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

Title of Course: **Engineering Mechanics I**
Semester: **Spring-2017**
Credits **3**

Class hours **2**
Lab hours **3**
Instructor Information:
Name:
Office:
Tel:

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

Course Student Learning Outcomes **Students will be able:**	**Measurements (means of assessment the learning outcomes listed in first column)**
To perform analysis of an engineering system, draw the free body diagram, introducing all reaction forces at the supports.	Graded statics problems involving application of Concentrated and distributed forces: exam questions and problems.
To understand the condition of static equilibrium and calculate the reaction at the supports	Graded laboratory report where students will experimentally determine reactions at the supports, subsequently comparing them with theoretical reactions calculated using equilibrium equations
To represent given forces and moments as vectors.	Graded exam problems and questions, containing step-by-step calculations necessary to represent given forces and moments as vectors.
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:**	**Measurements**
Analyze practical engineering problems and apply creative thinking to solve them	Graded statics problems involving application of concentrated and distributed forces: exam questions and problems.
Demonstrate advanced science and mathematical skills	Graded exam problems and questions, containing step-by-step calculations necessary to represent given forces and moments as vectors.

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.

Required Text & Readings
FERDINAND P. BEER and E. Russell Johnston Jr.; Vector Mechanics for Engineers; by McGraw-Hill Publishing Co. 10th Edition

Laboratory Manual and Study Quide

RAFAEL NIYAZOV, "Experimental Approach to Engineering Mechanics"**,** Cengage Learning, 2008. ***ISBN# 978-1426-63892-3***

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**
Forces in a plane. Addition of vectors. Resolution of vectors. Unit vectors. 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**
Center of gravity. Centroids of area and lines. Composite plates. Determination of centroids by integration. Theorem of Pappus-Guldinus. Distributed forces in beams and structures.
Reading Assignment: Beer & Johnston 5.1 to 5.8

6. **Engineering Stuctures**: **1-1/2 week**
The structural model. The simple truss. Solution of simple trusses. Method of Joints. Method of Sections.
Reading Assignment: Beer & Johnston 6.1 to 6.7

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**
Work of a force. Principle of virtual work and its application to machines and structures. Potential energy. Stability of equilibrium.
Reading Assignment: Beer & Johnston 10.1 to 10.4, 10.8, 10.9

11. **Kinematics of a Particle*:** **1week**
Curvilinear Motion of a Particle: Position vector, velocity and acceleration. Differentiation of a vector function with respect to time.

College Attendance Policy
At BMCC, the maximum number of absences is limited to one more hour than the number of hours a class meets in one week. For example, you may be enrolled in a three-hour class. In that class, you would be allowed 4 hours of absence (not 4 days). **In the case of excessive absences, the instructor has the option to lower the grade or assign an F or WU grade**.

Academic Adjustments for Students with Disabilities
Students with disabilities who require reasonable accommodations or academic adjustments for this course must contact the Office of Services for Students with Disabilities. BMCC is committed to providing equal access to all programs and curricula to all students.

BMCC Policy on Plagiarism and Academic Integrity Statement
Plagiarism is the presentation of someone else's ideas, words or artistic, scientific, or technical work as one's own creation. Using the idea or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations, require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism.