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:

AS Degree:	**Area**	Effective:	Inactive:
CSU GE:	**Transfer Area**	Effective:	Inactive:
IGETC:	**Transfer Area**	Effective:	Inactive:

CSU Transfer:	Transferable	Effective:	Spring 1982	Inactive:	
UC Transfer:	Transferable	Effective:	Spring 1982	Inactive:	

CID:
CID Descriptor:ENGR 140B Materials Science and Engineering
SRJC Equivalent Course(s): ENGR45

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	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