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Course Outline for ENGR 37

APPLIED STATICS AND MATERIALS

Effective: Spring 2019

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 39 - Trigonometry
with a minimum grade of C

Grading Methods:
Letter or P/NP

Discipline:
- Engineering

	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. MATH39
1. Define trigonometric functions in terms of the right triangle, using coordinates of a point and distance from the origin, and using the unit circle;
2. State from memory the values for sine, cosine and tangent functions of common angles given in either degrees or radians;
3. Identify special triangles and their related angle and side measures;
4. Evaluate the trigonometric function of an angle in degree and radian measure;
5. Manipulate and simplify a trigonometric expression;
6. Solve trigonometric equations, including equations with multiple angles over different intervals, and solve triangles and applied problems;
7. Develop and use trigonometric ratios or other trigonometric formulas to solve problems;
8. Develop and use the law of sines and law of cosines to completely solve an oblique triangle;

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
J. Resolve Force Vectors into components
K. Solve 2D equilibrium problems using scalar techniques.

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. Chung, Deborah D.L. *Applied Materials Science: Applications of Engineering Materials in Structural, Electronics, Thermal.*, CRC Press, 2001.
2. Limbrunner, George, and Craig D'Allaird. *Applied Statics and Strength of Materials.* 6th ed., Pearson, 2016.
3. Hibbeler, Russell C. *Statics and Mechanics of Materials.* 4th ed., Pearson, 2014.
4. Shackelford, James F. *Introduction to Materials Science for Engineers.* 8th ed., Pearson Publishing, 2015.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Hand-held scientific calculator