DIM-SAP-211 Introduction to Statics

SEMESTER: Fall
CREDITS: 6 ECTS (4 hrs. per week)
LANGUAGE: English
DEGREES: SAPIENS program

Course overview

This course is designed to give you an introduction to engineering mechanics in static systems. Statics deals with two- and three-dimensional systems of particles and rigid bodies in static equilibrium. Statics is indispensable in the design and analysis of structures that must hold their shape while bearing a load or performing a task where dynamic forces are absent or negligible.

Course objectives

At the end of this course, the students will be able to: calculate the moment of a force and couple vector in 3D-space using vector algebra; determine the resultants of force systems acting on rigid bodies; establish the equations of equilibrium for a rigid body or a group of rigid bodies; calculate the internal forces in engineering structures; determine the geometric properties of surfaces and volumes.

Prerequisites

General Physics and Vector calculus.

Course contents

1. **General Principles**
   1.1 Fundamental Concepts
   1.2 General Procedure for Analysis
   1.3 Scalars and Vectors
   1.4 Addition of Cartesian Vectors
   1.5 Dot Product
2. **Equilibrium of a Particle**
   2.1 The Free-Body Diagram
   2.2 Three-Dimensional Force Systems
3. **Force System Resultants**
   3.1 Moment of a Force

3.2 Moment of a Force about a Specified Axis
3.3 Simplification of a Force and Couple System
3.4 Reduction of a Simple Distributed Loading

4. **Equilibrium of a Rigid Body**
   4.1 Equations of Equilibrium
   4.2 Free-Body Diagrams
   4.3 Constraints and Statical Determinacy
5. **Structural Analysis**
   5.1 The Method of Joints
   5.2 The Method of Sections
6. **Internal Forces**
   6.1 Internal Loadings Developed in Structural Members
   6.2 Relations between Distributed Load, Shear, and Moment
7. **Friction**
   7.1 Characteristics of Dry Friction
   7.2 Frictional Forces on Screws, Collar Bearings, Pivot Bearings, Disks.
   7.3 Rolling Resistance
8. **Center of gravity and centroid**
   8.1 Center of Gravity, Center of mass and the centroid of a body
   8.2 Theorems of Pappus and Guldinus
   8.3 Resultant of a General distributed loading.
   8.4 Fluid Pressure
9. **Moments of Inertia**
   9.1 Center of Gravity, Center of Mass, and the Centroid of a Body
   9.2 Theorems of Pappus and Guldinus
   9.3 Parallel-Axis Theorem for an Area
   9.4 Moments of Inertia for Composite Areas
   9.5 Mohr's Circle for Moments of Inertia
   9.6 Mass Moment of Inertia
10. **Virtual Work**
   10.1 Principle of Virtual Work
   10.2 Principle of Virtual Work for a System of connected rigid bodies
   10.3 Conservative forces
   10.4 Potential Energy
11. **Introduction to Software as a help for problem resolution.**
   11.1 Matlab.
   11.2 Solidworks.

Textbook

Engineering Mechanics: Statics, (2016) by Hibbeler, R.C., Pearson-Prentice Hall, 14th ed.

Judging#

The grade will be determined by at least two midterms (35%), homework (40%), and the final examination (25%). The exams are all closed notebook and closed textbook. The course will not be graded on a curve, i.e., there is no bound on the numbers of A's, B's, C's etc.

In some special cases, and explicitly agreed between the student and the Professor, the final exam may be substituted by a final project.

The retake exam will bear the weight 40% on the total grade, meanwhile the midterms will have 30 % and the homework 30%. In some special cases, and explicitly agreed between the student and the Professor, the retake exam may be substituted by a final project.