Title of Course: Engineering Mechanics I  
Semester:  
Credits: 3  

Class hours 2  
Lab hours 3  

Instructor Information:  
Name:  
Office:  
Tel:  

BOROUGH OF MANHATTAN COMMUNITY COLLEGE  
City University of New York  
Department of Science  

Course Description  
This course is a three-dimensional vector treatment of the static equilibrium of particles and rigid bodies. The topics include: Equivalent force and couple system; analysis of beams, trusses, frames and machines, friction, impending motion, method of virtual work and stability of equilibrium.

Prerequisites/Co-requisites  
ESC 130, MAT 302, PHY 215 and SCI 120 or departmental approval  

Learning Outcomes  

<table>
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<tr>
<th>Course Student Learning Outcomes</th>
<th>Measurements (means of assessment the learning outcomes listed in first column)</th>
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<td>Students will be able:</td>
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<tr>
<td>To perform analysis of an engineering system, draw the free body diagram, introducing all reaction forces at the supports.</td>
<td>Graded statics problems involving application of Concentrated and distributed forces: exam questions and problems.</td>
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<tr>
<td>To understand the condition of static equilibrium and calculate the reaction at the supports</td>
<td>Graded laboratory report where students will experimentally determine reactions at the supports, subsequently comparing them with theoretical reactions calculated using equilibrium equations</td>
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<tr>
<td>To represent given forces and moments as vectors.</td>
<td>Graded exam problems and questions, containing step-by-step calculations necessary to represent given forces and moments as vectors.</td>
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| To solve two and three-dimensional statics problems and apply fundamental laws of mechanics to solve practical problems | a. Graded laboratory report containing both: the experimental and theoretical solutions for a 3D static problem;  
b. Graded exam questions and problems. |

The Program Outcomes  
Students will:  

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Required Text & Readings

Laboratory Manual and Study Guide

Use of Technology (if applicable)

Evaluation & Requirements of Students
45% Tests
25% Final Examination
20% Laboratory Reports
10% Home works and Class Participation

There will be three one hour examinations (15% each, total 45%) and comprehensive final examination (25%).

Outline of Topics

1. **Statics of Particles** 1 week
   - Equilibrium of a Particle. Reading Assignment: Beer & Johnston 2.1 to 2.11
   - Forces in a space. Rectangular components of a Force; Addition and subtraction of vectors (forces) in space. Equilibrium of a particle in Space.
   - Reading Assignment: Beer & Johnston 2.12 to 2.15

2. **Rigid Bodies** 1 week
   - External and internal forces. Vector product and Scalar product. Mixes triple product.
   - Moment of a force with respect to a point and an axis. Moment of a couple.
   - Addition of Couples. Reading Assignment: Beer & Johnston 3.1 to 3.14

3. **Equivalent Force Systems:** 1 week
   - Couples as Vectors. Reduction of a force system to one force and one couple.
   - Equivalent system of forces. Reduction of a force system to a single force.
   - Reading Assignment: Beer & Johnston 3.15 to 3.20

4. **Equilibrium of Rigid Bodies:** 2 weeks
   - Free-body diagram (FBD).
   - Equilibrium in two dimensions: Reaction at supports and connection for a two dimensional structure. Equilibrium of a rigid body in two dimensions.
   - Equilibrium of two-force and three-force bodies. Statical indeterminacy.
   - Reading Assignment: Beer & Johnston 4.1 to 4.7
   - Equilibrium in three dimensions:
     - Reaction at supports and connections for a three dimensional structure.
     - Equilibrium of a rigid body in three dimensions.
     - Reading Assignment: Beer & Johnston 4.8 to 4.9

5. **Distributed Forces: Centroid and Center of Gravity:** 1 week
   - Reading Assignment: Beer & Johnston 5.1 to 5.8

6. **Engineering Structures:** 1-1/2 week
   - Reading Assignment: Beer & Johnston 6.1 to 6.7
This syllabus is provided as a general informational guide. Some of the information may vary depending on the specific course section and instructor. Different sections of the same course may require different textbooks. Verify the section specific textbook information in the CUNY's Academic Course Schedule Web Page. Modifications of the grading system presented here will be communicated by the instructors of the sections when they meet the class.

7. **Forces in Beams:** 1 week
   - Internal forces in members. Types of loads and supports. Axial and shear forces, and bending moment in a beam.
   - Reading Assignment: Beer & Johnston 7.1 to 7.6

8. **Friction Forces:** 1-1/2 weeks
   - Laws of Coulomb (dry) friction. Simple contact friction problems.
   - Rolling resistance. Belt Friction
   - Reading Assignment: Beer & Johnston 8.1 to 8.4, 8.7 to 8.10

9. **Distributed Forces, Moments of Inertia:** 1-1/2 weeks
   - Second moments or Moment of inertia of a plane area. Polar moments of inertia. Parallel axis Theorem. Moments of inertia of composite areas.
   - Reading Assignment: Beer & Johnston 9.1 to 9.7

10. **Method of Virtual Work:** 1-1/2 weeks
    - Reading Assignment: Beer & Johnston 10.1 to 10.4, 10.8, 10.9

11. **Kinematics of a Particle**:
    - Curvilinear Motion of a Particle: Position vector, velocity and acceleration. Differentiation of a vector function with respect to time.

**Class Participation**
Participation in the academic activity of each course is a significant component of the learning process and plays a major role in determining overall student academic achievement. Academic activities may include, but are not limited to, attending class, submitting assignments, engaging in in-class or online activities, taking exams, and/or participating in group work. Each instructor has the right to establish their own class participation policy, and it is each student’s responsibility to be familiar with and follow the participation policies for each course.

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