El Camino College

COURSE OUTLINE OF RECORD – Approved

INSTRUCTOR: NICK COLIN

I. **Subject and Number:** **WELDING 40B**

Descriptive Title: **Intermediate Gas Tungsten Arc Welding**

Course Disciplines: **Welding**

Division: **Industry and Technology**

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. This course continues student preparation toward the American Welding Society (AWS) D17.1 certification.

Conditions of Enrollment:

Recommended Preparation:

Welding 40A

Course Length: **X Full Term Other (Specify number of weeks):**

Hours Lecture: **2.0 hours per week TBA**

Hours Laboratory: **4.0 hours per week TBA**

Course Units: **3.00**

Grading Method: **Both**

Credit Status: **Associate Degree Credit**

Transfer CSU: **X Effective Date: February 18, 2014**

Transfer UC:

General Education:

El Camino College:

CSU GE:

IGETC:

II. OUTCOMES AND OBJECTIVES

A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)

1. Safely set up weldment and GTAW equipment.

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

3. Produce GTAW weldment according to administered blueprint.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)

1. Set up and operate to specific welding parameters and procedures used in the aerospace industry.
   - Performance exams
2. Coordinate welding travel speed to compensate for material thickness.
   - Performance exams
3. Weld in increasingly difficult conditions in order to develop the necessary welding skills mirroring those in the aerospace industry.
   - Class Performance
4. Understand welding theory and proper application of GTAW.
   - Quizzes
5. Demonstrate the ability to weld low carbon steel, stainless steel and aluminum using GTAW equipment in out of normal positions.
   - Performance exams
6. Produce sound gas tungsten arc welded joints in both steel and aluminum.
   Performance exams

III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)

Lecture or Lab	Approximate Hours	Topic Number	Major Topic
Lecture	2	I	ORIENTATION Course syllabus GTAW equipment Shop processes and rules Constant voltage characteristics Equipment and settings Introduction to aerospace gas tungsten arc welding
Lab	4	II	WELDING EQUIPMENT PROCEDURES Set up, adjust, operate and shut down gas tungsten arc welding equipment Safety precautions Correct welding parameters
Lecture	2	III	PARAMETERS FOR FERROUS AND NON FERROUS METALS Polarity Heat settings Establishing the arc and controlling the weld pool Shielding gas flow
Lab	4	IV	COMPLETE PENETRATION WELDS (CJP) Key hole weld Tungsten angle

Lecture	2	V	PRINCIPLES OF GTAW Process and material preparation The effects of gas and tungsten selection on bead performance on various base metals
Lab	4	VI	INTERPRETING WELD BEADS Formulate corrective action Recognizing discontinuities Control of parameters
Lecture	2	VII	PROCESS VARIABLES ON THE WELDING ARC Rod angles and torch push angles Contact to work distance Current settings Input of filler metal Welding travel speed
Lecture	2	VIII	METALLURGY G. Effects of cold working H. Effects of annealing I. Effects of heat treating
Lab	8	IX	VISUAL DEFECTS IN WELD BEAD Weldments on various base metals Heat input and conductivity
Lecture	2	X	ALUMINUM AND MILD STEEL Heat transfer Welding characteristics Pre and post heating weldments

Lab	4	XI	CONTROLLING DISTORTION BY RECOGNIZING EFFECTS OF HEAT INPUT Tooling Fixturing Welding sequence
Lecture	2	XII	ALLOYING AND TEMPERS ON ALUMINUM American Iron and Steel Institute (AISI) series rating for aluminum Heat treatments and tempering designations
Lab	4	XIII	COMPLETE JOINTS (CJP) Vertical or 3G position Butt joints
Lecture	4	XIV	INTERMEDIATE STRUCTURAL WELDING Fixtures used in aerospce Positioning of weldment Jig and tack weld set up Back purging systems
Lab	8	XV	VERTICAL JOINTS Lap J. T-joint
Lecture	2	XVI	OPERATING VARIABLES Welding on dissimilar materials Welding on dissimilar metal thicknesses

Lab	4	XVII	JOINT SET UPS IN THE VERTICAL POSITION Various filler metals Tungsten heat concentration
Lecture	4	XVIII	INTERMEDIATE GTAW PROCESS ALLOYS AND EXOTIC METALS Chrome-moly Stainless steel Alloying
Lab	8	XIX	HORIZONTAL JOINT WELDMENTS Performance weld test Aluminum Mild steel
Lecture	4	XX	NON DESTRUCTIVE TESTING (NDT) OR NON DESTRUCTIVE EXAMINATION (NDE) Visual Testing (VT) Dye Penetrant (PT) Ultrasonic (UT) Radiographic (RT)

Lab	8	XXI	VERTICAL JOINTS Performance exam Aluminum Mild steel
Lecture	4	XXII	AWS D17.1 REQUIREMENTS Welding code Specifications for GTAW
Lab	8	XXIII	INTERMEDIATE JOINING SKILLS Alloys Exotic metals
Lecture	4	XXIV	BLUEPRINT READING Symbols Lines Section and orthograhic views
Lab	4	XXV	APPLYING BLUEPRINTS AND WELD SYMBOLS Layout of test project Visual inspection of dimensions
Lab	4	XXVI	SEMESTER WELDING PROJECT CRITIQUE Assessment of weld samples Inspection of weld samples Defect analyasis 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

Skill demonstration

B. 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.

C. TYPICAL ASSIGNMENT USING PRIMARY METHOD OF EVALUATION:

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.
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.

D. OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:

Performance exams

Quizzes

Class Performance

Homework Problems

Multiple Choice

Matching Items

V. INSTRUCTIONAL METHODS

Demonstration
Discussion
Field trips
Guest Speakers
Internet Presentation/Resources
Laboratory
Lecture
Multimedia presentations

VI. WORK OUTSIDE OF CLASS

Study

Problem solving activities

Estimated Independent Study Hours per Week: 3

VII. TEXTS AND MATERIALS

A. UP-TO-DATE REPRESENTATIVE TEXTBOOKS

1. Modern Welding, 11th Edition, Goodheart-Willcox, 2013 **REQUIRED**
   Authors: Althouse, Turnquist, Bowditch, Bowditch, Bowditch
2. Modern Welding Lab Workbook, 11th Edition, Goodheart-Willcox, 2013
   Authors: Althouse, Turnquist, Bowditch, Bowditch, Bowditch **REQUIRED**

B. ALTERNATIVE TEXTBOOKS

C. REQUIRED SUPPLEMENTARY READINGS Excerpts from AWS D17.1

D. OTHER REQUIRED MATERIALS

Notebook
Gloves
Safety glasses
Protective clothing
Welding helmet
Stainless steel brush
Pliers

} **REQUIRED**

VIII. CONDITIONS OF ENROLLMENT

A. Requisites (Course and Non-Course Prerequisites and Corequisites)

Requisites	Category and Justification

B. Requisite Skills

Requisite Skills
Ability to set up and operate GTAW equipment. WELD 40A - Complete a welding safety test covering the operation of tools, machines and equipment. WELD 40A - Perform GTAW on ferrous and nonferrous alloys, welding various joints in all positions. WELD 40A - Assemble torch set up, adjust machine for proper current, amperage and gas flow pressures required to produce weldments meeting industry standards.

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification
Course Recommended Preparation Welding-40A	

D. Recommended Skills

Recommended Skills

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by **RENEE NEWELL on October 29, 2013**

BOARD APPROVAL DATE: **FEBRUARY 18, 2014**

Last Reviewed and/or Revised by **RENEE NEWELL on October 29, 2013**