

**MACH 161 Course Outline as of Fall 2024****CATALOG INFORMATION**

Dept and Nbr: MACH 161 Title: METALLURGY

Full Title: Metallurgy

Last Reviewed: 12/12/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	3.00	Lab Scheduled	3.00	6	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	5.00		Contact Total	87.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00

Total Student Learning Hours: 157.50

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: MACH 61.1

**Catalog Description:**

Students will study metals including alloying, heat treating, testing and applications in industry.

**Prerequisites/Corequisites:****Recommended Preparation:****Limits on Enrollment:****Schedule of Classes Information:**

Description: Students will study metals including alloying, heat treating, testing and applications in industry. (Grade Only)

Prerequisites/Corequisites:

Recommended:

Limits on Enrollment:

Transfer Credit:

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:
<b>CSU Transfer:</b>		Effective:	Inactive:
<b>UC Transfer:</b>		Effective:	Inactive:

### **CID:**

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

Both Certificate and Major Applicable

## **COURSE CONTENT**

### **Student Learning Outcomes:**

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

1. Describe the basic classification of metals, crystal structures and various material properties.
2. Explain the manufacturing, identification, phase diagram, heat treatment processes and deformation of iron and iron alloys.

### **Objectives:**

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

1. Describe the basic properties of all metals.
2. Describe the process of mining, extraction and refining of ores to metals.
3. Identify metals and alloys using the periodical table of elements or tables of alloys numbering systems.
4. Explain various crystal structures.
5. Explain heat treatment processes and surface hardening techniques pertinent to steel alloys.
6. Use handout materials, text, and library materials to do research on metallurgical alloys.
7. Perform basic lab experiments including: plotting data, dimensional measurements, heat treatments, tensile loading and metallurgical sample preparation and examination methods.

### **Topics and Scope:**

- I. Introduction to Metallurgy
- II. History of Elements
- III. Iron and Steel Refining
- IV. Identifying Ferrous and Non-Ferrous Metals
- V. Crystal Structure Systems
- VI. Tensile Test
- VII. Heat Treatment Techniques
- VIII. Quenching Medias
- IX. Hardness Testers
- X. Physical and Chemical Metallurgy
- XI. Grain Structure and Patterns
- XII. Iron and Steel Systems
  - A. American Iron and Steel Institute (A.I.S.I.)

B. Society of Automotive Engineers (S.A.E.)

C. United States Standard (U.S.S.)

D. American Welding Society (A.W.S.)

XIII. Density Measurements

XIV. Surface Hardening Methods

All topics are covered in both the lecture and lab parts of the course.

### Assignment:

Lecture-Related Assignments:

1. Reading (10-15 pages per week)
2. Complete assignments related to weekly reading
3. Quizzes (7-15), midterm, and final exam
4. Semester project (group or individual) as per instructions by instructor

Lab-Related Assignments:

1. Laboratory assignments to be completed during the lab sessions (7-10)

### 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.

Semester project

Writing  
20 - 30%

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

Assignments related to weekly reading; lab assignments

Problem solving  
15 - 25%

**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.

Quizzes, midterm, and final exam

Exams  
55 - 60%

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

None

Other Category  
0 - 0%

### Representative Textbooks and Materials:

Metallurgy Fundamental. 5th ed. Brandt, Daniel and Warner, J.C. Goodheart-Wilcox Company,

Inc. 2009 (classic).  
Instructor prepared materials