Las Positas College
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Course Outline for ENGR 37

APPLIED STATICS AND MATERIALS

Effective: Fall 2015

I. CATALOG DESCRIPTION:
ENGR 37 — APPLIED STATICS AND MATERIALS — 3.00 units

Applied statics, mechanics of materials, and materials science. Topics include stress, strain, types of forces, moments, moment of inertia, friction, truss structures, centers of gravity, modulus of elasticity, fasteners, chemistry and atomic structure, crystalline structures, phase diagrams. This course is designed for Engineering Technology majors; it is not intended for students pursuing the Engineering Requirements (Transfer Preparation) path.

2.00 Units Lecture 1.00 Units Lab

Prerequisite
MATH 38 - Trigonometry with Geometry
with a minimum grade of C

Grading Methods:
Letter or P/NP

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. MATH38

IV. MEASURABLE OBJECTIVES:
Upon completion of this course, the student should be able to:

A. Explain the differences between Force, Moment, and Torsion
B. Identify the characteristics of Stress-Strain curves
C. Differentiate between static and kinetic friction
D. Describe center of gravity and centroids
E. Discriminate between area of moment of inertia and mass moment of inertia
F. Describe Poisson's Ratio, Modulus of Elasticity, and Shear Modulus
G. Calculate Poisson's Ratio, Modulus of Elasticity, and Shear Modulus
H. Describe the relationship between stress and strain, and interpret stress-strain curves
I. Apply theories of force, moment and torsion to explain the following types of fasteners: bolts, welds, and adhesives

V. CONTENT:
A. **Applied Statics**
1. **Forces**
2. **Torques (or Moments)**
3. **Friction**
4. **Trusses**
5. **Center of Gravity / Centroids**
B. **Applied Strength of Materials**
1. Stress, Strain
2. Torsion
3. Modulus of Elasticity (or Young's Modulus)
4. Shear Force and Bending Moment diagrams for beams
5. Buckling
6. Types of Fasteners
a. Welds
b. Bolts
c. Adhesives

7. Combined stresses
8. Thermal effects
9. Vacuum effects

C. Applied Materials Science
1. Chemistry and atomic structure
2. Crystalline structures
3. Phase diagrams
4. Phase diagrams for steel
5. Polymers
6. Ceramics
7. Metals
8. Composite materials
9. Semiconductor materials
10. Creep

VI. METHODS OF INSTRUCTION:
A. **Guest Lecturers** - From both Lawrence Livermore National Labs and other local employers
B. **Classroom Activity** - Individual and Group problem solving
C. **Lecture** - Lecture supported by powerpoint presentations and board work
D. **Student Presentations** - Powerpoint presentations
E. **Audio-visual Activity** - Videos and on-line lectures as needed
F. **Field Trips** -
G. **Projects** - Group-oriented design and building projects
H. **Lab** - Hands-on Materials laboratory assignments

VII. TYPICAL ASSIGNMENTS:
A. Homework
1. Weekly reading. For example - read and be prepared to discuss Chapter on Stress and Strain.
2. Weekly problems from reading. Answer the comprehension questions at the end of the chapter. For example - describe the relationship between stress and strain; How do temperature and speed of loading effect tensile testing?
3. Weekly problem-solving. For example - graph the stress-strain curve for a variety of materials

B. Weekly Laboratory Assignments
1. Apply measurement techniques to a variety of materials to test strain and stress properties
2. Record data in the laboratory
3. Graph and interpret data collected
4. Produce laboratory reports

C. Design Project
1. Students will work in teams to design a unique project that utilizes theories presented in class. Students will clearly identify the theories applied, and describe their application.
2. Students will present their project in class, both orally and in writing.

D. Field Trips to industry sites
1. Students will provide a summary of field trips, including the types of engineering peronnel, projects, materials, and tools observed during the trip.

VIII. EVALUATION:
A. **Methods**

1. Exams/Tests
2. Quizzes
3. Projects
4. Field Trips
5. Group Projects
6. Class Participation
7. Home Work
8. Lab Activities

B. **Frequency**

1. Weekly reading and homework problems
2. Weekly laboratory exercises
3. Quizzes as needed
4. 1-2 Midterm examinations
5. 1 Final examination
6. At least one Project
7. Field Trips - may vary from semester to semester

IX. TYPICAL TEXTS:

1. Spiegel, Leonard, and George Limbrunner. *Applied Statics and Strength of Materials.* 5th ed., Prentice Hall, 2008.
2. Burns, Thomas. *Applied Statics and Strength of Materials.* 2nd ed., Cengage Learning, 2010.
3. Chung, Deborah. *Applied Materials Science: Applications of Engineering Materials in Structural, Electronics, Thermal and Other Industries* . 1st ed., CRC Press, 2001.
4. Hibbeler, Russell. *Statics and Mechanics of Materials.* 4th ed., Pearson, 2013.
5. Shackelford, James. *Introduction to Materials Science for Engineers.* 8th ed., Pearson Publishing, 2015.

X. OTHER MATERIALS REQUIRED OF STUDENTS:
A. Hand-held scientific calculator