Escondido Union High School District

Welding and Metal Fabrication 2

EUHSD Board Approval Date: 4/17/18
The EUHSD Welding and Metal Fabrication 2 curriculum document identifies what students should be able to know by grade level in a comprehensive standards-based course of study in the Engineering and Architecture Pathway. This curriculum document may be revised based on student academic achievement data, research and best practices, and input from stakeholders. The EUHSD curriculum document contains the following documents and/or information:

A. Course Description
B. Course Guidelines/Requirements - graduation credit information, transcript information, adopted materials, adopted technology, assessment outline
C. Instructional Materials References
D. Scope and Sequence Map with Essential Standards outlined by Unit
E. References to key essential design and implementation documents

A comprehensive course of study and/or program is designed so that all students have access to the rigorous curriculum necessary to graduate high school demonstrating college and career readiness skills. Student-centered learning provides opportunity for collaboration, communication, and a robust learning environment and provides opportunities for all students to meet the goals of the district’s Instructional Focus at the time of this writing: “All students communicate their thinking, ideas and understanding by effectively using oral, written and/or non-verbal expression.”

A key design consideration in the transition to the updated California State Standards is a focus on changes to pedagogy with an emphasis on ensuring students are engaged via relevant learning experiences.

A key design consideration in the transition to the new California State Standards is a focus on changes to pedagogy. The CA Learning Standards describe key instructional shifts, which guide classroom teaching and learning and provide a foundation of curriculum and instructional design based on student inquiry and a focus on rigorous literacy tasks. These instructional shifts can be found by visiting the following URL: [https://www.cde.ca.gov/Re/cc/](https://www.cde.ca.gov/Re/cc/)

The curriculum document is aligned to the California Learning Standards and—more specifically—the Model Career Technical Education Standards, the CTE Knowledge and Performance Anchor Standards, and the Pathway Standards specific to this course of study. All CTE standards are located here: [https://www.cde.ca.gov/ci/ct/sf/](https://www.cde.ca.gov/ci/ct/sf/)

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**Welding and Metal Fabrication 2 Course Description**
Welding and Metal Fabrication 2 is a two-semester second year course and part of the Manufacturing and Product Development Career Pathway. This course provides training in critical thinking, welding, and metal fabrication skills for employment in occupations such as Ironworkers, Bridge-Builders, Metal Fabricators, Sales, Welders/Cutters/Fitters, Welding Inspectors, and Welding Engineers. Students gain experience in joining and fastening materials through welding, use of polymers, and other bonding agents and learn how and where it is appropriate to use each of these joining and fastening techniques. Areas of welding practice include, gas, arc, MIG and TIG welding and the related processes. Students also use plasma and oxyacetylene cutting equipment, electric welding machines, cutoff saws and shears. All students follow and demonstrate industry safety practices and participate in a lab-based instructional setting. They learn about the history of welding and fabrication, developing a practical understanding of today's industry standard processes as well as looking forward to what welding and fabrication will look like in the near future. Students will have the opportunity to develop understanding and skills through hands-on experience with a variety of industry related tools. Students will design, create, present, and evaluate their own work and the work of their classmates. Completion of the course requires 180 instructional hours.

Course Requirements

<table>
<thead>
<tr>
<th>Course Length: Year Long</th>
<th>Grade Level: 11-12</th>
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<tbody>
<tr>
<td>UC/CSU Requirement:</td>
<td>Graduation Requirement: EUHSD Elective Credit or CTE Requirement</td>
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<tr>
<td>Course Number (Semester A): 6362</td>
<td>Transcript Abbreviation (Semester A): WELD MTL FAB 2 P A</td>
</tr>
<tr>
<td>Course Number (Semester B): 6363</td>
<td>Transcript Abbreviation (Semester B): WELD MTL FAB 2 P B</td>
</tr>
<tr>
<td>Credits (Semester A): 5 Elective or CTE</td>
<td>Credits (Semester B): 5 Elective or CTE</td>
</tr>
<tr>
<td>Industry Sector: Manufacturing and Product Development</td>
<td>Recommended Prerequisite/s: None</td>
</tr>
<tr>
<td>Board Approval Date (Curriculum): 4/17/18</td>
<td>Career Pathway: Welding and Materials Joining</td>
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<tr>
<td>Board Approval Date (Materials):</td>
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Core Instructional Material/s:
- GMAW, & FCAW (DVDs, Instructor Guides, Technical Guides, Student Workbook, Written Tests)
- Welding and Metal Fabrication, by Larry Jeffus, Cengage Learning
- S/P2 Welding Safety Course

Supplemental Instructional Material/s:
- Gas Metal Arc Welding Handbook, W. Minnick. Goodheart-Willcox Publisher
- Shielded Metal Arc Welding, Walker/Polanin. G-W Publisher
- Oxyfuel Gas Welding, Bowditch/Bowditch. G-W Publisher
- Flux Cored Arc Welding Handbook, W. Minnick. G-W Publisher
- Gas Tungsten Arc Welding Handbook, Minnick/Prosser. G-W Publisher

Technology Resource/s: Students utilize a variety of technical equipment in the work/lab space including a variety of safety apparatus, welding and metal working tools and machines, and occasional access to computer workstations loaded with content specific software.

Assessments: The course is designed as a project-based curriculum and includes a variety of formative and summative assessments. Each unit outlines specific skills and/or long-term projects, which serve as unit and course assessments.

Meeting the Needs of ELs:
Our student information system is used by site leaders and instructors to acquire the language levels of EUHSD English Learners to ensure they are identified and their specific needs are met. Our approach to supporting English learners in based on the CA Department of Education (CDE) adopted language level proficiency descriptors and updated ELD Learning Standards. Visit the following website to learn more about those new descriptors and corresponding standards: [http://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf](http://www.cde.ca.gov/sp/el/er/documents/eldstndspublication14.pdf)

EUHSD uses the ELA-ELD Framework to inform pedagogical practices related to supporting English Learners. Visit the following URL to learn more about the new frameworks which describe in detail specific research-based best practices used to support English Learners: [http://www.cde.ca.gov/ci/rl/cf/documents/elaeldfwchapter11.pdf](http://www.cde.ca.gov/ci/rl/cf/documents/elaeldfwchapter11.pdf)

Instructional Resources:
- Machinery’s Handbook

Instructional Strategies:
- Teacher led modeling and direct instruction
<table>
<thead>
<tr>
<th>Resource</th>
<th>Activity</th>
</tr>
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<tbody>
<tr>
<td><a href="https://sp2.org/site/">https://sp2.org/site/</a> (Unit 1)</td>
<td>Industry guest presentation</td>
</tr>
<tr>
<td><a href="http://www.osha.gov">www.osha.gov</a> (Unit 1)</td>
<td>Industry fieldtrips and open-houses</td>
</tr>
<tr>
<td><a href="http://www.youtube.com">www.youtube.com</a></td>
<td>Video demonstrations</td>
</tr>
<tr>
<td>Safety Manual</td>
<td>Group work and/or pair work</td>
</tr>
<tr>
<td><em>Precision Machining Technology, Section 4: &quot;Drill Press&quot; (Unit 2)</em></td>
<td>Differentiate vocabulary or use of glossary</td>
</tr>
<tr>
<td><a href="http://www.globalclassroom.org/rulegame200/">http://www.globalclassroom.org/rulegame200/</a> (Unit 3)</td>
<td>Teacher led demonstrations on all equipment prior to safety tests</td>
</tr>
<tr>
<td>A variety of intermediate digital and print texts including instructional and modeling videos</td>
<td>Use of instructional notebooks and digital and physical portfolios</td>
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The Scope and Sequence Guide for this course is informed by the California Learning Standards and delineates the concepts and skills students are expected to acquire in order to meet College and Career Readiness expectations set for by the state and local board approved guidelines. Each unit of study is designed to build upon the previous unit and/or prerequisite coursework in support of student mastery of specific standards based skills. This Scope and Sequence document provides guidelines for instructors to ensure they have the necessary information related to content and pedagogy to guarantee students can meet the learning objectives of the course. The document is updated as needed based on input from all stakeholders to ensure it meets the needs of students.

All Career Technical Education coursework in the EUHSD is based on a series of state-adopted CTE standards which include the CTE Knowledge and Performance Anchor Standards, the California Standards for Career Ready Practice, and the CTE Model Curriculum Pathway Specific Standards. Not every standard and its related learning objective is included in the Scope and Sequence Guide since this document provides the essential pathway focus standards and key learning objectives for each unit with the related assignments and assessments. However, all of the CTE model Curriculum Pathway Standards are imbued in the student tasks throughout the course with specific standards emphasized in particular units in order to ensure students build the skills to ensure their success.

The CTE Standards for Career Ready Practice and CTE Model Curriculum Pathway Specific Standards below are integrated throughout the units and describe the fundamental knowledge and skills that a career ready student needs in order to prepare for transition to postsecondary education, career training, or the workforce. These standards are not exclusive to a career pathway, a CTE program of study, a particular discipline, or level of education. Standards for Career Ready Practice are taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a given pathway/program of study.

### CTE Standards for Career Ready Practice
1. Apply appropriate technical skills and academic knowledge.
2. Communicate clearly, effectively, and with reason [both in writing and verbally]
3. Develop an education and career plan aligned with personal goals.
4. Apply technology to enhance productivity
5. Utilize critical thinking to make sense of problems and persevere in solving them.
6. Practice personal health and understand financial literacy.
7. Act as a responsible citizen in the workplace and the community.
8. Model integrity, ethical leadership, and effective management.
9. Work productively in teams while integrating cultural and global competence.
10. Demonstrate creativity and innovation
11. Employ valid and reliable research strategies.
12. Understand the environmental, social, and economic impacts of decisions

### CTE Model Curriculum Pathway Specific Standards
1. Academics: Analyze and apply appropriate academic standards...
2. Communications: Acquire and accurately use general academic and domain specific words...
3. Career Planning and Management: Integrate multiple sources of information...
4. Technology: Use technology, including the Internet, to produce, publish, and update writing...
5. Problem Solving and Critical Thinking: Conduct short as well as more sustained research...
6. Health and Safety: Determine the meaning of symbols, key words [related to health and safety...]
7. Responsibility and Flexibility: Initiate and participate in a range of collaborative discussions...
8. Ethics and Legal Responsibilities: Respond thoughtfully to diverse perspectives...
9. Leadership and Teamwork: Work with peers...[to] set clear goals,...establish individual roles...
10. Technical Knowledge and Skills: Use technology...to produce, publish, and update...products...
11. Demonstration and Application: Demonstrate and apply the knowledge and skills contained in the industry-sector anchor standards, pathway standards, and performance indicators...
**Welding and Metal Fabrication 2 Scope and Sequence**

**Unit 1 – Workshop Safety Review**

**Length: 1 Week and Ongoing**

**Unit Description:** In Unit 1, students will participate in hands-on activities designed to build on their prior understanding of safe practices in a workshop environment. Students examine and create specific safety policies, procedures, and practices; they also examine sample workspaces for safety and/or health concerns and demonstrate a variety of safety practices through various classroom assignments and activities and will demonstrate their understanding through completion of a required safety test. All of the skills and procedures acquired in this unit will be used in subsequent units of study and are designed to ensure students can present and respond—if necessary—to work-related accidents and emergencies.

**Focus Unit Standards:**

**Manufacturing and Product Development Anchor Standards:**

6.0 Health and Safety Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Manufacturing and Product Design sector workplace environment. (Direct alignment with RSTS 9-10, 11-12.4)

6.1 Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions.

6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.

6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.

6.4 Set up a work area, or shop, to avoid potential health concerns and safety hazards including but not limited to ergonomics, electrical (shock), wires (tripping), fumes (lung health), noise (hearing loss), fire (burns), and so forth, incorporating ergonomics.

6.5 Practice personal safety when lifting, bending, or moving equipment and supplies.

6.6 Demonstrate how to prevent and respond to work-related accidents or injuries and emergencies.

6.7 Maintain a safe and healthful working environment.

6.8 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA).

**Manufacturing and Product Development Pathway Standards:**

C9.1 Know how scheduling, quality control, accident prevention, and inventory control are used efficiently and appropriately in a welding production management system.

**Learning Objectives:**

Students will…

- Present to one another and the instructor a Material Safety Data Sheet including what it is, its features, where to access it, and how to apply its information to enhance personal safety. Students may be asked to create documents and safety related materials for students in the entry-level course.

- Review and present a workshop protocol document to demonstrate that they know what they are responsible for in the workshop.

- Show their understanding of how to properly store, clean and maintain tools, equipment and supplies.

- Safely set up their work areas to avoid health hazards and injuries.

- Demonstrate safe and proper techniques when moving equipment and supplies.

- Demonstrate how to prevent and respond to work related accidents, injuries and emergencies.

- Maintain a safe and healthful work environment.

- Recall 2-3 OSHA laws, which pertain to worker safety and apply them to various scenarios.

**Key Unit Assignments and Assessments:**

- Students will work in groups of 2-3 to review, revise or create an infographic poster, pamphlet, or document diagramming and outlining key components of workshop safety. Students will present their posters to two other groups, and groups will evaluate one another’s posters and presentation quality.

- In order to demonstrate their ability to work safely in the shop environment, all students in course 2 shall take a multiple choice safety assessment and pass the test with 90% accuracy prior to utilizing equipment and/or working in the shop area. All wrong questions will be written out with the correct answers, and will contain reasoning as to why the correct answer is appropriate.

- Students will review, revise and/or develop a housekeeping/clean-up plan for each shop based on photographs and videos of the workshops as they appear during actual work. The plan will be in a spreadsheet format, identifying potential hazards and ways to mitigate those hazards so they do not result in injuries.

- Students complete a series of measurement tests designed to assess their understanding and mastery of basic measurements utilized throughout the course. This may be either a hands on and/or paper demonstration of understanding (fraction, inch, decimal inch, dial caliper, micrometer, etc.).

- Evaluation of safety posters determining accuracy and relevance.

- Written safety assessment with 100% correct responses, formative—students can retake after review.

- Measuring Test with passing score of 85%.
Welding and Metal Fabrication 2 Scope and Sequence
Unit 2 – Intermediate/Advanced Welding and Cutting Processes

Length: Ongoing (these skills and concepts in are reinforced and refined throughout the school year)

Unit Description: In Unit 2, after receiving a reintroduction regarding the various metalworking and machine tools used in the welding and metal fabrication trade, students are trained in the safe operation of each machine through written, verbal and demonstration methodologies that include the proper demonstration of the primary tools and equipment as well as the creation of procedural use list(s). Various tools are used to support the completion of major projects.

Focus Unit Standards:
Manufacturing and Product Development Pathway Standards:
C2.0 Understand and demonstrate how materials can be processed through the use of welding tools and equipment.
C2.2 Use standard and new emerging welding tools and equipment, such as oxygen fuel cutting (OFC), plasma arc cutting (PAC), and carbon arc cutting (CAC) to cut materials for the purpose of completing a finished product that meets the standards of the AWS or a similar industry standard.
C2.3 Use welding tools and equipment such as oxy fuel welding (OFW), shielded metal arc welding (SMAW), gas metal arc welding (GMAW), flux-cored arc welding (FCAW), gas tungsten arc welding (GTAW), forge, and furnace to combine or join manufactured parts and products resulting in a finished product that meets the standards of the AWS or a similar industry standard.
C3.1 Use welding tools such as OFW, SMAW, GMAW, FCAW, GTAW, forge, and furnace and the equipment and assembly processes appropriate to the design criteria of a specific product to result in a finished part or product that meets the standards of the AWS or similar industry welding standards.
C6.1 Select and use appropriate welding tools, equipment, and inspection devices to manufacture parts or products.
C6.3 Research new and emerging welding systems and their effects on the standard hand and machine manufacturing industry.
C8.1 Recognize the importance of base metal preparation and joint fit-up and alignment.
C8.2 Analyze and be able to defend various welding processes used to complete a fabrication, an assembly, or a repair.
C8.3 Produce a completed fabrication, an assembly, or a repair by using appropriate joining and mechanical fastening techniques and processes.

Learning Objectives:

Students will…
- Describe necessary preparations for various welded joints.
- Properly install the major components of an FCAW machine to prepare for welding.
- Achieve the correct shielding gas flow, voltage, and wire feed settings in preparation for welding a given thickness of metal on an FCAW machine.
- Properly install the major components of a GTAW machine to prepare for welding.
- Select the correct electrode type, electrode size, and set the correct amperage in preparation for welding a given thickness of metal on a GTAW machine.
- Properly install the major components of an OFW setup to prepare for welding.
- Select the appropriate torch tip and filler metal size and achieve the correct gas pressures in preparation for welding a given thickness of metal using oxy-fuel welding equipment.
- Select the appropriate torch tip and achieve the correct gas pressures in preparation for cutting a given thickness of metal using oxy-fuel cutting equipment.
- Use an oxy-fuel cutting torch to make straight cuts through weld joints for the purpose of re-using the metal for welding practice.

Key Unit Assignments and Assessments:

Items 1 and 2 will be part of the student’s certification process. Students will spend a significant amount of time throughout the school year, practicing items 1 and 2.
Item 3-7 will not be part of the student’s certification process. Items 3-7 are in response to Industry Standards and Expectations.

1. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for completing a weldment, which includes outside corner, butt, lap, and tee joints in the flat position on carbon steel using the FCAW process.
2. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for completing a weldment, which includes outside corner, butt, lap, and tee joints in the flat position on carbon steel using the GTAW process.
3. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for completing a brazing weldment, which includes outside corner, butt, lap, and tee joints in the flat position on carbon steel using the OFW process.
4. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for using the oxy-acetylene gas-cutting torch to make straight cuts through weld joints for the purpose of re-using the metal for welding practice.
5. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for making straight, bevel and pierce cuts on ¼” mild steel plate.
6. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for completing the SkillsUSA test plate for oxy-fuel cutting.
7. Students will, through written, verbal and demonstration methods, demonstrate/list procedures to correctly set up the operation of the Oxygen Acetylene Cutting torch. Utilizing this
cutting process, students will perform skill-building practice cuts on ¼" thick mild steel plate. As a performance task, students will cut out a 5" x 5" dimensioned test plate with various features.

Students will complete the following tasks in addition to those listed above:

- Create and inspect acceptable welds in each process for the outside corner, butt, lap, and tee joints.
- Receive a passing result of a break test on the standard 3-piece weldment using the FCAW process.
- Receive a passing result of a break test on the standard 3-piece weldment using the GTAW process.
- Receive a passing result of a break test on the standard 3-piece weldment using the OFW process.
- Receive an acceptable evaluation of cut edges by instructor
- Receive an acceptable evaluation of cut quality and dimensions of OFC test plate

Final exams to test overall knowledge of the various preparations and knowledge of welding machines, hand tools, power tools and fabricating machines.
Welding and Metal Fabrication 2 Scope and Sequence
Unit 3 – Fabrication Tools and Machines Advanced Projects

Length: Ongoing (skills in Unit 3 are reinforced and refined throughout the school year; initial instructional time is approximately 4 weeks/15 hours)

Unit Description: In Unit 3, after receiving reintroduction about various metalworking tools, metalworking machines, and welding machines, students are trained in the safe operation of each machine and through written, verbal and demonstration methods, demonstrate/list procedures for each of those tools. They apply these skills on specific projects delineated below and use the various tools and machines mentioned in this unit in support of completing the major projects for the Welding & Fabrication 2 course.

Focus Unit Standards:
Manufacturing and Product Development Pathway Standards:
B1.0 Validate that a provided part meets specifications from its engineering drawing by comparing specifications (geometric dimensioning and tolerancing) and by demonstrating proper technique using appropriate precision measuring tools.
B1.2 Demonstrate the correct use of precision measuring tools such as vernier and dial calipers and height gauges, utilizing both English and Metric systems.
B2.4 Use a surface plate, surface gauge, height gage, prick and center punches, scriber, layout dye, and other appropriate tools to locate hole centers, radii, and locations matching the specifications provided.
B4.0 Demonstrate a cutoff saw operation(s) to produce a length of bar stock to specification.
B4.1 Using a length of bar stock and a process specification or drawing, cut a length of bar stock matching the cut list and demonstrate no sharp edges.
B5.2 Describe and demonstrate the care and use of the common file which can be used to form radii on a variety of commercially available metals or those that have been cast or forged.
B5.9 Complete a layout project using a detailed set of sequential instructions to manufacture the project to plan specifications.
B7.1 Set up and safely operate a drill press.
B7.3 Drill, tap, or ream holes according to specifications.
B7.4 Research the proper material machinability and tooling recommendations from trade resources such as 'Machinery's Handbook'; choose the correct tool and holder; and calculate the spindle rpm and the feed rate for holes.
B7.5 Perform secondary operations on each hole to specification including reaming, counter-sinking, counter boring, tapping, and deburring.
B2.0 Understand and demonstrate how materials can be processed through the use of welding tools and equipment.
C2.2 Use standard and new emerging welding tools and equipment, such as oxygen fuel cutting (OFC), plasma arc cutting (PAC), and carbon arc cutting (CAC) to cut materials for the purpose of completing a finished product that meets the standards of the AWS or a similar industry standard.

Learning Objectives:

- Students will...
  - Safely use a variety of metalworking and finishing tools (machine tools, portable electric tools, pneumatic tools, layout tools, hand tools, etc.) in order to complete required projects.
  - Use measuring tools to verify conformance of parts according to technical drawings.
  - Use measuring tools to accurately create layout lines for the purposes of cutting out material or outlining a part's edges.
  - Explain the major parts and functions of a twist drill bit.
  - Set up and use various tool-holding and work-holding devices on the press.
  - Set up and safely operate a drill press.
  - Calculate the appropriate RPM for a given work piece.
  - Perform drill press operations such as drilling, reaming, countersinking, counter boring, tapping, and deburring.
  - Set up and safely operate the oxygen fuel-cutting torch and the plasma arc-cutting torch.
  - Select which welding process would be best suited for a particular project based on part function, application, installed location, and desired aesthetics.

- Students will become knowledgeable about the working parts of various machines by completing Machine Parts Matching worksheets.
- Students will complete Workbook Section 4; Unit 2 questions entitled Tools, Tool Holding, and Workholding for the Drill Press in order to familiarize them with the various tools used on the drill press.
- Students will be guided through the peer-to-peer Set-up and Operation Observation Checklist so they will be able to evaluate one another.
- Students will cut out raw stock, perform deburring operations, layout dimension and feature lines, and remove excess metal to produce parts to specific dimensions, which are with tolerance, and perform finishing techniques to produce complete parts.
- Students will perform measurements and inspections to ensure that their projects are made to specification in order to evaluate their own, as well as their peers' projects.
- Students will, through written, verbal, and demonstration methods, demonstrate/list procedures for preventing common hazardous conditions associated with the use of welding machines and power tools in order to prevent accidents and injuries.
- Students review and revise Welding Machine Setup and Operation Observation checklists.

Specific Projects:
| C6.0 Explore and understand various welding systems that require standard hand and machine tools.  
| C6.1 Select and use appropriate welding tools, equipment, and inspection devices to manufacture parts or products.  
| C8.0 Understand various joining or combining processes, including welding processes used in manufacturing, maintenance, and repair.  
| C8.2 Analyze and be able to defend various welding processes used to complete a fabrication, an assembly, or a repair.  |

- Students will collaborate to build a functioning go-kart, taking the project from ideation/conceptualization to engineering drawing. After students develop a plan of procedure, they will deliberate about what tools, machines, and welding processes are most fitting to build their project. After the project is complete, they will share their design and construction process with the class to allow for questioning, feedback, and ideas about how to improve the overall process based on achieving the desired outcome, keeping work time and cost as low as possible.

- **Student choice:** Students will select an appropriate finishing process to meet the design criteria of a specific welded product, and apply the process to a manufactured part of the project.
Focus Unit Standards:

Manufacturing and Product Development Anchor Standards:

- 7.2 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.
- 8.4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace.
- 9.1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
- 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
- 9.3 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
- 9.4 Explain how professional associations and organizations and associated leadership development and competitive career development activities enhance academic preparation, promote career choices, and contribute to employment opportunities.
- 9.6 Respect individual and cultural differences and recognize the importance of diversity in the workplace.

Manufacturing and Product Development Pathway Standards:

- B1.2 Demonstrate the correct use of precision measuring tools such as vernier and dial calipers and height gages, utilizing both English and Metric systems.
- C1.0 Interpret and demonstrate the planning and layout operations used in the welding processes.
- C1.1 Use current information technology ideation and design process systems in the manufacturing of welded parts and products.

Learning Objectives:

Students will…

- Interpret weld symbols on drawings and locate dimension, tolerance, process, and finishing information.
- Create isometric and orthographic drawings from a representative object.
- Solve basic welding fabrication math problems.
- Round numbers.
- Convert mixed units, fractions and decimal fractions.
- Reduce fractions and decimal fractions.
- Regularly practice the traits of responsible and capable employees (such as punctuality, integrity, showing initiative, having a safe attitude, and maintaining a commitment to excellence).

Leadership and Project Management:

Students will…

- Practice time management and efficiency to fulfill responsibilities.
- Regularly practice the traits of responsible and capable employees (such as punctuality, integrity, showing initiative, having a safe attitude, and maintaining a commitment to excellence).

Key Unit Assignments and Assessments:

The review and extension of the projects/tasks below are part of the students’ ongoing achievement of the certification process. Students spend a significant amount of time throughout the school year continuing to practice and apply these skills.

Students will, through written, verbal and demonstration methods do the following:

- Explore, define and demonstrate effective employee traits and skills.
- Communicate effectively regarding which parts are checked for workmanship and accuracy against the products’ technical drawings and dimensions.
- Select and apply an appropriate finishing process to meet the design criteria of a specific welded product, and apply the process to fabricated parts.

Specific Student Projects (choose two):

- Motorsport fabricated project
- Home décor fabricated project
- Wood-burning “BBQ” or fire-pit project
- Mobile cart fabricated project
- Fabricated metal art project
- CNC plasma-cut welding project

Students must produce at least two completed projects along with an engineering drawing, plan of procedure,
C1.2 Interpret scaled welding blueprints; gather design and materials information; perform calculations; and use the detail to plan, lay out, and produce parts or finished products.
C1.3 Analyze welding symbols on drawings, specifications, and welding procedure specifications.
C2.1 Introduce joint preparation methods and explain how to identify joint specifications.
C2.4 Compare and contrast the physical qualities of various industrial materials and how these qualities affect the ability of the materials to be processed to produce useful welded parts and products.
C4.0 Understand finishing processes and the differences between various types of finishing materials used in the manufacture of welded parts and products.
C4.1 Employ and explain the steps to be taken, and the choices to be made, in finishing welded materials.
C4.2 Apply the processes used for finishing welded materials.
C4.3 Assess how to select an appropriate finishing process to meet the design criteria of a specific welded product.
C6.2 Compare and contrast the various welding systems used in conventional manufacturing industries in order to select and use appropriate tools, equipment, and inspection devices.
C8.0 Understand various joining or combining processes, including welding processes used in manufacturing, maintenance, and repair.
C8.1 Recognize the importance of base metal preparation and joint fit-up and alignment.

- Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
- Interpret weld symbols on drawings and locate dimension, tolerance, process, and finishing information.
- Create isometric and orthographic drawings from a representative object.
- Solve basic welding fabrication math problems.
- Round numbers.
- Convert mixed units, fractions and decimal fractions.
- Reduce fractions and decimal fractions.
- Regularly practice the traits of responsible and capable employees (such as punctuality, integrity, showing initiative, having a safe attitude, and maintaining a commitment to excellence).

welding process and assembly overview, finishing techniques, and a critical critique by both the fabricator and the audience.

At least one project must be entered for consideration into the San Diego County Fair along with a measured blueprint and student welder biography to go on display with their project.

All course 2 students will undergo a final project-based assessment to test their overall knowledge and application of the various preparations and knowledge of welding machines, hand tools, power tools and fabricating machines. These will be maintained in a portfolio.
Welding and Metal Fabrication 2 Scope and Sequence
Unit 5 – Weld Inspection, Testing, and Certification
Length: 8 Weeks

Unit Description: Unit 5 is the final unit of course 2 and—just as in course 1—students must perform semi-precision measurements that enable them to verify project parameters and requirements. Students will complete a more advanced weld sample designed to demonstrate their increasing understanding of quality assurance and how the process is used to produce parts that are within workmanship acceptability according to industry standards. Their work must be completed in accordance with typical American Welding Society inspection techniques. After completing a welding sample, the welded piece will be tested using destructive testing and, upon passing the test, students will be issued the appropriate associated welding certifications from the American Welding Society (AWS) for structural steel (D1.1) thus demonstrating their ongoing development in the application of welding and metal fabrication.

Focus Unit Standards:
Manufacturing and Product Development Anchor Standards:
10.0 Technical Knowledge and Skills Apply essential technical knowledge and skills common to all pathways in the Manufacturing and Product Design sector, following procedures when carrying out experiments or performing technical tasks. (Direct alignment with WS 11-12.6)

Manufacturing and Product Development Pathway Standards:
C2.1 Introduce joint preparation methods and explain how to identify joint specifications.
C4.2 Apply the processes used for finishing welded materials.
C5.1 Identify and explain weld imperfections and their causes.
C5.2 Identify and explain destructive and nondestructive examination practices.
C5.4 Analyze and identify the steps to check for distortion, joint misalignment, and poor fit-up before and after welding.
C8.1 Recognize the importance of base metal preparation and joint fit-up and alignment.
C8.3 Produce a completed fabrication, an assembly, or a repair by using appropriate joining and mechanical fastening techniques and processes.

CTE Anchor Standard emphasized in end-of-course project(s):
10. Demonstrate creativity and innovation. Career-ready individuals recommend ideas that solve problems in new and different ways and contribute to the improvement of the organization. They consider unconventional ideas and suggestions by others as solutions to issues, tasks, or problems. They discern which ideas and suggestions may have the greatest value. They seek new methods, practices, and ideas from a variety of sources and apply those ideas to their own workplace practices.

Learning Objectives:
Students will…
• Use common welding inspection measuring devices such as gauges, calipers, and rules to verify a weldment’s conformance to acceptability criteria as set forth in the AWS’ structural steel codebook (D1.1).
• Examine welding samples with common weld discontinuities to determine if the welds are defective or if the discontinuities fall within the ranges of acceptability set forth in the D1.1 codebook.
• Achieve AWS D1.1 certification in FCAW and SMAW in 3/8” steel in the flat position.
• Produce a completed fabrication, an assembly, or a repair by using appropriate joining and mechanical fastening techniques and processes.
• Apply the processes used for finishing welded materials.
• Review and identify common weld discontinui ties, what causes them, and then take corrective action to prevent them.
• Explain the difference between destructive and non-destructive testing methods, and when each would best be used in a more detailed manner and with greater efficiency and accuracy than was necessary in course 1.

Key Unit Assignments and Assessments:
In order to receive the welding certification, students must demonstrate competency by performing the following skills in greater detail and with more technical language than was required in course 1.

Students will, through written, verbal and demonstration methods, demonstrate/list procedures for:
✓ Preparing weld plates (grinding mill scale, grinding bevels)
✓ Fitting together and tacking weld plates
✓ Completing groove weld stringer passes and a cover pass
✓ Removing a backing strip and grinding off weld reinforcement
✓ Measuring out test strip specimens
✓ Cutting out test strip specimens
✓ Post-processing test strip specimens and radiusing sharp edges in preparation for a destructive bend test

Final Project-based Assessments:
➢ Students will perform intermediate to advanced visual inspections of welded plates for acceptability.
➢ Students will create written reflections of the processes used to produce the test plates and the weldment, describing the excision, and bending of specimens.
➢ Students will create and/or build-on a final welding and metal fabrication *project that meet the conformance of weld test specimens and bend test results to AWS Structural Steel D1.1 Welding Code.
➢ Students will gather, organize and present the concepts, skills, and products they learned and created in course 2 and present them both
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<th>Review, explain and demonstrate how base metal is prepared before welding and know the principles of good joint fit-up.</th>
<th>Achieve AWS D1.1 certification in GMAW and SMAW in 3/8” steel in the flat position.</th>
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<td>in class and to outside audiences including other students as well as industry representatives.</td>
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<tr>
<td><em>Students are encouraged to enter a chosen product at a state or local event such as a fair or trade show as well as present their work in a digital portfolio.</em></td>
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