

WELD 0011 - WELDING METALLURGY

Catalog Description

Formerly known as WELD 60

Prerequisite: Completion of WELD 2A, WELD 3A or WELD 5A with grade of "C" or better

Hours: 90 (36 lecture, 54 laboratory)

Description: Exploration of the production and properties of ferrous metals used in the welding industry. The chemical and physical properties of metals, crystallization, and theoretical concepts of alloying. Laboratory experiments in metal identification, hardness and destructive testing, heat treating, sample preparation, and microphotography. (CSU)

Course Student Learning Outcomes

- CSLO #1: Apply safety standards for both a learning environment and worksite environment of a Metallurgy Lab.
- CSLO #2: Define terms related to this course; cooling rate, cementite, ferrite, martensite, pearlite, phase change, microstructure, spheroidite, tempering and hardening.
- CSLO #3: Perform lab assignments and report results of study of micro-structure changes present resulting the heating and cooling of metals.
- CSLO #4: Report results of experiments in the study of steel micro-structure under high magnifications.

Effective Term

Fall 2019

Course Type

Credit - Degree-applicable

Contact Hours

90

Outside of Class Hours

72

Total Student Learning Hours

162

Course Objectives

Lecture Objectives:

1. Explain safety expectations as applied in a working Metallurgical Laboratory.
2. Describe the role a metallurgist plays in the welding and fabrication industries.
3. Define metallurgical and chemical terminology used within the commercial and industrial welding field.
4. Identify and explain the behavior of mechanical, physical and chemical properties of materials.
5. Describe steel composition identification system of types of steel and industries numbering system.

6. Create reports based on facts uncovered from assigned lab experiments.

Laboratory Objectives:

1. Apply standards of safety, lab procedures working with samples, use of equipment to gather data and create lab reports of the results.
2. Investigate and evaluate the mechanical, physical and chemical properties of materials with a focus on low, medium carbon and alloy steels typically used in welded fabrication.
3. Determine different steel compositions as assigned for lab experiments.
4. Identify and evaluate crystallization, solidification, and solution.
5. Demonstrate and complete an industry standard failure analysis report.
6. Evaluate an iron-phase diagram.
7. Perform a microstructure analysis.
8. Demonstrate heat treating, quenching, annealing and normalization processes.

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- CSU Transferable

Methods of Evaluation

- Objective Examinations
 - Example: Written examination of chemistry related to element influence in Ferris metal.
- Problem Solving Examinations
 - Example: Perform and evaluate 3 physical test procedures. Student will be assessed based upon accuracy of performance and evaluation.
- Reports
 - Example: Perform chemical tests to identify a metal's composition. In a lab report, present findings. Student will be evaluated based upon a rubric developed by the instructor and shared with students.
- Skill Demonstrations
 - Example: Demonstrate proper procedures to prepare a sample for microscope examination.

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. With instructor's demonstration and oversight on material type testing, students will apply various techniques for the material types testing.

Lecture:

1. Lecture and interpersonal group discussion on the various applications of test analysis with following presentation of group results.

Distance Learning

1. Instructor will use slide show presentation, instructor created video, or lecture presentation on a learning platform to teach about best safety practices in the for personal protective equipment, the weld lab environment, and/or tools & equipment. Students will be given a scenario and expected to list the best safety practices that should be employed and explain why they should be used. Students will submit the assignment via text entry, file upload, video or audio recording.

Typical Out of Class Assignments Reading Assignments

1. Read textbook chapter on alloying of metals and be prepared to discuss in class. 2. Carry out research on ductility vs. malleability and prepared a paper with your findings to present to class.

Writing, Problem Solving or Performance

1. Complete review questions from the reading assignments on alloying of metals. 2. Demonstrate performance of various analyses, such as tensile pull, hardness testing, and ductility on welds during lab assignment and report.

Other (Term projects, research papers, portfolios, etc.)

1. Perform and report on assigned lab experiments.

Required Materials

- Metallurgy Fundamentals
 - Author: Daniel A. Brandt and J. C. Warner
 - Publisher: Goodheart Willcox Co., Inc.
 - Publication Date: 2009
 - Text Edition: 5th
 - Classic Textbook?:
 - OER Link:
 - OER:
- Metallurgy
 - Author: Bhadeshia and Honeycombe
 - Publisher: Elsevier Ltd
 - Publication Date: 2017
 - Text Edition: 4th
 - Classic Textbook?:
 - OER Link:
 - OER:
- Welding
 - Author: David J. Hoffman, Kevin R. Dahle, David J. Fisher
 - Publisher: Pearson / Prentice Hall
 - Publication Date: 2012
 - Text Edition: 1st
 - Classic Textbook?:
 - OER Link:
 - OER:

- Machining and Metalworking Handbook
 - Author: Denis Cormier
 - Publisher: McGraw Hill
 - Publication Date: 2006
 - Text Edition: 3rd
 - Classic Textbook?:
 - OER Link:
 - OER:
- Welding Principles and Practices
 - Author: Bohnart, Edward
 - Publisher: McGraw Hill
 - Publication Date: 2017
 - Text Edition: 5th
 - Classic Textbook?:
 - OER Link:
 - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.