

**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	Course Hours Total	
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:

Transfer Credit: CSU;UC.

Repeatability: Two Repeats if Grade was D, F, NC, or NP

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

<b>AS Degree:</b>	<b>Area</b>	Effective:	Inactive:
<b>CSU GE:</b>	<b>Transfer Area</b>	Effective:	Inactive:

<b>IGETC:</b>	<b>Transfer Area</b>	Effective:	Inactive:
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<b>CSU Transfer:</b>	Transferable	Effective:	Spring 1982	Inactive:
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<b>UC Transfer:</b>	Transferable	Effective:	Spring 1982	Inactive:
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### **CID:**

CID Descriptor: ENGR 140B      Materials Science and Engineering

SRJC Equivalent Course(s):      ENGR45

### **Certificate/Major Applicable:**

Major Applicable Course

## **Approval and Dates**

Version:	05	Course Created/Approved:	11/15/1991
Version Created:	11/21/2019	Course Last Modified:	6/5/2021
Submitter:	Josh Adams	Course last full review:	1/25/2021
Version Status:	Approved (Changed Course)	Prereq Created/Approved:	1/25/2021
Version Status Date:	12/9/2019	Semester Last Taught:	Spring 2021
Version Term Effective:	Fall 2020	Term Inactive:	Fall 2021

## **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

Problem solving  
10 - 15%

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

None

Skill Demonstrations  
0 - 0%

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

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

Exams  
60 - 75%

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

None

Other Category  
0 - 0%

## Representative Textbooks and Materials:

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

## **OTHER REQUIRED ELEMENTS**

### **STUDENT PREPARATION**

Matric Assessment Required:	X	Exempt From Assessment
Prerequisites-generate description:	U	User Generated Text
Advisories-generate description:	NA	No Advisory
Prereq-provisional:	N	NO
Prereq/coreq-registration check:	Y	Prerequisite Rules Exist
Requires instructor signature:	N	Instructor's Signature Not Required

### **BASIC INFORMATION, HOURS/UNITS & REPEATABILITY**

Method of instruction:	02	Lecture
	04	Laboratory
	71	Internet-Based, Simultaneous Interaction
	72	Internet-Based, Delayed Interaction
Area department:	ENGR	Engineering and Applied Technology
Division:	73	Science, Technology, Engineering & Mathematics
Special topic course:	N	Not a Special Topic Course
Program status:	1	Major Applicable Course
Repeatability:	00	Two Repeats if Grade was D, F, NC, or NP
Repeat group id:		

### **SCHEDULING**

Audit allowed:	N	Not Auditable
Open entry/exit:	N	Not Open Entry/Open Exit
Credit by exam:	N	Credit by examination not allowed
Budget code: Program:	0000	Unrestricted
Budget code: Activity:	0901	Engineering

### **OTHER CODES**

Discipline:	Engineering	
Basic skills:	N	Not a Basic Skills Course
Level below transfer:	Y	Not Applicable
CVU/CVC status:	Y	Distance Ed, Not CVU/CVC Developed
Distance Ed Approved:	N	<a href="#">None</a>
Emergency Distance Ed Approved:	Y	<a href="#">Fully Online</a>
		<a href="#">Partially Online</a>
		<a href="#">Online with flexible in-person activities</a>
Credit for Prior Learning:	N	Agency Exam
	N	CBE
	N	Industry Credentials
	N	Portfolio
Non-credit category:	Y	Not Applicable, Credit Course
Classification:	Y	Liberal Arts and Sciences Courses
SAM classification:	E	Non-Occupational
TOP code:	0901.00	Engineering, General
Work-based learning:	N	Does Not Include Work-Based Learning
DSPS course:	N	Not a DSPS Course

In-service:

N

Not an in-Service Course

Lab Tier:

23

Credit Lab - Tier 3