

Introduction to Metallurgy (WLDG 1437)



Credit: 4 semester credit hours (4 hour lecture)

Prerequisite/Co-requisite: None

Course Description

A study of ferrous and nonferrous metals from the ore to the finished product. Emphasis on metal alloys, heat treating, hard surfacing, welding hardness, machinability, and ductility.

Required Textbook and Materials

1. *Modern Welding* by Althouse, Turnquist, Bowditch. 2013
 - a. ISBN number is 978-1-60525-795-2
2. Notebook.

Course Objectives

Upon completion of this course, the student will be able to:

1. Describe the technical terms used in the various phases of metallurgy, from early history to classification of steel.
2. Discuss ferrous and non-ferrous metals and how they are processed and used in industry.
3. Describe the mechanical and physical properties of metals.
4. Describe surface treatment and heat treatment metals.

Course Outline

1. **Special welding processes**
 - Describe the various special welding processes.
 - Identify and specify these special welding processes using AWS abbreviations.
 - Identify equipment that is used with many of the special welding processes.
2. **Special ferrous welding applications**
 - Define low-, medium-, and high-carbon steel.
 - Describe preheat, interpass heat and post heat treatment and why is each done.
 - Describe the proper procedure for welding stainless steel, tool steel, and cast iron.
3. **Special nonferrous welding applications**
 - Define a nonferrous metal and alloy.
 - Discuss how to weld both wrought and cast aluminum.

- Describe how to GTAW brass, titanium, and other nonferrous metals.
 - Identify the equipment that makes up a plastic welding station.
4. **Pipe and Tube Welding**
- Define the difference of pipe and tube.
 - Describe the welding procedures used when welding pipe or tubing with SMAW, GMAW, GTAW, and FCAW.
 - Identify several nondestructive test methods for weld quality.
5. **Special Cutting Processes**
- Identify various cutting processes by AWS abbreviations.
 - Explain when a particular cutting process would be pick over another.
 - List safety hazards involved when using the cutting processes.
6. **Automatic and Robotic Welding**
- Discuss the advantages of automatic or robotic welding.
 - Discuss the safety hazards encountered in and around a robotic workstation.
7. **Metal Surfacing**
- Define the term surfacing.
 - Define thermal spraying.
 - Define hard facing, cladding, buttering, and buildup.
8. **Production of Metals**
- Describe and identify modern methods of manufacturing metals.
 - Describe and identify the various semi finished and finished shapes produced in a rolling mill.
9. **Metal Properties and identification**
- List and describe eight physical properties of metal
 - Identify cast iron, plain carbon steel, and alloy steel by making a spark test on a grinder using comparison charts.
 - Describe plain carbon steels from their SAE/ ANSI compositions numbers.
10. **Heat treatment of metals**
- List seven reasons to heat treatments.
 - Name the methods used to heat metals for heat treatment.
 - Describe the weld heat-affected zone.
 - Define and discuss annealing, normalizing, tempering, and hardening.

Grade Scale

90 – 100	A
80 – 89	B
70 – 79	C
60 – 69	D
0 – 59	F

Course Evaluation

Final grades will be calculated according to the following criteria:

Assignments	30%
TEST	70%

Late Penalties will be assessed on all work turned in late. 5 points per day.

Course Requirements

1. Describe the technical terms used in the various phases of metallurgy, from early history to classification of steel.
2. Discuss ferrous and non-ferrous metals and how they are processed and used in industry.
3. Describe the mechanical and physical properties of metals.
4. Describe surface treatment of metals.
5. Describe heat treatment of metals.
6. Define low-, medium-, and high-carbon steel.

Attendance Policy

- I. Students are allowed to miss two days without penalty; each additional day will result in the student's grade being dropped by a letter grade.
Example: 2 days absent = If student has an A average no penalty
 3 days absent = A drops to a B
 4 days absent = B drops to a C
 5 days absent = C drops to a D (student must retake class)
 6 days absent = D drops to a F (student must retake class)
- II. Absences are counted for unexcused, excused and coming to class late.
- III. 3 tardies = 1 absence
 - A. Tardy- arriving within 15 minutes after class begins or leaving before the end of class.
 - B. More than 15 minutes late you will be counted absent.
 - C. If you go to sleep in class you will be counted absent.
- IV. **Excused absences.** Only given to allow students to make up missed work.
 - A. Will be given for documented Injury or Illness. Doctor's excuse required showing proof. Will count toward total days missed.
 - B. Will be given for documented Death in immediate family. Will count toward total days missed.
 - C. Approved LIT school functions; E.g. SkillsUSA, SGA etc. Will not count toward total days missed

- D. It is the student's responsibility to obtain from the instructor any handouts or assignments for classes missed. Lectures will not be repeated.
- V. If you wish to drop, you are responsible for the drop process. I will not initiate the drop, no matter how many absences or zeroes you have; that is, if you stop coming to class and do not drop, you will earn an "F" in the course. Students are only allowed to drop 6 times in their college career.

Course Policies

1. No electronic devices of any kind (cell phones, I-pod, headphone, ect.) will be tolerated in the classrooms or labs. If you are seen using any electronic device you will be asked to leave the class for the day.
2. No food or drink will be allowed in the classroom.
3. No derogatory or foul language will be tolerated.
4. Zero tolerance policy for sexual harassment.
5. Zero tolerance policy of racial or ethnic discrimination.
6. Be considerate of others in the classroom.

Disabilities Statement

The Americans with Disabilities Act of 1992 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. Among other things, these statutes require that all students with documented disabilities be guaranteed a learning environment that provides for reasonable accommodations for their disabilities. If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409) 880-1737 or visit the office in Student Services, Cecil Beeson Building.

Course Schedule

Week	Lecture Topics	Reference
1-2	Course Introduction and Policies Special Welding Processes Test	Syllabi Chapter 19
3	Special Ferrous Welding Application Test	Chapter 20
4-5	Special Nonferrous Welding Applications Test (LAB)	Chapter 21
6-7	Pipe and Tube Welding Test	Chapter 22
8	Special Cutting Processes Test	Chapter 23
9	Automatic and Robotic Welding Test	Chapter 25
10-11	Metal Surfacing Test	Chapter 26

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Course Syllabus

Week	Lecture Topics	Reference
12	Production of Metals Test	Chapter27
13-14	Metal Properties and Identification Test	Chapter28
15-16	Heat Treatment of Metals Test	Chapter29