#### ENGR 45 Course Outline as of Fall 2020

### **CATALOG INFORMATION**

Dept and Nbr: ENGR 45 Title: PROP OF MATERIALS Full Title: Properties of Materials Last Reviewed: 1/25/2021

Units		Course Hours per Week		Nbr of Weeks	<b>Course Hours Total</b>	
Maximum	4.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	4.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	6.00		Contact Total	105.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00

Total Student Learning Hours: 210.00

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

#### **Catalog Description:**

Structure, properties, selection, utilization, and deterioration of engineering materials. (CAN ENGR 4)

**Prerequisites/Corequisites:** 

Course Completion of PHYS 40 AND; Course Completion of CHEM 3A AND CHEM 3AL; OR CHEM 1A; OR CHEM 4A

**Recommended Preparation:** 

**Limits on Enrollment:** 

#### **Schedule of Classes Information:**

Description: Structure, properties, selection, utilization, deterioration of engineering materials. (Grade only) (Grade Only) Prerequisites/Corequisites: Course Completion of PHYS 40 AND; Course Completion of CHEM 3A AND CHEM 3AL; OR CHEM 1A; OR CHEM 4A Recommended: Limits on Enrollment:

# **ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:**

AS Degree: CSU GE:	Area Transfer Area		Effective: Effective:	Inactive: Inactive:	
IGETC:	Transfer Area		Effective:	Inactive:	
CSU Transfer	Transferable	Effective:	Spring 1982	Inactive:	
UC Transfer:	Transferable	Effective:	Spring 1982	Inactive:	
<b>CID:</b> CID Descriptor SRJC Equivaler		Materials Scien ENGR45	ce and Engineer	ing	

**Certificate/Major Applicable:** 

Major Applicable Course

# **COURSE CONTENT**

#### **Student Learning Outcomes:**

At the conclusion of this course, the student should be able to:

1. Describe classification, properties and theories related to the behaviors of various materials.

2. Apply mechanical, thermal and electrical techniques to characterize and/or manipulate properties of materials.

### **Objectives:**

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

1. Describe the fundamental concepts related to atomic theory, the periodic table and bonding types/forces.

2. Apply various crystal systems, Miller Indices and x-ray diffraction methods to the evaluation of solids.

3. Describe all types of defects in solids, calculate/measure their densities and explain their effects on the properties of materials.

- 4. Explain different diffusion mechanisms.
- 5. Apply various mechanical testing methods to different materials.

6. Use the dislocation concept to explain the strengthening mechanism and heat treatment of materials.

7. Identify various modes of failure, their mechanisms, and factors affecting their rate.

8. Analyze binary phase diagrams of various alloys and Temperature Time Transition (TTT) diagram for steel and their application for processing of metals.

9. Describe the properties of non-ferrous metals, ceramics, polymers and composites.

10. Explain basic electrical, thermal, optical and magnetic properties of materials.

11. Explain the types of corrosion mechanisms, the factors affecting the rate of corrosion, and the methods of protection against corrosion.

### **Topics and Scope:**

Topics covered include:

- 1. Classification of engineering materials
- 2. Atomic structure and the periodic table
- 3. Chemical bonding and intermolecular forces
- 4. Space lattices and atomic arrangements
- 5. Vacancies, impurities, and dislocations in atomic arrangement
- 6. Diffusion in materials
- 7. Mechanical properties of materials
- 8. Deformation, work hardening, and annealing of materials
- 9. Nucleation and grain growth, and grain size strengthening
- 10. Phase diagrams and TTT
- 11. Solid solution strengthening and dispersion strengthening
- 12. Heat treatment of materials
- 13. Ferrous alloys
- 14. Nonferrous alloys
- 15. Electrical properties of metals and semiconductors, including corrosions
- 16. Magnetism in materials & space
- 17. Composite materials
- 18. Preservation, deterioration, and failure of materials

Lab work includes:

- 1. Mechanical testing of materials
- 2. Crystal model building
- 3. Use of an electrical strain gage to measure modulus of elasticity
- 4. Determination of lattice constant of macroscopic pseudocrystal by microwave spectrometry
- 5. Determination of lattice constant by electron diffraction
- 6. Phase diagrams
- 7. Precipitation hardening
- 8. Hardening, tempering, and annealing of steel
- 9. Jominy hardenability test
- 10. Cold working and annealing of brass
- 11. Introduction to finite element analysis

### Assignment:

- 1. Read textbook, one chapter per week
- 2. Homework problem sets (10-16)
- 3. Laboratory experiments (8-16), including lab reports
- 4. Mid-term exams (3-5)
- 5. Final exam

### Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Lab reports

Writing 15 - 25% **Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problem sets

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None

**Exams:** All forms of formal testing, other than skill performance exams.

Multiple choice, true/false, matching items, completion, problems

**Other:** Includes any assessment tools that do not logically fit into the above categories.

None

## **Representative Textbooks and Materials:**

Materials Science and Engineering, An Introduction by Callister, 9th ed. Wiley, 2014

Problem solving	
10 - 15%	

Skill Demonstrations 0 - 0%



Other Category 0 - 0%