**MEC 260**
MECHANICAL ENGINEERING STATICS
2016

**Lectures:** Dr. Raheem Al-Sabur
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Office Hours:
Mon 1:00pm-3:00pm and Tue 2:00pm-4:00pm (107 LE)

**Catalog Data:**

A review of vector algebra. Concept of force. Equilibrium of particles. Moments about points and lines, couples and equivalent force systems. Equilibrium of rigid bodies. Analysis of simple structures such as trusses, frames, and beams. Centroids, centers of gravity, and moments of inertia. Dry friction with applications to wedges, screws, and belts. Method of virtual work, potential energy, and stability.

**Textbook:**

*Vector Mechanics for Engineers: Statics* 10th Edition, by Beer, Johnston, Mazurek, Cornwell, and Eisenberg, McGraw-Hill Higher Education

**Course Objectives**

At the completion of the course:

1. The student will be able to identify, formulate, and solve static equilibrium problems in two dimensions.
2. The student will be able to calculate geometric and inertial properties of composite areas and masses.
3. Provide the necessary background for further study of MEC 262 Dynamics, MEC 363 Mechanics of Solids, and MEC 364 Fluid Mechanics.

**Grading:**

In-Class Quizzes (5% + bonus), Homework (5%, your 10 best HW's, weighted equally), two Midterm Exams (2×20%), Final Exam (50%).

**Course Policies**

1. Students are expected to attend ALL class meetings and ARRIVE ON-TIME prepared for class.
2. All exams will be closed book and closed notes. An exam absence will be scored as a zero, unless a valid excuse.
3. **Homework**
    a. All homework, quizzes, and assignments must be completed on A4 paper (**handwritten assignments**). Paper torn from spiral notebooks will not be accepted.
    b. Begin each problem on a separate piece of paper. Pages must be stapled together in the upper left hand corner.
    c. Homework will be assigned usually during each class and will be collected the next class. Late homework will not be accepted. Homework submitted by email will not be accepted.
    d. Use a pencil only…DO NOT USE INK PENS for homework
    e. Units must always be shown in the problem, solution, and final answer. The final answer must be boxed-in, circled, or highlighted

**Schedule:**

| Week | Date | Topics | HW |
|---|---|---|---|
| *1* | | *2.1 Introduction*<br>*2.2 Force on a Particle. Resultant of Two Forces*<br>*2.3 Vectors*<br>*2.4 Addition of Vectors* | |
| | | *2.5 Resultant of Several Concurrent Forces*<br>*2.6 Resolution of a Force into Components*<br>*2.7 Rectangular Components of a Force. Unit Vectors*<br>*2.8 Addition of Forces by Summing X and Y Components* | |
| | | *2.9 Equilibrium of a Particle*<br>*2.10 Newton's First Law of Motion*<br>*2.11 Problems Involving the Equilibrium of a Particle FBD* | |
| *2* | | *2.12 Rectangular Components of a Force in Space*<br>*2.13 Force Defined by Its Magnitude and 2 Points on Its Line of Action*<br>*2.14 Addition of Concurrent Forces in Space*<br>*2.15 Equilibrium of a Particle in Space* | |
| | | *Ch. 2: Examples* | *HW1* |
| | | *3.1 Introduction*<br>*3.2 External and Internal Forces*<br>*3.3 Principle of Transmissibility. Equivalent Forces*<br>*3.4 Vector Product of Two Vectors* | |
| *3* | | *No class* | |
| | | *3.5 Vector Products Expressed in Terms of Rectangular Components*<br>*3.6 Moment of a Force about a Point*<br>*3.7 Varignon's Theorem*<br>*3.8 Rectangular Components of the Moment of a Force* | *HW2* |
| | | *3.9 Scalar Product of Two Vectors*<br>*3.10 Mixed Triple Product of Three Vectors*<br>*3.11 Moment of a Force about a Given Axis* | |
| *4* | | *3.12 Moment of a Couple*<br>*3.13 Equivalent Couples*<br>*3.14 Addition of Couples*<br>*3.15 Couples Can Be Represented by Vectors*<br>*3.16 Resolution of a Given Force into a Force at O and a Couple* | |
| | | *3.17 Reduction of a System of Forces to One Force and One Couple*<br>*3.18 Equivalent Systems of Forces*<br>*3.19 Equipollent Systems of Vectors*<br>*3.20 Further Reduction of a System of Forces*<br>*3.21 Reduction of a System of Forces to a Wrench* | *HW3* |
| | | *Ch. 3: Examples* | |
| *5* | | *Catch up Examples* | |
| | | *4.1 Introduction*<br>*4.2 Free-Body Diagram*<br>*4.3 Reactions at Supports and Connections for a 2D Structure*<br>*4.4 Equilibrium of a Rigid Body in 2D* | *HW4* |
| | | *4.5 Statically Indeterminate Reactions. Partial Constraints*<br>*4.6 Equilibrium of a Two-Force Body*<br>*4.7 Equilibrium of a Three-Force Body* | |
| *6* | | *4.8 Equilibrium of a Rigid Body in 3D* | |
| | | *Ch. 4: Examples* | *HW5* |
| | | *Catch up Examples* | |
| *7* | | *Catch up review for EXAM* | |
| | | *EXAM Chapter 2, 3, 4* | |

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| | | *5.1 Introduction*<br>*5.2 Center of Gravity of a Two-Dimensional Body*<br>*5.3 Centroids of Areas and Lines*<br>*5.4 First Moments of Areas and Lines*<br>*5.5 Composite Plates and Wires* | |
| *8* | | *5.6 Determination of Centroids by Integration*<br>*5.7 Theorems of Pappus-Guldinus*<br>*5.8 Distributed Loads on Beams* | |
| | | *5.10 Center of Gravity of a 3D Body. Centroid of a Volume*<br>*5.11 Composite Bodies*<br>*5.12 Determination of Centroids of Volumes by Integration* | |
| | | *6.1 Introduction*<br>*6.2 Definition of a Truss*<br>*6.3 Simple Trusses*<br>*6.4 Analysis of Trusses by the Method of Joints*<br>*6.5 Joints Under Special Loading Conditions*<br>*6.6 Space Trusses* | *HW6* |
| *9* | | *6.7 Analysis of Trusses by the Method of Sections*<br>*6.8 Trusses Made of Several Simple Trusses* | |
| | | *Ch. 6: Examples* | |
| | | *Catch up* | *HW7* |
| *10* | | *6.9 Structures Containing Multiforce Members*<br>*6.10 Analysis of a Frame*<br>*6.11 Frames Which Cease to Be Rigid When Detached from Their Supports*<br>*6.12 Machines* | |
| | | *Ch. 6 Examples* | |
| | | *7.1 Introduction*<br>*7.2 Internal Forces in Members*<br>*7.3 Various Types of Loading and Support*<br>*7.4 Shear and Bending Moment in a Beam* | *HW8* |
| *11* | | *Ch. 6 Examples* | |
| | | *Catch up* | *HW9* |
| | | *8.1 Introduction*<br>*8.2 The Laws of Dry Friction. Coefficients of Friction*<br>*8.3 Angles of Friction*<br>*8.4 Problems Involving Dry Friction* | |
| *12* | | *8.5 Wedges*<br>*8.6 Square-Threaded Screws* | |
| | | *Ch. 8 Examples* | *HW10* |
| | | *Catch-up, Review for Exam III* | |
| *13* | | *EXAM II Chapter (5, 6, 7, 8)* | |
| | | *9.1 Introduction*<br>*9.2 Second Moment, or Moment of Inertia, of an Area*<br>*9.3 Determination of the Moment of Inertia of an Area by Integration*<br>*9.4 Polar Moment of Inertia*<br>*9.5 Radius of Gyration of an Area* | |
| | | *9.6 Parallel-Axis Theorem*<br>*9.7 Moments of Inertia of Composite Areas* | |
| *14* | | *9.11 Moment of Inertia of a Mass*<br>*9.12 Parallel-Axis Theorem*<br>*9.13 Moments of Inertia of Thin Plates*<br>*9.14 Determination of the Moment of Inertia of a 3D Body by Integration* | |

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| | | *9.15 Moments of Inertia of Composite Bodies* | |
| | | *No Class* | |
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| | | *Ch. 9 Examples* | *HW11* |
| *15* | | *10.1 Introduction*<br>*10.2 Work of a Force*<br>*10.3 Principle of Virtual Work*<br>*10.4 Applications of the Principle of Virtual Work* | |
| | | *Catch up –review for final exam* | *HW12* |
| | | *Final Exam* | |