Las Positas College
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Course Outline for ENGR 35

STATICS

Effective: Spring 2020

I. CATALOG DESCRIPTION:
ENGR 35 — STATICS — 3.00 units

A first course in engineering mechanics: properties of forces, moments, couples and resultants; two- and three-dimensional force systems acting on engineering structures in equilibrium; analysis of trusses, and beams; distributed forces, shear and bending moment diagrams, center of gravity, centroids, friction, and area and mass moments of inertia. Optional additional topics include fluid statics and cables.

2.00 Units Lecture 1.00 Units Lab

Prerequisite
PHYS 1A - General Physics I
with a minimum grade of C

MATH 2 - Calculus II
with a minimum grade of C

Strongly Recommended
ENGR 22 - Engineering Design Graphics
with a minimum grade of C

Grading Methods:
Letter Grade

Discipline:
- Engineering

	MIN
Lecture Hours:	36.00
Expected Outside of Class Hours:	72.00
Lab Hours:	54.00
Total Hours:	162.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. PHYS1A
1. Construct vectors in three dimensions to model physical phenomena, and perform algebraic calculations with these vectors.
2. Use algebra, trigonometry, geometry, and calculus to model physical phenomena and calculate relevant physical parameters.
3. Analyze a physical situation with multiple constant forces acting on a point mass using Newtonian mechanics.
4. Analyze a physical situation with multiple forces acting on an extended object using the concept of torque.

B. MATH2
1. Use integration to solve applications such as work, arc length and the surface area of a solid of revolution;

Before entering this course, it is strongly recommended that the student should be able to:

A. ENGR22
1. develop technical sketches
2. demonstrate and discuss visualization techniques
3. construct graphic construction, e.g., planes, angles, surfaces
4. construct axonometric projections
5. strengthen ability to analyze spatial relationships

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

A. An introduction to the formulation and solution of engineering problems.
B. Effectively communicate legible problem solutions.
C. Perform vector analysis methods addressing forces acting on rigid bodies, trusses, frames, and machines.
D. Determine the forces that act on rigid bodies including external forces, weight, normal, distributed loads, friction and reactions at supports.
E. Analyze two- and three-dimensional force systems on rigid bodies in static equilibrium.
F. Calculate internal forces in members and create shear and bending moment diagrams for beams.

V. CONTENT:

A. Vector Operations
B. Concurrent two- and three-dimensional force systems
C. Moments and couples
D. Equivalent force systems
E. Equilibrium of rigid bodies (two- and three-dimensional)
F. Center of mass; center of gravity
G. Centroids of areas and volumes
H. Distributed force systems
I. Trusses
J. Frames and machines
K. Beams; shear and bending moment diagrams
L. Principles of friction
M. Friction in machines
N. Area and mass moments of inertia
O. Cables (optional)
P. Mohr's circle (optional)
Q. Virtual work (optional)
R. Fluid statics (optional)

VI. LAB CONTENT:

A. Computer-Based-Laboratory work
    1. MS Excel based numerical solutions
        a. Flight distance calculator (dot products)
    2. MS Excel based graphing
    3. Solidworks based solid modeling
        a. Graphical solutions to vector-based problems
        b. Center of gravity calculation
        c. Moment of inertia calculation
    4. Matlab based problem solving
B. Projects
    1. Mobile project
        a. Mobile construction from wooden skewers
        b. Reinforces knowledge of moments and equilibrium
        c. Written calculations
    2. Truss project
        a. 3D truss construction from wooden skewers
        b. Analysis of all internal truss element forces
        c. Reinforces ability to analyze truss
        d. Failure mechanisms
        e. Written Report
    3. Wine Rack project
        a. Built from cardboard and glue only
        b. Designed to support wine bottle off ground
        c. Reinforces knowledge of centers of gravity, composite shapes
        d. Written calculations

VII. METHODS OF INSTRUCTION:

A. **Lecture** - Lecture methods are mainly delivered on the whiteboard, plus a limited number of powerpoint presentations.
B. **Discussion** - Review and discussion of lecture topics
C. **Projects** - Hands-on building projects which reinforce Statics principles, including building and designing (a) mobiles, (b) truss structures, and (c) projects constructed from cardboard
D. Group problem solving
E. **Lab** -

VIII. TYPICAL ASSIGNMENTS:

A. Read Chapter 6, "Structural Analysis" in Engineering Mechanics: Statics by R.C. Hibbeler.
B. Complete the 15 problems assigned on the Mastering Engineering website
C. Construct,and test, a truss structure, built entirely out of shish-kebab skewers and wood glue, and analyze which element in the truss is most likely to fail first, given a compressive load.
D. Create an Excel worksheet, which will analyze internal forces, for either a Pratt or Howe truss configuration.

IX. EVALUATION:

Methods/Frequency

A. Exams/Tests
    2-3 Midterm Exams 1 Final Exam
B. Quizzes
    3-6 Quizzes
C. Projects
    Building / Designing Projects
D. Group Projects
    Students have the option for group projects
E. Class Work
    Problem solving techniques
F. Home Work
    Submitted either manually or through on-line websites
G. Other
    Tests, examinations, homework or projects where students demonstrate their mastery of the learning objectives and their ability

to devise, organize and present complete solutions to problems.

X. TYPICAL TEXTS:

1. Beer, Ferdinand, and Russell Johnston. *Vector Mechanics for Engineers: Statics.* 12th ed., McGraw Hill, 2018.
2. Hibbeler, R.C.. *Engineering Mechanics: Statics.* 14th ed., Pearson, 2016.
3. Meriam, , Kraige, and Bolton. *Engineering Mechanics: Statics.* 8 ed., Wiley, 2015.
4. Bedford, Anthony, Wallace Fowler *Engineering Mechanics: Statics.* 5 ed., Pearson, 2007.
5. Plesha, M.E.,G.L. Gray, F. Costanzo *Engineering Mechanics:Statics.* 2nd ed., McGraw Hill, 2013.

XI. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Calculator
B. Access to website-based homework software, "Mastering Engineering"