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

Textbook

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

Grading

The grade will be determined by two midterms (25%), homework (45%), and the final examination (30%). The exams are all closed notebook, closed textbook, and no programmable calculator. 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.

The extraordinary exam will bear the very same weight (30%) on the total grade as the final exam.