ENGR R140L: MATERIALS SCIENCE AND ENGINEERING LABORATORY

Originator
jwmiller

College
Oxnard College

Discipline (CB01A)
ENGR - Engineering

Course Number (CB01B)
R140L

Course Title (CB02)
Materials Science and Engineering Laboratory

Banner/Short Title
Materials Science Lab

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
This course is the laboratory portion of Materials Science and Engineering. It consists of experimental investigations of crystalline structures, the mechanical behavior of metals and polymers, cold-working, heat-treatment, material hardness, ductile-to-brittle fracture behavior, fatigue, equilibrium phase diagrams, steel microstructure and corrosion. Computers are used to control test equipment, gather and process data, and to visualize microscopic images.

Taxonomy of Programs (TOP) Code (CB03)
0901.00 - Engineering, General (requires Calculus) (Transfer)

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
52.5
Total Maximum Contact/In-Class Hours
52.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
52.5
Total Maximum Student Learning Hours
52.5

Minimum Units (CB07)
1
Maximum Units (CB06)
1

Prerequisites
ENGR R140 or concurrent enrollment and PHYS R131 and CHEM R120

Requisite Justification

Requisite Type
Prerequisite

Requisite
ENGR R140

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Requisite Type
Prerequisite

Requisite
PHYS R131

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Requisite Type
Prerequisite

Requisite
CHEM R120

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Requisite Type
Concurrent

Requisite
ENGR R140

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Closely related lecture/laboratory course

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Students shall properly prepare and perform tensile tests on metals and polymers.
2	Students shall perform impact tests on metals and relate results to specimen temperature.
3	Students shall properly gather and interpret temperature (cooling curve) data to generate phase diagrams.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Measure material properties and/or evaluate processing treatments using standard materials testing equipment and techniques.
2	Write laboratory reports that communicate the collection, analysis, and interpretation of experimental data according to professional engineering standards.
3	Explain the relationship between the internal structure of materials and their macroscopic properties.
4	Explain methods (intentional or unintentional) of altering the structure of materials by mechanical, chemical, or thermal means in order to change material properties.
5	Illustrate the various systems for classifying materials, and compare differences in properties among material classes that derive from differences in structure.
6	Gather data from reference sources regarding the properties, processing, and performance characteristics of materials, and use it as a basis to recommend appropriate material(s) to meet engineering design criteria.

Course Content

Lecture/Course Content
None

Laboratory or Activity Content
This course focuses on the direct examination, processing, and testing of material properties. The labs will use standard techniques regarding testing, processing, and examining the materials under consideration.

1. Laboratory Safety Procedures and Awareness
2. The Examination of Atomic Structure and Bonding
3. Crystallography: The Examination of Crystal Structures and Imperfection within
4. The Examination of Polymers and Ceramics
5. Diffusion
6. Elastic and Plastic Deformation in Metals
7. Mechanical Properties - Stress-Strain Analysis
8. Determining the Tensile Strength of a Material
9. Determining the Hardness of a Material
10. Mechanical Properties and Testing
11. Preforming Impact Tests and Analyzing the Results

12. Mechanical Failure: Analyzing Fracture, Fatigue, and Creep
13. Phase Diagrams and Phase Transformations
14. The Properties of Metal and Metal Alloys
15. Stregthening and Toughening in Metals
16. The Heat Treatment of Steels
17. The Ductile-to-Brittle Transition Temperature
18. The Processes of Forming and Fabrication
19. Processing Treatments and their Effects
20. Chemical Properties and Corrosion Effects
21. Studying Thermal, Electrical and Magnetic Properties, Including Semiconductors

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Laboratory activities
Laboratory reports
Projects
Problem-Solving Assignments
Quizzes

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Distance Education
Demonstrations
Laboratory activities
Small group activities

Describe specific examples of the methods the instructor will use:

1. Demonstrations: Typically, before students use lab equipment and/or proceed with a given lab, the instructor will demonstrate the safe and proper use of said equipment.
2. Distance education: Laboratory activities, as noted below, will take place in a virtual setting. The experiments will be tailored to utilize computer simulations, prerecorded data acquisition, live online meetings, and message boards where questions can be asked and answered.
3. Laboratory activities: Each week the students will preform a laboratory activity investigating certain aspects of a system/material that has been discussed in lecture. These activities will direct the students such that the intricacies and properties of a given system are explored. For instance; an activity in which the students determine the hardness of various materials and categorize them based on their observations.
4. Small group activities: The students will work in small groups while preforming the activities where applicable.

Representative Course Assignments

Writing Assignments

1. Most lab reports require students to answer short essay-style pre-lab and post-lab questions as well as document their observations and finding regarding the particular activity.

Critical Thinking Assignments

1. Students will compile and analyze experimental data and/or results using tabular, graphical or computational methods; the results of this process are an integral part of the lab reports that students will submit each week.

Reading Assignments

1. Before each activity, students will read about what is to be performed, including the underlying theory, principles, and applications of the procedure/activity itself.

Skills Demonstrations
None

Other assignments (if applicable)
None

Outside Assignments

Representative Outside Assignments
None

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Other Instructional Materials

Description
Khraishi, T.A., & Al-Haik, M.S. (2011). *Experiments in Materials Science and Engineering*. San Diego, University Readers Inc.

Resource Type
Manual

Description
Miller, J.M. (2020). *Oxnard College Material Science and Engineering Lab Manual*. Ricoh Publications.

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.
Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.
Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	Recordings of data acquisition and/or simulation use regarding a given lab experiment may be used.
Synchronous Dialog (e.g., online chat)	Online meetings will be held to go over the experiment at hand and discuss how to proceed with the given experiment. Recordings will be made of all class meetings. Students may also be put into groups to work on a given experiment/activity.
Asynchronous Dialog (e.g., discussion board)	Discussion boards will be used to allow students to discuss and ask questions pertaining to a given experiment.
Face to Face (by student request; cannot be required)	Face to face meetings may be scheduled when needed.

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	Recordings of data acquisition and/or simulation use regarding a given lab experiment may be used.
Synchronous Dialog (e.g., online chat)	Online meetings will be held to go over the experiment at hand and discuss how to proceed with the given experiment. Recordings will be made of all class meetings. Students may also be put into groups to work on a given experiment/activity.
Asynchronous Dialog (e.g., discussion board)	Discussion boards will be used to allow students to discuss and ask questions pertaining to a given experiment.
Face to Face (by student request; cannot be required)	Face to face meetings may be scheduled when needed.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	Recordings of data acquisition and/or simulation use regarding a given lab experiment may be used.
Synchronous Dialog (e.g., online chat)	Online meetings will be held to go over the experiment at hand and discuss how to proceed with the given experiment. Recordings will be made of all class meetings. Students may also be put into groups to work on a given experiment/activity.
Asynchronous Dialog (e.g., discussion board)	Discussion boards will be used to allow students to discuss and ask questions pertaining to a given experiment.

Examinations

Hybrid (1%–50% online) Modality
Online
On campus

Hybrid (51%–99% online) Modality
Online
On campus

Primary Minimum Qualification
ENGINEERING

Review and Approval Dates

Department Chair
09/11/2020

Dean
09/11/2020

Technical Review
09/23/2020

Curriculum Committee
09/23/2020

Curriculum Committee
11/25/2020

CCCCO
MM/DD/YYYY

Control Number
CCC000599714

DOE/accreditation approval date
MM/DD/YYYY