

EL CAMINO COLLEGE

COURSE OUTLINE OF RECORD

I. Course Information

Course Acronym:*

WELD

Course Number:* 40B

Descriptive Title:* Intermediate Gas Tungsten Arc Welding (GTAW)

Division: Industry and Technology

Department:*

Welding

Course Disciplines: Welding

Catalog Description:*

This is an intermediate course in Gas Tungsten Arc Welding (GTAW). Special emphasis is placed on the welding of ferrous and non-ferrous metals in the various positions and building skill development in GTAW. Students continue to prepare for the American Welding Society (AWS) D17.1 certification.

Conditions of Enrollment:

Prerequisite:

Co-requisite:

Recommended Preparation: Welding 40A

Enrollment Limitation:

Course Length: Full Term

Hours Lecture (per week): 2

Hours Laboratory (per week): 4

Outside Study Hours:* 4

Total Course Hours:* 108

Course Units:* 3

Grading Method: Letter Grade and Pass/No Pass

Credit Status: Credit, degree applicable

Transfer CSU: Yes

Effective Date: 02/18/2014

Transfer UC: No

Effective Date:

General Education:
ECC

Term:

Other:

CSU GE:

Term:

Other:

IGETC:

Term:

Other:

II. Outcomes and Objectives

A. Student Learning Outcomes (SLOs) (The course student learning outcomes are listed below.)
SLO revisions are completed via the SLO Change Form available on the College Curriculum Committee website.

Student Learning Outcomes:

SLO #1

Safely set up weldment and GTAW equipment.

SLO #2

Correctly adjust welding parameters to produce quality weldments in and out of position.

SLO #3

Produce GTAW weldment according to administered blueprint.

B. Course Objectives (The major learning objective for in this course are listed below.)

Course Objectives:

1. Set up and operate to specific welding parameters and procedures used in the aerospace industry.
2. Coordinate welding travel speed to compensate for material thickness.
3. Demonstrate out of position welding.
4. Demonstrate the ability to weld low carbon steel, stainless steel and aluminum using lap joints and tee joints in GTAW.
5. Produce sound gas tungsten arc welded joints in both steel and aluminum.

III. Outline of Subject Matter

(Topics should be detailed enough to enable an instructor to determine the major areas that should be covered to ensure consistency from instructor to instructor and semester to semester.)

Example:

- I. Main Topic (3 hours, lecture)
 - A. Sub topics
 - B. Sub topics
 1. Super sub topic
 2. Super sub topic

Major Topics:

I. OVERVIEW OF INTERMEDIATE GTAW (2 hours, lecture)

- A. GTAW equipment
- B. Shop processes and rules
- C. Constant current characteristics
- D. Equipment and settings
- E. Introduction to aerospace GTAW

II. WELDING EQUIPMENT PROCEDURES (4 hours, lab)

- A. Set up, adjust, operate and shut down GTAW equipment
- B. Safety precautions
- C. Correct welding parameters

III. PARAMETERS FOR FERROUS AND NON FERROUS METALS (2 hours, lecture)

- A. Polarity
- B. Heat settings
- C. Establishing the arc and controlling the weld pool
- D. Shielding gas flow

IV. COMPLETE PENETRATION WELDS (CJP) (4 hours, lab)

- A. Key hole weld
- B. Tungsten angle

V. PRINCIPLES OF GTAW (2 hours, lecture)

- A. Process and material preparation
- B. The effects of gas and tungsten
- C. Selection on bead performance on various base metals

VI. INTERPRETING WELD BEADS (4 hours, lab)

- A. Formulate corrective action
- B. Recognizing discontinuities

C. Control of parameters

VII. PROCESS VARIABLES ON THE WELDING ARC (2 hours, lecture)

A. Rod angles and torch push angles

B. Arc length

C. Current settings

D. Input of filler metal

E. Welding travel speed

VIII. METALLURGY (2 hours, lecture)

A. Effects of cold working

B. Effects of annealing

C. Effects of heat-treating

IX. VISUAL DEFECTS IN WELD BEAD (8 hours, lab)

A. Weldments on various base metals

B. Heat input and conductivity

X. ALUMINUM AND MILD STEEL (2 hours, lecture)

A. Heat transfer

B. Welding characteristics

C. Pre and post heating weldments

XI. CONTROLLING DISTORTION BY RECOGNIZING EFFECTS OF HEAT INPUT (4 hours, lab)

A. Tooling

B. Fixturing

C. Welding sequence

XII. ALLOYING AND TEMPERS ON ALUMINUM (2 hours, lecture)

A. American Iron and Steel Institute (AISI) series rating for aluminum

B. Heat treatments and tempering designations

XIII. CJP BUTT JOINTS (4 hours, lab)

- A. Vertical or 3G position
- B. Key hole welding

XIV. INTERMEDIATE STRUCTURAL WELDING (4 hours, lecture)

- A. Fixtures used in aerospace
- B. Positioning of weldment
- C. Jig and tack weld set up
- D. Back purging systems

XV. VERTICAL JOINTS (8 hours, lab)

- A. Lap
- B. T-joint

XVI. OPERATING VARIABLES (2 hours, lecture)

- A. Welding on dissimilar materials
- B. Welding on dissimilar metal thicknesses

XVII. JOINT SET UP IN THE VERTICAL POSITION (4 hours, lab)

- A. Various filler metals
- B. Tungsten heat concentration

XVIII. INTERMEDIATE GTAW PROCESS ALLOYS AND EXOTIC METALS (4 hours, lecture)

- A. Chrome-moly
- B. Stainless steel
- C. Alloying

XIX. HORIZONTAL JOINT WELDMENTS (8 hours, lab)

- A. Performance weld test
- B. Aluminum
- C. Mild steel

XX. NON DESTRUCTIVE EXAMINATION (NDE) (4 hours, lecture)

- A. Visual testing
- B. Dye penetrant
- C. Ultrasonic
- D. Radiographic

XXI. AWS D17.1 REQUIREMENTS (4 hours, lecture)

- A. Welding code
- B. Specifications for GTAW

XXII. INTERMEDIATE JOINING SKILLS (8 hours, lab)

- A. Alloys
- B. Exotic metals

XXIII. PRINT READING (4 hours, lecture)

- A. Symbols
- B. Lines
- C. Section and orthographic views

XXIV. APPLYING PRINTS AND WELD SYMBOLS (8 hours, lab)

- A. Layout of test project
- B. Visual inspection of dimensions

XXV. SEMESTER WELDING PROJECT CRITIQUE (8 hours, lab)

- A. Assessment of weld samples
- B. Inspection of weld samples
- C. Defect analysis of weld samples

Total Lecture Hours: 36

Total Laboratory Hours: 72

Total Hours: 108

IV. Primary Method of Evaluation and Sample Assignments

A. Primary Method of Evaluation (choose one):

- 1) Substantial writing assignments
- 2) Problem solving demonstrations (computational or non-computational)
- 3) Skills demonstrations

Primary Method of Evaluation: 3) Skills demonstration

B. Typical Assignment Using Primary Method of Evaluation

Typical Assignment Using Primary Method of Evaluation: Demonstrate on a weldment the proper base metal and bead qualification procedures per requirements set by the AWS. Submit weldment to the instructor.

C. College-level Critical Thinking Assignments

Critical Thinking Assignment 1: Read and interpret an alpha-numeric weldment identification code and identify metal specifications used in welding and fabrication. Determine the proper filler and rod specifications and write findings on a one-page report. Submit report to the instructor.

Critical Thinking Assignment 2: Given an undescribed piece of metal, identify the metal and alloy through non-destructive testing such as: magnetic, spark, weight, and hardness testing. Write findings on a one-page report and submit report to the instructor.

D. Other Typical Assessment and Evaluation Methods

Examples: Class Performance, Objective Exam, Clinical Evaluation, Oral Exams, Completion, Other Exams, Embedded Questions, Performance Exams, Essay Exams, Presentation, Fieldwork, Quizzes, Homework Problems, Reading Reports, Journal kept throughout course, Term or Other Papers, Laboratory Reports, True/False, Matching Items, Written Homework, Multiple Choice, Other (specify)

Other Evaluation Methods: Class Performance
Homework Problems
Matching Items
Multiple Choice
Performance Exams
Quizzes

V. Instructional Methods

Examples: Lecture, Group Activities, Lab, Role play/simulation, Discussion, Guest Speakers, Multimedia presentations, Field trips, Demonstration, Other (specify)

Instructional Methods: Demonstration
 Discussion
 Field trips
 Guest Speakers
 Lab
 Lecture

If other:

Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

VI. Work Outside of Class

Work Outside of Class:* Problem solving activity
 Skill practice
 Study

If Other:

VII. Texts and Materials

A. Up-to-date Representative Textbooks: Please use the following format(s):

Printed Text - Author, Title, Edition, Publisher, Year.

Digital Text (OER Text) - Author (last name first). Title. Edition or Version (if beyond 1st). Publisher, Publication year or Revision date. URL. License.

Sample: Dillon, Dave. *Blueprint for Success in College and Career. Version 1.3. Rebus Community, 2018. press.rebus.community/blueprint2/*. Licensed under CC BY 4.0.

If you wish to list a text that is more than 5 years old, please annotate it as a “discipline standard”.

***Multiple textbooks may be listed.**

Up-To-Date Representative Textbooks: Hobart Institute of Welding Technology, GAS TUNGSTEN ARC WELDING (EW-369 TECHNICAL GUIDE), Hobart Institute of Welding Technology, 2010. (Discipline Standard)
 Hobart Institute of Welding Technology, GAS TUNGSTEN ARC WELDING (EW-470 TECHNICAL GUIDE), Hobart Institute of Welding Technology, 2002. (Discipline Standard)

B. Alternative Textbooks: Please use the following format(s): if applicable

Printed Text - Author, Title, Edition, Publisher, Year.

Digital Text (OER Text) - Author (last name first). Title. Edition or Version (if beyond 1st). Publisher, Publication year or Revision date. URL. License.

Sample: Dillon, Dave. Blueprint for Success in College and Career. Version 1.3. Rebus Community, 2018. press.rebus.community/blueprint2/. Licensed under CC BY 4.0.

If you wish to list a text that is more than 5 years old, please annotate it as a “discipline standard”.

**Multiple textbooks may be listed.*

Alternative
Textbooks:

C. Required Supplementary Readings

Required
Supplementary
Readings: Excerpts from AWS D17.1

D. Other Required Materials

Other Required
Materials: Notebook
Gloves
Safety glasses
Protective clothing
Welding helmet
Stainless steel brush
Pliers

VIII. Conditions of Enrollment

A. Requisites (Course Prerequisites and Corequisites) Skills needed without which a student would be highly unlikely to succeed.

Requisite:

Category:

Requisite course(s):
List both
prerequisites and
corequisites in this
box.

Requisite and
Matching skill(s):**Bold**
the requisite skill.
List the

B. Requisite Skills: (Non-Course Prerequisite and Corequisites) Skills needed without which a student would be highly unlikely to succeed.

Requisite Skill:

Requisite Skill and Matching Skill(s):
Bold the requisite skill(s). If applicable

C. Recommended Preparations (Course) (Skills with which a student's ability to succeed will be strongly enhanced.)

Requisite course: Welding 40A

Requisite and Matching skill(s):
Bold the requisite skill.
List the corresponding course objective under each skill(s).

Ability to set up and operate GTAW equipment.

WELD 40A - Perform GTAW on ferrous and nonferrous alloys, welding various joints in all positions.

WELD 40A - Assemble a torch set up, adjust machine for proper current, amperage and gas flow pressures required to produce weldments meeting industry standards.

D. Recommended Preparation (Non-Course) (Skills with which a student's ability to succeed will be strongly enhanced.)

Requisite Skill:

Requisite Skill and Matching skill(s):
Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable

E. Enrollment Limitations

Enrollment Limitations and Category:

Enrollment Limitations Impact:

Course Created by: Renee Newell

Date: 10/29/2013

Original Board Approval Date: 02/18/2014

**Last Reviewed and/or
Revised by:** Nick Colin

Date: 05/10/2023

**Last Board Approval
Date:** 11/20/2023 effective FALL 2024

Transfer Status:

Basic Skills:

CSU Approval Date:

UC Approval Date: