ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA

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

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Textbook

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

Grading

ORDINARY:

The grade will be determined by:

1. Exams (70%): 2 midterms (40%; 2x20%) and a final examination (30%)
2. Homework (30%)

- Class attendance is mandatory. If you miss more than 15% of the classes, you lose the right to take the exam.
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.

EXTRA-ORDINARY:

The grade will be determined by two ways: the student can choose the weight of the retake exam it as its best choice.

1st way.

1. Exams (65%): Midterms (25%; already done) and **the final retake exam** (40%):
2. Homework (30%; already done)
3. Attendance and Participation: (5%; already done)

2nd way.

4. Midterms (10%; 5% each) and **a final retake exam** (75%)
5. Homework (10%; already done).
6. Attendance and Participation: (5% already done)

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.

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Use of AI

The use of AI to create entire works or relevant parts, without citing the source or the tool, or without explicit permission in the assignment description, will be considered plagiarism and will be regulated in accordance with the University General Regulations.

The use of Artificial Intelligence is allowed exclusively in the performance of the HOMEWORK. Therefore, Level 1 of the Perkins et al. (2024) Assessment Scale is set: " The assessment is completed entirely without AI assistance in a controlled environment, ensuring that students rely solely on their existing knowledge, understanding, and skills."

You must not use AI at any point during the assessment. You must demonstrate your core skills and knowledge.