**Las Positas College**
3000 Campus Hill Drive
Livermore, CA 94551-7650
(925) 424-1000
(925) 443-0742 (Fax)

**Course Outline for ENGR 35**

**STATICS**

**Effective: Fall 2013**

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

Force systems under equilibrium conditions; rigid body structures; vector; graphical and algebraic solutions of problems. Centroids, centers of gravity and moments of inertia. Prerequisites: Physics 8A, Mathematics 2 ( both completed with a grade of “C” or higher) Recommended: Engineering 22.

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:**

| | MIN |
|---|---|
| **Lecture Hours:** | 36.00 |
| **Lab Hours:** | 54.00 |
| **Total Hours:** | 90.00 |

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
B. MATH2
1. Evaluate definite and indefinite integrals by a variety of integration techniques;
2. Find arc length and the surface area of a solid of revolution;
3. Perform basic vector algebra in two-space and three-space and interpret the results geometrically;
4. Find dot product and cross product of vectors.

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

A. ENGR22

IV. MEASURABLE OBJECTIVES:

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

1. apply mechanics knowledge as applied to static structures
2. analyze the effects of vertical and horizontal forces on rigid structures
3. evaluate tangential forces generated between contacting surfaces
4. develop beam shear and moment diagrams
5. calculate summation of moments
6. sum the effects of distributed force over a region or surface
7. graphically and mathematically determine the resultant of force systems

V. CONTENT:
A. Fundamentals of mechanics review

1. Dimensional analysis
2. Units of mass
3. Idealizations of mechanics
4. Vector and scalar quantities
5. Equality of vectors and equivalency
6. Laws of mechanics

B. Elements of vector algebra
1. Vector magnitude and multiplication
2. Vector addition and subtraction
3. Vector resolution
4. Dot products
5. Cross products
6. Scalar triple produce
7. Vector notation

C. Vector quantities
1. Position vector
2. Unit vector
3. Moment of force about a point
4. Moment of force about an axis
5. Couple and couple moments
6. Couple moment as a free vector
7. Couple addition and subtraction
8. Moment of a couple absent a line

D. Equivalent force systems
1. Rigid body analysis
2. Translation of a force to parallel position
3. Force system resultant
4. Simplest resultants
5. Parallel force distribution over plane surface
6. Distributed force systems
7. Parallel force distribution over plan surface
8. Coplanar parallel force distribution

E. Equations of equilibrium
1. Free body diagrams
2. Equal and opposite forces
3. General equations of equilibrium
4. Problems of equilibrium
5. Two-point equivalent loading
6. Structure issues
7. Static indeterminacy

F. Structural mechanics introduction
1. Structural model
2. Single truss
3. Simple truss solutions
4. Section forces in beams
5. Differential equations of equilibrium
6. Chains and cables

G. Friction forces
1. Coulomb's law of friction
2. Boundary conditions for use of Coulomb's law
3. Coulomb's law applied
4. Belt friction
5. Square screw threads

H. Surface properties
1. Moment of an area and the controid
2. Axis of symmetry of a plane area
3. Other centers
   a. Three-dimensional applications
   b. Areas
   c. Volume
4. Second moments and product of area of plane area
5. Transfer theorem
6. Relationship between second moments and product of area
7. Polar moment of area

VI. METHODS OF INSTRUCTION:
A. **Discussion** - Review and discussion of lecture topics
B. Group problem solving
C. **Projects** -
D. **Lab** -
E. **Lecture** -

VII. TYPICAL ASSIGNMENTS:

Read Chapter 6, "Structural Analysis" in Engineering Mechanics: Statics by R.C. Hibbeler.

Complete the 15 problems assigned on the Mastering Engineering website

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.

Create an Excel worksheet, which will analyze internal forces, for either a Pratt or Howe truss configuration.

VIII. EVALUATION:
A. **Methods**

1. Exams/Tests
2. Quizzes
3. Home Work

4. Final Performance
5. Other:
    a. Methods of Evaluation
        1. Assignments (to be graded at instructor's discretion)
        2. Examinations
            a. Quizzes
            b. Midterm(s)
        3. Final Examination
    b. Typical Problems/Questions:
        1. Sketch the shear-force and bending-moment distributions for the simple supported beam shown in figure 6.45 and label the key points.
        2. Find the simplest resultant of the parallel force system in figure 4.22
        3. Find equivalent force system at position A for the 100 N force and the couple moment about A for figure 1. Show all work.
        4. Each of the members BE and FC is capable of supporting compression as well as tension. Compute the forces in members CB, BE, and EF. See figure 12. Show all work.

B. **Frequency**

Quizzes are given every 1-3 weeks.

There are 2 midterms per semester.

There is 1 final exam per semester.

## IX. TYPICAL TEXTS:

1. Hibbeler, R.,C. *Engineering Mechanics: Statics.* 13th ed., Pearson, 2012.
2. Beer, F. *Vector Mechanics for Engineers: Statics.* 10th ed., McGraw Hill, 2012.
3. Meriam,J.L,L.G. Kraige *Engineering Mechanics: Statics.* 7 ed., Wiley, 2011.
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.

## X. OTHER MATERIALS REQUIRED OF STUDENTS:

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