4. Shear force/bending moment diagrams for laterally loaded beams

**Dry Frictional Contact**

1. Amonton-Coulomb law of dry friction
2. Determine state of friction (stick/slip) and calculate frictional forces on bodies in dry frictional contact using the Amonton-Coulomb law of dry friction and the equations of equilibrium

**Geometric and Inertial  
Properties of Solid Bodies**

1. Locate centers of gravity/ mass and centroid of rods, plates and volumes
2. Replace distributed loading by resultants at the centroids of loading profiles (fluid statics applications)
3. Calculate area moments of inertia of a plane cross-sections
4. Calculate mass moment of inertia of volumes

**Computer Mini-Projects**

Several parameter study and graphing exercises on the computer will be assigned