Sungkyunkwan University (SKKU) International Summer Semester (ISS) 2018

Engineering Mechanics: Statics

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SHORT COURSE DESCRIPTION

This course familiarizes students with the principles of static equilibrium by applying Newton's laws of motion to solve engineering problems. Emphasis is placed on drawing free body diagrams and self-checking strategies. Topics include introduction to forces; 2D equilibrium of particles and rigid bodies; center of gravity and centroids; distributed loading and hydrostatics; friction; analysis of truss structures; and shear force and bending moment diagrams.

READING MATERIALS

The following text book is recommended to assist your learning with this course:
Hibbeler, R. C. (2017). Engineering Mechanics Statics, 12th Edition in SI units, Pearson. http://www.pearson.com.au/9781292089232
http://maktab-fatemeh.com/wp-content/uploads/ebooks/Hibbeler%20Statics%2012th.pdf

Additionally, the following is text is a useful supplementary resource to the course content
Meriam, J. L. & Kraige, L. G. (2013). Engineering Mechanics Statics, 7th Edition, Wiley. http://au.wiley.com/WileyCDA/WileyTitle/productCd-EHEP002436.html

COURSE REQUIREMENTS AND GRADING

Student academic achievement evaluated by grades on a scale of 100 points
Grade of 60 or above is Pass.
SKKU regulations require students to attend at least 80% of all classes.

Grading Percentages

Attendance:	10%
Quiz:	20%
Assignments:	20%
Final Exam:	50%

On successful completion of this course students will be able to:

- Define Newton's laws of motion.
- Recall trigonometric laws and apply to the addition and decomposition of vectors quantities.
- Identify the moment of a force and calculate its value about a specified axis. Define the moment of a couple.
- Describe the concept of dry friction and analyze the equilibrium of rigid bodies subjected to this force.
- Construct "Free Body Diagrams" of real world problems and apply Newton's Laws of motion and vector operations to evaluate equilibrium of particles and bodies.
- Apply the principles of equilibrium of particles and bodies to analyze the forces in planar truss members.
- Discuss the concepts of “center of gravity” and “centroids” and compute their location for bodies of arbitrary shape.
- Apply the concepts used for determining center of gravity and centroids to find the resultant of a generally distributed loading.
- Implement methods learnt for equilibrium of bodies and the resultant of a generally distributed loading to compute the internal forces in beams. Generalize the procedure to construct bending moments and shear force diagrams (internal forces) and utilize this information in engineering design.

COURSE SCHEDULE

- General Principles
  - Introduction to the basic quantities and idealizations of mechanics
  - Newton’s laws of motion and gravitation
  - SI system of units
  - Standard procedures for performing numerical calculations
  - General guide for solving problems
- Force Vectors

    - Add forces and resolve them into components using the Parallelogram Law
    - Express force and position in Cartesian vector form and determine vector's magnitude and direction
    - Introduce dot product to determine the angle between two vectors or projection of one vector onto another
- Equilibrium of a Particle
    - Introduce concept of a particle free body diagram
    - Solve particle equilibrium problems
- Force System Resultants
    - Calculate moment of a force in two and three dimensions
    - Find the moment of a about a specified axis
    - Define the moment of a couple
    - Determine the resultants of non-concurrent force systems
    - Reduce a simple distributed loading to a resultant force
- Equilibrium of a Rigid Body
    - Develop equations of equilibrium for a rigid body
    - Introduce the free-body diagram for a rigid body
    - Solve rigid-body equilibrium problems
- Structural Analysis
    - Determine forces in the members of a truss
    - Analyze forces acting on pin-connected members of frames and machines
- Internal Forces
    - Determine the internal loadings in a member using the method of sections
    - Formulate equations that describe internal shear and moment throughout a member
    - Analyze forces and geometry of cables supporting a load
- Friction
    - Analyze the equilibrium of rigid bodies subjected to dry friction
    - Present applications of frictional force analysis on wedges, screws, belts, and bearings
    - Investigate the concept of rolling friction
- Center of Gravity and Centroid
    - Discuss the concept of center of gravity, center of mass, and the centroid
        - Determine the location of the center of gravity and centroid for a system of discrete particles
    - Find the area and volume for a body having axial symmetry
    - Find the resultant of a general distributed loading and apply it to finding the resultant force of a pressure loading from a fluid
- Moments of Inertia
    - Determine the moment of inertia for an area
    - Determine the minimum and maximum moments of inertia for an area using the product of inertia
    - Discuss the mass moment of inertia