Career Technical Education/Fresno Regional Occupational Program

Course Information

Course Title:	**Welding Fabrication & Application (Ag & Manufacturing)**
CTE Industry Sector:	Manufacturing and Product Development
Certification(s):	AWA Certifications, OSHA 10, NCCER

Please check:

Course Level:	Introductory		Concentrator	X	Capstone	X
UC Designation Category:						

Local Course Number:	17090600
CALPADS Title:	Intermediate Welding and Materials Joining (Concentrator), Advanced Welding & Materials Joining (Capstone)
CalPADS Number:	8230 Intermediate Welding and Materials Joining (Concentrator), 8231 Advanced Welding & Materials Joining (Capstone)

Course Hours:	360
Dual Enrollment/Unitrack Information:	Fresno City College/Reedley College/West Hills/Madera Community College
Board Approval Date:	10/2002
Advisory Committee Meeting:	10/2002

Career Pathway: Identify the sequence of courses for students **(Ed. Code Section 52314(b))**

ROP/CTE Recommended Courses	Grade 9	Grade 10	Grade 11	Grade 12	Post-secondary course, certificate or degree program
	Ag Mech I or Metal Fab I	Ag Mech II Metal Fab II	Welding Fabrication & Application or Welding Processes & Fabrication	Welding Fabrication & Application or Welding Processes & Fabrication	Material Science Metallurgy for welding engineers

Pathway occupations organized by level of education and training required for workplace entry. (Asterisked occupations require certification or licensure.)		
High School (diploma)	**Postsecondary Training (certification and/or AA degree) *Vary by employer**	**College University (bachelor's degree or higher)**
Maintenance Welder Welding Tech, cutters, solderers and brazers	Production welders, cutters, solderers and brazers	Metallurgy for welding engineers Material Science

ROP Course Description:

ROP Welding Fabrication and Application is the capstone course designed to train students for entry-level positions in welding/metal fabrication shops and preparing students for post-secondary agricultural mechanics, welding technology & industrial technology educational programs. This full year course emphasizes welding and fabrication skills in the advanced phases of Oxyacetylene, SMAW (Arc Welding), GMAW (MIG Welding) & TIG welding. This course applies the practical knowledge and skills learned during the previous three years of instruction. The course devotes a high percentage of classroom time in project planning and job seeking skills; Students will prepare working drawings, develop and compute bill of materials, prepare a resume, letter of application, student work samples and complete an individual portfolio. Shop time is devoted to constructing and fabricating student projects. The majority of advanced shop skills will be taught on an individual basis on student projects. Students are encouraged to exhibit any constructed, repaired or restored projects at the local County Fair and the California State Fair.

Course Objectives/Core Competencies:

Core Competencies: (reference for course outline)

1. Student has good safety habits and uses good judgment
2. Understands measuring and squaredness
3. Make simple sketches
4. ARC welding skills
5. ARC plasma skills
6. MIG welding skills
7. Oxy fuel cutting skills
8. Read basic blueprints

Course Objectives (list several detailed subject specific learning objectives)

Students will:

- **a.** Demonstrate proper safety habits and use good judgment.
- **b.** Be able to accurately measure down to 1/16th of an inch
- **c.** Layout, plan and cut materials efficiently
- **d.** Set up and operate arc welding machines

e. Be able to change and adjust regulators

f. Perform and understand the five basic weld joints

g. Possess basic competency in the five basic welding processes

h. Demonstrate basic concepts and practices of technical drawing and blueprint reading in accordance with industry standards

i. Produce drawings using Computer Aided Drafting (CAD) software

j. Demonstrate fabrication techniques and cost estimation, and principles of applied statics and strength of materials

Instructional Strategies:

Methods of instruction will include, but are not limited to:

1. Direct instruction (lecture, reading, labs, and investigations, writing – reports, journals, analyses, essay – speaking, presentations, guest speakers).
2. Laboratory investigations and project using educational courseware and computer technology.
3. Team teaching including assisted instruction from university, business, and community partners.
4. Community – based research projects with professional mentors.
5. Use variety of instructional materials and resources including electronic media, professional journals and reference materials, textbooks and other print information.
6. Self-directed, cooperative, and collaborative learning to increase responsibility of students for their own learning.
7. Student presentations, exhibits, and competitions – both team and individual.
8. Embedded assessment as a learning tool.
9. SDAIE (Specially Designed Academic Instruction in English).
10. Differentiated instruction of exceptional students.

Evaluation Procedures

Assessment opportunities, which allow continuous evaluation of students' progress, will be embedded throughout the course and should be a learning experience. All students will be expected to achieve mastery of all topics; often, demonstrations of mastery will occur in a public forum. The following strategies, which include both formal and informal assessment techniques will include, but are not limited to:

1. Performance – based assessments such as experiments, demonstrations, discussions, debates simulations, and projects.
2. Student presentations, exhibits, and competitions – both team and individual
3. On-going and cumulative portfolio record of project and component investigative accomplishments.
4. Written tests with a variety of short answer and essay questions.
5. Written assignments such justification, investigations, and research, evaluative, or technical papers.
6. Individual and group assessments (including assessments of working relationships).

7. Opportunities for self-assessment and peer-assessment.

Process Skills Infused Throughout The Course:

a. Research Types and Methods.

b. Accurate Lab Techniques.

c. Data Collection and Analysis.

d. Teamwork and Collaboration.

e. Presentation Skills.

f. Project Completion – Initiation, Investigation, Collaboration and Presentation.

Instructional Materials:

These instructional materials could include (but not limited to) magazines, newspapers, journals, video and audio files, digital and web resources.

Selection of instructional materials should be continuously re-evaluated in relation to changing curriculum content, pedagogical research, and the needs of students, teachers and administration.

Textbooks & Supplemental Materials:

Agriculture Mechanics: Fundamentals and Applications

Welding Skills and Practices

Bowditch, W.A. Bowditch, K.E. (1997). Welding Technology Fundamentals.

The Goodheart-Willcox Company, Inc.: Tinley Park, IL.

Bowditch & W.A. & Bowditch, K.E., Modern Welding.

The Goodheart-Willcox Company, Inc.: Tinley Park, IL.

Juffus, Welding Applications

American Technical publishers

Content Areas of Instruction	Class/CC/ CVE Hrs.	Key Assignments	Curriculum Map: Anchor Standards	Pathway Standards	CC
I. Safety A. General Shop Safety Review 1. Personal Equipment a. Helmets b. Gloves c. Safety Glasses d. Leathers 2. Oxyacetylene Equipment Review 3. Basic Hand Tools – Use & Storage a. Grinders – Portable & Stationary b. Drills – Portable & Stationary c. Air Compressors & Air Tools d. Iron Worker & Shears e. Band Saws, Abrasive Saws & Cold Cut Saws f. Other 4. Welding Equipment Review **5.** Shop Cleanup & Procedures Review	**30**	Read and review general safety instructions. Discuss and take notes on safety procedures and requirements. Shop tour and discussion. General shop safety test passed by 100%.	**6.0**	**B1.0**	**RLST 11-12.10 WS 11-12.3 G-CO 1, G-CO 5 N-Q 2, N-Q 3 SEP 1-2, SEP 4-7 SEP 8, CC 1 & 3 CC 6-7, ETS1, ETS2**
II. Metal Cutting Processes A. Safety B. Oxyacetylene Cutting (Hand, Line Machines, Portable) C. Plasma D. Arc **E.** Air Carbon Arc		Read information, discuss and demonstrate the proper safety procedures on various types of cutting equipment Can read and find information from charts regarding pressure, setting tip sizes, travel speeds, and kerf sizes Students read the chart on the machine to verify they have the right tip and electrode for the size of material they are cutting	**4.7 6.0 10.0 11.1**	**B9.2 B9.6 C1.0 C2.1 C2.2 C2.4 C6.0**	**RLST 11-12.3 RLST 11-12.4 RLST 11-12.6 RLST 11-12.7 RLST 11-12.10 A-CED 1.1 G-C 2, G-CO 1-2 G-CO 5, G-CO 12 G-GMD 5 N-Q 1, S-IC 6 S-ID 1, SEP 1-4, SEP 6-8 CC 1-2, CC 3 CC 5, PS1.A, PS1.B, PS3.B, ETS1, ETS2, WH 10.11**
III. Shielded Metal Arc Welding (Out of Position) A. Power Sources 1. Transformer 2. Rectifier		Fill out PowerPoint packets, read welding journal articles, and answer relevant questions regarding	**4.7 6.0 10.0 11.1**	**B1.0 B8.0 B9.0 C1.0**	**RLST 11-12.3 RLST 11-12.4 RLST 11-12.6 RLST 11-12.7**

	3. Generator 4. Inverter Technology B. Welding Positions 1. Vertical Up 2. Overhead C. Electrode Proficiencies 1. E-7018 2. E-7024 **3.** Specialty Electrodes		the articles using the Bloom's Taxonomy of questioning		**C2.0** **C3.0** **C5.0** **C6.0** **C8.0**	**RLST 11-12.10** **WS 11-12.3** **WS 11-12.9** **WHSST 11-12.9** **A-CED 1.1** **A-REI 1, F-IF 1** **G-C 2, G-CO 1-2** **G-CO 5, G-CO 12** **G-GMD 5** **N-Q 1-3, S-IC 6** **S-ID 1,** **SEP 1-8** **CC 1-3** **CC 5-7, PS1.A, PS1.B, PS3.B, ETS1, ETS2, WH 10.11**
IV.	**Gas Metal Arc Welding** A. GMAW Processes 1. Short Circuit Transfer 2. Spray Arc Transfer 3. Flux Core 4. Dual Shield 5. Inner Shield B. Gases 1. Carbon Dioxide 2. Argon 3. Mixes C. AWS Wire Classification D. Positions 1. Flat 2. Horizontal 3. Vertical 4. Overhead E. Machine Maintenance 1. Care & Use 2. Wire Spool Change 3. Tips, Liners, Etc.	**75**	Know how to set the regulators and know how many cubic feet per hour are being used and can calculate how many hours at the current setting you can use.	**4.7** **6.0** **10.0** **11.1**	**B1.0** **B8.0** **B9.0** **C1.0** **C2.0** **C3.0** **C5.0** **C6.0** **C8.0**	**RLST 11-12.3** **RLST 11-12.4** **RLST 11-12.6** **RLST 11-12.7** **RLST 11-12.10** **WS 11-12.3** **WS 11-12.9** **WHSST 11-12.9** **A-CED 1.1** **A-REI 1, F-IF 1** **G-C 2, G-CO 1-2** **G-CO 5, G-CO 12** **G-GMD 5** **N-Q 1-3, S-IC 6** **S-ID 1,** **SEP 1-8** **CC 1-3** **CC 5-7, PS1.A, PS1.B, PS3.B, ETS1, ETS2, WH 10.11**
V.	**Gas Tungsten Arc Welding** A. TIG Welding 1. Power Source & Equipment 2. Gases 3. Filler Rods B. TIG Torches 1. Air	**20**	Fill out PowerPoint packet, read welding journal articles, and answer relevant questions regarding the articles using the Bloom's Taxonomy of questioning. Able to adjust the machine by understanding the relationship between amps travel speed, post flow time and gas volume settings	**4.7** **6.0** **10.0** **11.1**	**B1.0** **B8.0** **B9.0** **C1.0** **C2.0** **C3.0** **C5.0**	**RLST 11-12.3** **RLST 11-12.4** **RLST 11-12.6** **RLST 11-12.7** **RLST 11-12.10** **WS 11-12.3** **WS 11-12.9**

	2. Water C. Tungsten Electrode D. Metal Preparation E. Aluminum & Stainless Steel				**C6.0** **C8.0**	**WHSST 11-12.9** **A-CED 1.1** **A-REI 1, F-IF 1** **G-C 2, G-CO 1-2** **G-CO 5, G-CO 12** **G-GMD 5** **N-Q 1-3, S-IC 6** **S-ID 1,** **SEP 1-8** **CC 1-3** **CC 5-7, PS1.A,** **PS1.B, PS3.B,** **ETS1, ETS2,** **WH 10.11**
VI.	**Pipe Welding** A. SMAW – All Positions B. GMAW – All Positions C. GTAW – All Positions	**20**	Fill out PowerPoint packets, read welding journal articles, and answer relevant questions regarding the articles using the Bloom's Taxonomy of questioning	**4.7** **6.0** **10.0** **11.1**	**B1.0** **B8.0** **B9.0** **C1.0** **C2.0** **C3.0** **C5.0** **C6.0** **C8.0**	**RLST 11-12.3** **RLST 11-12.4** **RLST 11-12.6** **RLST 11-12.7** **RLST 11-12.10** **WS 11-12.3** **WS 11-12.9** **WHSST 11-12.9** **A-CED 1.1** **A-REI 1, F-IF 1** **G-C 2, G-CO 1-2** **G-CO 5, G-CO 12** **G-GMD 5** **N-Q 1-3, S-IC 6** **S-ID 1,** **SEP 1-8** **CC 1-3** **CC 5-7, PS1.A,** **PS1.B, PS3.B,** **ETS1, ETS2,** **WH 10.11**
VII.	**Metallurgy** A. Classification B. Ferrous C. Non-Ferrous Metals D. Shapes E. Size	**25**	Fill out PowerPoint packets, read welding journal articles, and answer relevant questions regarding the articles using the Bloom's taxonomy of questioning. Can read charts to figure out the pounds per foot that specific materials weigh Read and describe the different geometric shapes and understand the proper way to call out the types of metal you want on a bill of materials.	**4.7** **5.0** **6.0** **10.0** **11.1**	**B5.0** **B9.0** **C2.4** **C3.0** **C.4.0** **C6.0** **C7.1** **C7.2** **C8.0**	**RLST 11-12.2** **RLST 11-12.3** **RLST 11-12.7** **RLST 11-12.10** **A-REI 1, F-IF 1** **G-C 2, G-CO 1-2** **G-CO 5, G-CO 12** **N-Q 2,** **S-IC 3, S-IC 6** **C 4.0**

					SEP 1, SEP 3 SEP 5-8, CC 1-2 CC 5, PS1.A, PS1.B, PS3.B, ETS1, ETS2, WH 10.11
VIII. **Demonstrated Skill Applications** A. Electrode Use B. Multiple Positions **C.** AWS Certification	**20**		**4.7 6.0 8.0 10.0 11.1**	**B1.0 B8.0 C1.0-C6.0 C8.0**	**RSIT 11-12.7 RLST 11-12.2 RLST 11-12.3 RLST 11-12.4 RLST 11-12.6 RLST 11-12.7 RLST 11-12.10 WS 11-12.3 WS 11-12.9 WHSST 11-12.9 A-CED 1.1 A-REI 1, F-IF 1 G-C 2, G-CO 1-2 G-CO 5, G-CO 12 G-GMD 5 N-Q 1-3, S-IC 3 S-IC 6, S-ID 1, SEP 1-8 CC 1-3 CC 5-7, PS1.A, PS1.B, PS3.B, ETS1, ETS2, WH 10.11**
IX. **Individual or Group Project Design & Fabrication** A. Measuring Review B. CAD Drafting C. Welding Symbols D. Bill of Materials E. Cutting List F. Drawing & Layout G. Project Finish		Cut materials to length with the use of tape measures and rulers. Square projects by taking diagonal measurements and using the 3-4-5 triangle method. Use the Pythagorean Theorem to calculate material length. Use sine and co-sine to determine unknown angles. Add and subtract fractions to determine total length materials needed. Using percentages figure out taxes and shop fees for projects and add it to the bill of materials. Create a scaled drawing of each project using the proper dimensions to assist in determining the amount of materials needed. Use area and volume formulas to determine how many squares feet of materials are needed for the project design and how much materials are going to be needed to hold a certain	**2.0 4.0 5.0 6.0 7.0 10.0 11.1**	**B1.0 B5.0 B7.0 B8.0 B9.0 C1.0-C9.0**	**RSIT 11-12.7 RLST 11-12.2 RLST 11-12.3 RLST 11-12.4 RLST 11-12.6 RLST 11-12.7 RLST 11-12.10 WS 11-12.3 WS 11-12.9 WHSST 11-12.9 A-CED 1.1 A-CED 2, A-CED 4 A-REI 1, F-IF 1 G-C 2, G-CO 1-2 G-CO 5, G-CO 12**

			volume of liquid. Use the basic formula for figuring out what is the recommended size bead face required different sizes of materials			**G-GMD 5 N-Q 1-3, S-IC 3 S-IC 6, S-ID 1, S-ID 5, C 4.0 SEP 1-8 CC 1-3, CC 5-7, PS1.A, PS1.B, PS3.B, ETS1, ETS2, WH 10.11**
X.	**Competitions & Community Services Activities**	**40**		**3.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0**	**B1.0 B5.0 B7.0 B8.0 B9.0 C1.0-C3.0 C4.2 C5.0-C6.0 C8.0**	**RSIT 11-12.7 RLST 11-12.2 RLST 11-12.3 RLST 11-12.4 RLST 11-12.6 RLST 11-12.7 RLST 11-12.10 WS 11-12.3 WS 11-12.9 WHSST 11-12.9 A-CED 1.1 A-CED 2, A-CED 4 A-REI 1, F-IF 1 G-C 2, G-CO 1-2 G-CO 5, G-CO 12 G-GMD 5 N-Q 1-3, S-IC 3 S-IC 6, S-ID 1, SEP 1-8 CC 1-3, CC 5-7, PS1.A, PS1.B, PS3.B, ETS1, ETS2, WH 10.11**
XI.	**Employability Skills** A. Career Paths 1. Employment Opportunities 2. Educational/Certification Requirements B. Sources of Job Information C. Communication Skills D. Employment Literacy 1. Application 2. Resume 3. Cover Letter 4. Interviews	**20**	Students write job applications and resumes that provide clear and purposeful information and appropriately address the intended audience. Students modify the tome of their documents with varied levels, patterns, and types of language to appropriately address the intend audience. Students must follow the conventional style for each type of document, (e.g., resume, memorandum), as well as use page formats, fonts, and spacing that contribute to the readability and impact of the document.	**2.0 3.0 4.0 7.0 10.0 11.0**	**B1.0 B5.0 B9.0 C9.0**	**RLST 11-12.3 RLST 11-12.10 WS 11-12.3 WHSST 11-12.9 G-C 2, G-CO 1 G-CO 5, G-CO 12 N-Q 2, N-Q 3 S-ID 5, SEP 1-2 SEP 4-6, SEP 8 CC 1, CC 3, CC 6-7 ETS1, ETS2**

5. Grooming and Dress 6. Follow Up Letter E. Job Retention Skills 1. Team Work/Cooperation 2. Ethics and Professionalism 3. Work Habits and Ethics		As part of their "Job Search" research paper, students find out and write down the different types of jobs that are available in the field they are researching, where the jobs are located and what type of wages and benefits if any you can expect. Have guest speakers come in and take field trips regarding careers in welding and fabrication. Before the speaker comes in or we arrive at the location we discuss and compile a list of questions related to their topic and the students ask the questions and converse in more detail with the speaker. Complete a research paper on a welding career of their choice and present it to the class with charts that show years of school required, expected wages that could be earned and years of schooling needed for the specific career choice.			

Codes for California Standards:

ELA Strand Codes K – 12: RL – Reading: Literature; RI – Reading: Informational Text; RF – Reading: Foundational Skills; RH – Reading: History/Social Studies; RST – Reading: Science & Technical Subjects; W – Writing; WHST – Writing: History/Social Studies, Science & Technical Subjects; SL – Speaking & Listening

Mathematics Strand Codes: Number & Quantity (NQ); The Real Number System (N-RN); Quantities (N-Q); The Complex Number System (N- CN); Vector & Matrix Quantities (N-VM); Algebra (A); Seeing Structure in Expressions (A-SSE); Arithmetic with Polynomials & Rational Expressions (A-APR); Creating Equations (A-CED); Reasoning with Equations & Inequalities (A-REI); Functions (F); Interpreting Functions (I-IF); Building Functions (F-BF); Linear, Quadratic & Exponential Models (F-LE); Trigonometric Functions (F-TF); Geometry (G); Congruence (G-CO); Similarity, Right Triangles, & Trigonometry (G- SRT); Circles (G-C); Expressing Geometric Properties with Equations (G- PE); Geometric Measurement & Dimension (G-MGD); Modeling with Geometry (G-MG); Statistics & Probability (SP); Interpreting Categorical & Quantitative Data (S-ID); Making Inferences & Justifying Conclusions (S-IC); Conditional Probability & the Rules of Probability (S-CP); Using Probability to Make Decisions (S-MD)

Next Generation Science

Standards: History/Social

Science Standards: