

### Course Outline

**COURSE:** ENGR 4                      **DIVISION:** 10                      **ALSO LISTED AS:**

**TERM EFFECTIVE:** Fall 2012                      **CURRICULUM APPROVAL DATE:** 03/26/2012

**SHORT TITLE:** PROPERTIES OF MATERIALS

**LONG TITLE:** Properties Of Materials

<u>Units</u>	<u>Number of Weeks</u>	<u>Type</u>	<u>Contact Hours/Week</u>	<u>Total Contact Hours</u>
3	17.34	Lecture:	3	52.02
		Lab:	0	0
		Other:	0	0
		Total:	3	52.02

#### **COURSE DESCRIPTION:**

Basic principles of physics and chemistry are used to determine the quantitative relationships that describe the behavior of solids. Particular emphasis is placed upon the relationship between the structure and properties of crystalline solids. Applications consider control of properties as an engineering design variable. A term paper based upon review of the periodical technical literature is required. **PREREQUISITE:** Chemistry 1A and Physics 4A.

#### **PREREQUISITES:**

Completion of CHEM 1A, as UG, with a grade of C or better.  
AND Completion of PHYS 4A, as UG, with a grade of C or better.

#### **COREQUISITES:**

**CREDIT STATUS:** D - Credit - Degree Applicable

#### **GRADING MODES**

L - Standard Letter Grade

**REPEATABILITY:** N - Course may not be repeated

#### **SCHEDULE TYPES:**

02 - Lecture and/or discussion

#### **STUDENT LEARNING OUTCOMES:**

1. Describe the broad role of materials science in the design and manufacture of engineered devices and structures.

Measure: Homework, exams, term paper.

PLO: 1, 4

ILO: 7, 1

GE-LO: B1, 3, 5, 6, 8

2. Identify, compare, contrast, and describe the relationships between physics, chemistry, mathematics, and the science of materials.

Measure: Homework, exams, term paper.

PLO: 1, 4

ILO: 7, 1

GE-LO: B1, 3, 5, 6, 8

3. Identify, compare, contrast, and describe the relationships between structure and properties of crystalline solids.

Measure: Homework, exams, term paper.

PLO: 1, 4

ILO: 7, 1

GE-LO: B1, 3, 5, 6, 8

4. Identify, compare, contrast, and describe the mechanisms that control the properties of materials.

Measure: Homework, exams, term paper.

PLO: 1, 4

ILO: 7, 1

GE-LO: B1, 3, 5, 6, 8

5. Identify, compare, contrast, and describe methods to influence the properties of materials.

Measure: Homework, exams, term paper.

PLO: 1, 4

ILO: 7, 1

GE-LO: B1, 3, 5, 6, 8

6. Identify, compare, contrast, and describe the properties of polymers, ceramics, and composite materials with the properties of crystalline solids.

Measure: Homework, exams, term paper.

PLO: 1, 4

ILO: 7, 1

GE-LO: B1, 3, 5, 6, 8

## **CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS**

Curriculum Approval Date: 03/26/2012

HOURS: 3

TOPIC: Introduction to Materials Science and Engineering.

STUDENT PERFORMANCE OBJECTIVES: Identify and describe the role of Materials Science in the engineering profession.

OUT OF CLASS ASSIGNMENTS: Homework problems from text and instructor.

HOURS: 6

TOPIC: Chemical Bonding and Mechanical Properties in Solids.

STUDENT PERFORMANCE OBJECTIVES: Identify, compare, contrast, analyze, and predict the different types of chemical bonding and the values of mechanical properties of materials using energy concepts.

OUT OF CLASS ASSIGNMENTS: Homework problems from text and instructor. Assignment of term paper due at end of semester.

HOURS: 6

TOPIC: Structure of Crystalline Solids and Imperfections.

STUDENT PERFORMANCE OBJECTIVES: Identify, compare, contrast, and discuss the arrangement of atoms and the effect of the arrangement of atoms and defects on the properties on materials.

OUT OF CLASS ASSIGNMENTS: Homework problems from text and instructor. Term paper.

HOURS: 3

TOPIC: Diffusion.

STUDENT PERFORMANCE OBJECTIVES: Identify, compare, contrast and apply the concepts of diffusion in controlling the deformation of solids.

OUT OF CLASS ASSIGNMENTS: Homework problems from text and instructor. Term paper.

HOURS: 9

TOPIC: Phase Diagrams and Heat Treatment.

STUDENT PERFORMANCE OBJECTIVES: Identify, compare, contrast, and apply the concepts of equilibrium and non-equilibrium to the development of microstructures in important engineering alloys.

OUT OF CLASS ASSIGNMENTS: Homework problems from text and instructor. Term paper.

HOURS: 9

TOPIC: Stress Concentration, Fracture, and Fatigue.

STUDENT PERFORMANCE OBJECTIVES: Identify, compare, contrast, discuss, and apply the role of material choice, defect shape and orientation, cracks, and crack stability on the properties and life of structural elements.

OUT OF CLASS ASSIGNMENTS: Homework problems from text and instructor. Term paper.

HOURS: 3

TOPIC: Creep.

STUDENT PERFORMANCE OBJECTIVES: Identify, compare, contrast, and describe mechanisms of creep deformation in comparison with elastic deformation. Discuss the use of deformation mechanism maps as a design tool.

OUT OF CLASS ASSIGNMENTS: Homework problems from text and instructor. Term paper.

HOURS: 10

TOPIC: Ceramics, Polymers, and Composites.

STUDENT PERFORMANCE OBJECTIVES: Identify, compare, contrast, describe and apply the structure/property relationships of ceramics, polymers, and composites with those of crystalline materials. Identify, compare, contrast, discuss and apply the applications, concerns, and engineering design rationale of ceramics, polymers, and composites with those of crystalline materials.

OUT OF CLASS ASSIGNMENTS: Homework problems from text and instructor. Term paper.

HOURS: 3

TOPIC: Electronic Properties of Materials.

STUDENT PERFORMANCE OBJECTIVES: Identify, compare, contrast, discuss and apply band theory of solids, conduction in metals, the properties of semiconducting materials, and the common electrical and mechanical mechanisms of failure of electrical components.

OUT OF CLASS ASSIGNMENTS: Homework problems From text and instructor.

HOURS: 2

TOPIC: Final exam.

**METHODS OF INSTRUCTION:**

Lecture and/or discussion

**METHODS OF EVALUATION:**

CATEGORY 1 - The types of writing assignments required:

Percent range of total grade: 20 % to 30 %

Term or Other Papers

CATEGORY 2 -The problem-solving assignments required:

Percent range of total grade: 70 % to 80 %

Homework Problems

Exams

CATEGORY 3 -The types of skill demonstrations required:

Percent range of total grade: 0 %

CATEGORY 4 - The types of objective examinations used in the course:

Percent range of total grade: 0 %

### **REPRESENTATIVE TEXTBOOKS:**

Required:

William D. Callister, Materials Science and Engineering: An Introduction, Wiley, 2009, or other appropriate college level text.

Reading level of text, Grade: 12 Verified by: Russell Lee using MS Word

### **ARTICULATION and CERTIFICATE INFORMATION**

Associate Degree:

CSU GE:

IGETC:

CSU TRANSFER:

Transferable CSU, effective 199370

UC TRANSFER:

Transferable UC, effective 199370

### **SUPPLEMENTAL DATA:**

Basic Skills: N

Classification: A

Noncredit Category: Y

Cooperative Education:

Program Status: 1 Program Applicable

Special Class Status: N

CAN: ENGR4

CAN Sequence: XXXXXXXX

CSU Crosswalk Course Department: ENGR

CSU Crosswalk Course Number: 4

Prior to College Level: Y

Non Credit Enhanced Funding: N

Funding Agency Code: Y

In-Service: N

Occupational Course: E

Maximum Hours:

Minimum Hours:

Course Control Number: CCC000277558

Sports/Physical Education Course: N

Taxonomy of Program: 090100