El Camino College

COURSE OUTLINE OF RECORD - Approved

I. GENERAL COURSE INFORMATION

Subject and Number: Welding 10A
Descriptive Title: Introduction to Shielded Metal Arc Welding (SMAW)

Course Disciplines: Welding

Division: Industry and Technology

Catalog Description: This course is designed for the beginning student. Students will develop manipulative skills using the oxy-gas and Shielded Metal Arc Welding (SMAW) processes. Emphasis is placed on safety procedures, use of manual and semi-automatic welding equipment, welding techniques, electrodes and joints. Practical aspects of Flux Core Arc Welding (FCAW) process will be introduced.

Conditions of Enrollment: *You have no defined requisites.*

Course Length: [X] Full Term [ ] Other (Specify number of weeks):
Hours Lecture: 2.50 hours per week [ ] TBA
Hours Laboratory: 5.00 hours per week [ ] TBA
Course Units: 4.00

Grading Method: Both
Credit Status Associate Degree Credit

Transfer CSU: [X] Effective Date: 2/18/2014
Transfer UC: [ ] No

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. Students will be able to demonstrate the safe set up and operation of welding equipment using all applicable personal protective equipment.
2. Safe operation of manual and semi-automatic base metal cutting tools.
3. Students will have a basic understanding how heat affects their weldment.

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. Properly set up regulators, safely light and adjust oxy-acetylene flame to a neutral flame.

   Performance exams
2. Weld in a flat, horizontal, vertical, or overhead position.

   Performance exams
3. Safely operate SMAW equipment.

   Class Performance
4. Evaluate the numbering system of the SMAW electrode.

   Multiple Choice
5. Identify the five essentials of welding.

   Completion
6. Explain how the application of heat affects a weldment.

   Performance exams
7. Identify different weld joints.

   Multiple Choice
8. Safely operate FCAW equipment.

   Class Performance

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	INTRODUCTION A. Safety procedures B. Course objectives C. Syllabus and text support

Lab	4.5	II	OVERVIEW OF EQUIPMENT A. Safe set up of various machines B. Inverters C. Rectifiers
Lecture	3	III	OXY-ACETYLENE - OXY FUEL - GAS PROCESS A. Gases B. Equipment, manifolds hoses, fittings C. Positive pressure set up 1. Regulators 2. Set up 3. Shut down D. Flame characteristics and applications 1. Carburizing 2. Neutral 3. Oxidizing flame E. Torch angle and manipulation OTHER CUTTING TECHNIQUES A. Air carbon arc gouging B. Plasma cutting
Lab	5.5	IV	THERMAL CUTTING PROCESSES A. Oxy-acetylene cutting, plasma cutting, gouging set ups B. Adjusting regulators, safely light and adjust torch heads C. Cutting techniques with materials using various thermal cutting processes
Lecture	5	V	THE FIVE ESSENTIALS OF WELDING A. Electrode choice B. Polarity C. Arc length D. Electrode angle E. Travel speed
Lab	10	VI	FABRICATION OF METAL CROSS - LAB A. Beading in the flat position B. Striking an arc C. Running beads with electrodes D. Puddle identification E. Whip manipulation
Lecture	4	VII	ELECTRODE IDENTIFICATION AND CHARACTERISTICS

			A. Tensile strength B. Position designation C. Flux coating D. Operation polarity E. Manipulation technique
Lab	8	VIII	CONSTANT CURRENT MACHINES A. Correct set up of amperage B. Arc force setting control C. Controlling the weld puddle D. Rod manipulation
Lecture	3	IX	THE EFFECTS OF HEAT INPUT IN WELDMENT A. Over building of weldment B. Code limitations of single bead C. Multiple passes
Lab	6	X	PROGESSING LAB REQUIREMENTS A. Flat position (1F) B. Horizontal positioning (2F) C. Virtual welder - locating correct angle
Lecture	4	XI	WELDABILITY OF METALS AND ELEMENTS A. Filler metal selection B. Skill level C. Electrode diameter and coatings D. Polarity E. Exploring how positioning of weldment effects choice of filler metal F. Flat 1. Horizontal 2. Vertical 3. Overhead
Lab	8	XII	POSITIONING OF METAL CROSS A. Horizontal beading and multiple pass welds (2F) B. Maintaining equal legs, with flat cover
Lecture	5	XIII	METALLURGICAL ASPECTS OF THE HEAT AFFECTED ZONE (HAZ) A. Deformation B. Brittleness C. Stress points D. Preheating base metal

Lab	10	XIV	INTRODUCTION TO DRAG ROD A. New manipulation technique B. E7018 C. Surfacing beads D. F1 position / F2 position
Lecture	2	XV	METALLURGICAL ASPECTS OF MILD CARBON STEEL A. Grain structure B. Ductility C. Magnetic properties D. Yield strength
Lecture	4	XVI	THE FIVE JOINTS OF WELDING A. T-joint B. Butt joint C. Lap joint D. Corner joint E. Edge joint TWO TYPES OF WELDS A. Fillet B. Groove
Lab	12	XVII	INTRODUCTION TO BEAD TECHNIQUE A. Stringer bead B. Weave bead C. 3F E7018 1/8"
Lecture	3	XVIII	INTRODUCTION TO WELD SYMBOLS AND DEFINITIONS A. American Welding Society (AWS) A2.4 B. Joints and types of welds
Lab	6	XIX	PERSONAL WELDMENTS A. 2F or 3F positioning of E7018 B. Visual examination of weldments C. Adjusting various machine settings
Lecture	5	XX	STEPS FOR PROPER WELDMENTS A. Understanding the puddle B. Adjusting components using the five essentials of welding C. Visual inspection of cover pass

Lab	10	XXI	GROOVE JOINTS A. V-groove using E7018 B. Open root V-groove with 1/8" landing using E6010 SEMESTER PROJECT DEVELOPMENT A. Critical analysis B. Individual and group discussion C. Visual examination of weldments D. Destructive testing
Lecture	5	XXII	Flux Core Arc Welding (FCAW) A. Contact to Work Distance (CTW) B. Amperage adjust wire feed C. Electrode torch travel angle D. Operating FCAW equipment
Lab	10	XXIII	Flux Core Arc Welding A. set-up machine and wire feeder correctly B. use correct travel angle C. proper CTW D. tie beads together with proper heat and travel speed
Total Lecture Hours		45	
Total Laboratory Hours		90	
Total Hours		135	

IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

A. **PRIMARY METHOD OF EVALUATION:**

Problem solving demonstrations (computational or non-computational)

B. **TYPICAL ASSIGNMENT USING PRIMARY METHOD OF EVALUATION:**

Discuss the numbering system in electrode identification and the charateristics of the flux coating.

An example is E6010

E - electrode

60 - tensile strength in KSI

1 - position

0 - characteristics of the flux - polarity, alloying elements, cellulose rod from F3 catagory

C. **COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:**

1. Given a piece of alloyed metal, analyze the metal to see if it should be preheated before welding begins. Describe on a lab report how to increase the HAZ.

2. Describe on a lab report the purpose of a hot pass and how it applies in the weld process.

D. **OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:**

Performance exams

Embedded questions

Quizzes

Class Performance

Multiple Choice

Completion

Matching Items

V. INSTRUCTIONAL METHODS

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

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

Study
Problem solving activities

Estimated Independent Study Hours per Week: 4.5

VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**
Andrew Daniel Althouse, Carl H. Turnquist, William A. Bowditch, Kevin E. Bowditch. Modern Welding. 11th ed. Goodheart-Willcox , 2012.
Qualifier Text: Modern Welding is a comprehensive text that has long been the standard for teaching the theory, fundamentals, equipment, and techniques of welding technology. This text provides thorough coverage of common welding and cutting processes, including gas tungsten arc welding, gas metal arc welding, shielded metal arc welding, oxyfuel gas welding and cutting, plasma arc cutting, and resistance welding. The text also includes extensive instruction in welding symbol interpretation, weld testing and inspection, and employment in the welding field.,

B. **ALTERNATIVE TEXTBOOKS**

C. **REQUIRED SUPPLEMENTARY READINGS**
Handouts from American Welding Society (AWS) Code Books
A2.4
D1.1

D. **OTHER REQUIRED MATERIALS**
Personal protective gear, chipping hammer and wire brush

VIII. CONDITIONS OF ENROLLMENT

A. Requisites (Course and Non-Course Prerequisites)

Requisites	Category and Justification

B. Requisite Skills

Requisite Skills

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification

D. Recommended Skills

Recommended Skills

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by Renee Newell on 11/01/2013.

BOARD APPROVAL DATE: 02/18/2014

Last Reviewed and/or Revised by Renee Newell on 11/01/2013

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