ME 270
BASIC MECHANICS I

Course Outcomes [Related ME Program Outcomes in brackets]

1. Develop an understanding of static equilibrium and Newton’s laws of motion and how to apply them to engineering systems. [A1, A2]
2. Develop an understanding of shear-force and bending-moment diagrams and basic stress analysis [A1, A2]
3. Learn a systematic approach to problem solving. [A3]
4. Foster effective mathematical and graphical communication skills. [B1]

Statics of Rigid Bodies (9 wks)

Fundamentals (2 wks)
1. Newton’s Laws
2. Vector Algebra; Vector Components
3. Position, Unit and Force Vectors
4. Dot Products
5. Moment about a Point

Static Equilibrium (5 wks)
1. Equilibrium of a Particle (2D, 3D)
2. Support Reactions and Free Body Diagrams
3. 2-D and 3-D Static Equilibrium
4. Static Indeterminacy and Partial Constraints
5. Dry Friction
   - Coulomb’s Laws
   - Systems with Friction
   - Sliding or Tipping
   - Wedges
   - Belt Friction
6. Trusses
   - Method of Joints
   - Method of Sections
   - Zero-Force Members
7. Frames and Machines

Equivalent Systems (2 wks)
1. Force Couples
2. Equivalent Force/Couple Systems
3. Distributed Loads
4. Centroid and Center of Mass
   - by integration
   - by composite parts
5. Fluid Statics
   - Buoyancy
   - Flat Surfaces
   - Curved Surfaces

Stresses in Statically Determinate Structures (6 wks)

Internal Loads (1 wk)
1. Internal Force/Couple Analysis
2. Shear-Force Diagrams
3. Bending-Moment Diagrams

Introduction to Stress Analysis (5 wks)
1. Basic Definitions of Stress and Strain
2. Mechanical Properties of Materials
3. Stresses and Strains in Axial Loading
4. Stress and Strain due to Shear Loading
5. Stresses and Strains in Torsional Loading
   - Circular Shafts
   - Tubular Shafts
6. Stress in Beams under Bending Loading
7. 2nd Moments of Area
   - integration
   - composite parts
   - parallel axis theorem
8. Shear Stress in Beams

Revision Date:
May 06, 2014
**COURSE NUMBER:** ME 27000  
**COURSE TITLE:** Basic Mechanics I

**REQUIRED COURSE OR ELECTIVE COURSE:** Required  
**TERMS OFFERED:** Fall, Spring and Summer

**TEXTBOOK/REQUIRED MATERIAL:**  
Lecture Book: Forces, Moments, and Stress in the Mechanical World.

**PRE-REQUISITES:**  
PHYS 17200 - Modern Mechanics and MA 16600 - Analytical Geometry & Calculus II or equivalent

**CONCURRENT PRE-REQUISITES:**  
MA 26100 - Multivariate Calculus and ENGR 13200 - Transforming Ideas to Innovation II

**COORDINATING FACULTY:** E.A. Nauman

**COURSE OUTCOMES**  
[Related ME Program Outcomes in brackets]:
1. Develop an understanding of static equilibrium and stresses in statically determinate structures and how to apply them to engineering systems. [A1, A2]
2. Learn a systematic approach to problem solving. [A2]
3. Foster effective mathematical and graphical communication skills. [B1]

**COURSE DESCRIPTION:**  
Vector operations, forces and couples. Free body diagrams, equilibrium of a particle and of rigid bodies. Distributed forces. Centers of gravity and centroids. Friction. Trusses, frames, and machines. Internal reactions resulting from axial, shear, torsional, and bending loading. Stress and strain analyses and elementary failure criteria.

**ASSESSMENTS TOOLS:**
1. Daily homework.
2. Periodic announced or unannounced quizzes during lecture periods.
3. Three, one-hour exams.
4. One comprehensive final exam.

**PROFESSIONAL COMPONENT:**
1. Engineering Topics: Engineering Science – 3 credits (100%)

**COMPUTER USAGE:** None

**COURSE STRUCTURE/SCHEDULE:**
1. Lecture - 3 days per week at 50 minutes

**ME PROGRAM OUTCOMES:**
A1. Engineering Fundamentals; B3. Prof/Ethical Responsibility;  
A3. Experimental Skills; B5. Life-Long Learning;  
A4. Modern Engr Tools; C1. Leadership;  
A5. Design Skills; C2. Global Engineering Skills;  
A6. Impact of Engr Solns; C3. Innovation;  
B1. Communication Skills; C4. Entrepreneurship;  
B2. Teamwork Skills; 

**PREPARED BY:** E.A. Nauman  
**REVISION DATE:** May 06, 2014