

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

INTRODUCTION TO METALS

Date: May 2017

Proposed Grade Level(s): 9-12

Grading: A-F

CTE Sector / Pathway: Manufacturing and Product Development / Welding and Materials Joining

Prerequisite(s): None

Intent to Pursue 'A-G' College Prep Status: No

Course Length: 1 Semester

Subject Area: Career Technical Education

Credits: 5.0

COURSE DESCRIPTION:

Students are introduced to metal technology and its use in industry through a variety of experiences in working metals: bench work, welding, and machining. Activities are designed for students to construct useful articles. Design, planning, and metalworking activities will be an integral part of the course. Safety is emphasized in the use of hand tools and power equipment throughout the course.

GENERAL GOALS/ESSENTIAL QUESTIONS:

Goals:

- Students will have the opportunity to experience skill-building activities that are related to metalworking occupations.
- Students will select procedures, tools, and/or equipment including computer and related technologies.
- Students will work safely and be able to recognize potential hazards.
- Students will develop interpersonal skills, work habits, and acquire information that will lead to an informed decision for future employment.
- Students will identify, organize, plan, and allocate resources in the development of products.
- Students will know how social, organizational, and technological systems work, and operate effectively within them in performing tasks in a collaborative effort.

Essential Questions:

- Can students be self-directed learners who will be able to solve engineering problems?
- Can students be effective communicators who can express technology and manufacturing concepts to others effectively?
- Can students become quality producers who can solve manufacturing problems in a neat and organized manner?
- Are students able to become successful constructive thinkers who are able to approach complex manufacturing problems in an organized, logical, and systematic fashion?
- Can students learn to be collaborative workers who can work in teams to accomplish a task?
- Are students able to be responsible citizens who accept responsibility for their actions?
- Will students become trusted to conduct themselves safely and professionally in a manufacturing environment?

COMMON CORE STATE ANCHOR STANDARDS FOR READING (K-12):

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Reading Range / Text Complexity

10. Read and comprehend complex literary and informational texts independently and proficiently.

COMMON CORE STATE ANCHOR STANDARDS FOR WRITING (K-12):

Text Types and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details and well-structured event sequences.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Research to Build Knowledge

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Range of Writing

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

COMMON CORE STATE ANCHOR STANDARDS FOR SPEAKING AND LISTENING (K-12):

Comprehension and Collaboration

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

Presentation of Knowledge and Ideas

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and ensure that the organization, development, and style are appropriate to task, purpose, and audience.
5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

CTE STANDARDS FOR CAREER READY PRACTICE:

1. Apply appropriate technical skills and academic knowledge.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education. They make connections between abstract concepts with real-world applications and recognize the value of academic preparation for solving problems, communicating with others, calculating measures, and other work-related practices.
2. Communicate clearly, effectively, and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, using written, verbal, electronic, and/or visual methods. They are skilled at interacting with others, are active listeners who speak clearly and with purpose, and are comfortable with the terminology common to the workplace environment. Career-ready individuals consider the audience for their communication and prepare accordingly to ensure the desired outcome.
3. Develop an education and career plan aligned with personal goals.
Career-ready individuals take personal ownership of their own educational and career goals and manage their individual plan to attain these goals. They recognize the value of each step in the educational and experiential process and understand that nearly all career paths require ongoing education and experience to adapt to practices, procedures, and expectations of an ever-changing work environment. They seek counselors, mentors, and other experts to assist in the planning and execution of education and career plans.
4. Apply technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They understand the inherent risks—personal and organizational—of technology applications and they take actions to prevent or mitigate these risks.
5. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals recognize problems in the workplace, understand the nature of the problems, and devise effective plans to solve the problems. They thoughtfully investigate the root cause of a problem prior

to introducing solutions. They carefully consider options to solve the problem and, once agreed upon, follow through to ensure the problem is resolved.

6. Practice personal health and understand financial literacy.

Career-ready individuals understand the relationship between personal health and workplace performance. They contribute to their personal well-being through a healthy diet, regular exercise, and mental health activities. Career-ready individuals also understand that financial literacy leads to a secure future that enables career success.

7. Act as a responsible citizen in the workplace and the community.

Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are aware of the impacts of their decisions on others and the environment around them and think about the short-term and long-term consequences of their actions. They are reliable and consistent in going beyond minimum expectations and in participating in activities that serve the greater good.

8. Model integrity, ethical leadership, and effective management.

Career-ready individuals consistently act in ways that align with personal and community-held ideals and principles. They employ ethical behaviors and actions that positively influence others. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they recognize the short-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

9. Work productively in teams while integrating cultural and global competence.

Career-ready individuals positively contribute to every team as both team leaders and team members. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They interact effectively and sensitively with all members of the team and find ways to increase the engagement and contribution of other members.

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.

11. Employ valid and reliable research strategies.

Career-ready individuals employ research practices to plan and carry out investigations, create solutions, and keep abreast of the most current findings related to workplace environments and practices. They use a reliable research process to search for new information and confirm the validity of sources when considering the use and adoption of external information or practices.

12. Understand the environmental, social, and economic impacts of decisions.

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment. They are aware of and utilize new technologies, understandings, procedures, and materials and adhere to regulations affecting the nature of their work. They are cognizant of impacts on the social condition, environment, workplace, and profitability of the organization.

CTE KNOWLEDGE AND PERFORMANCE ANCHOR STANDARDS:

1.0 Academics: Students will analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment.

2.0 Communications: Students will acquire and accurately use Manufacturing and Product Development sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

- 3.0 Career Planning and Management: Students will integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.
- 4.0 Technology: Students will use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the Manufacturing and Product Development sector workplace environment.
- 5.0 Problem Solving and Critical Thinking: Students will conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Manufacturing and Product Development sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.
- 6.0 Health and Safety: Students 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 Development sector workplace environment.
- 7.0 Responsibility and Flexibility: Students will initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Manufacturing and Product Development sector workplace environment and community settings.
- 8.0 Ethics and Legal responsibilities: Students will practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.
- 9.0 Leadership and Teamwork: Students will work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organizations.
- 10.0 Technical Knowledge and Skills: Students will apply essential technical knowledge and skills common to all pathways in the Manufacturing and Product Development sector, following procedures when carrying out experiments or performing technical tasks.
- 11.0 Demonstration and Application: Students demonstrate and apply the knowledge and skills contained in the Manufacturing and Product Development anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings.

DETAILED UNITS OF INSTRUCTION:

Unit 1. Orientation

Students will be introduced to a variety of manufacturing processes. They will be given an overview of the safety, work ethic, and teamwork that is necessary for being successful in career or college.

Unit 2. Safety

Students will be required to pass a safety test for each machine and be instructed on the safety precautions of said machine. Safety demonstrations will be executed by the instructor and be a prerequisite for the future use of equipment. Students will be required to successfully demonstrate best safety practices.

Unit 3. Sheet Metal Construction

Students will be introduced to the process of sheet metal manufacturing. Students will be able to identify and correctly measure all of the tolerances necessary for sheet metal use and production through classification.

Unit 4. Welding-Gases

The student will be introduced to a variety of inert gasses for the welding process. Strong emphasis will be put on the oxygen and acetylene to further support the required safety and welding skill base.

Unit 5. Cutting Metal-Gas

The student will be able to select proper cutting torches and pressures for a variety of metal thicknesses.

Unit 6. Cutting Metal-Plasma-Air

The student will be able to set up and safely operate the plasma cutting machine for a variety of types and thickness' of materials.

Unit 7. Design and Planning

The student will be able to design and plan their projects to exhibit mastery of the different welding processes. Squareness and working to tolerances will be emphasized.

Unit 8. Introduction to Machining

The students will be introduced to the unique precision measuring instruments used for machining individual metal parts.

Unit 9. Intro to Computer Applications in Metals Technology

The students will be introduced to M and G codes used in industry. This will enable them to transition from the CTE program into modern manufacturing positions available in the work place today.

TEXTBOOKS AND RESOURCE MATERIALS:

Textbook

Fundamentals of Modern Manufacturing Processes by, Mikell P Groover; Wiley 2007

Resource Materials

Teacher Selected

CTE PATHWAY STANDARDS TO BE ADDRESSED:

Welding and Materials Joining Pathway Standards:

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.

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.

C1.4 Critique the design parameters across welding processes to produce a welded part or product.

C2.0 Understand and demonstrate how materials can be processed through the use of welding tools and equipment.

C2.1 Introduce joint preparation methods and explain how to identify joint specifications.

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.

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.

C3.0 Differentiate and apply various types of welding assembly processes.

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.

C3.2 Produce bonded industrial materials by using adhesive such as flow, pressure, and fusion welding.

C3.3 Compare and contrast existing material bonding methods with future innovative bonding processes.

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.

C5.0 Understand and defend the purposes and processes of inspection and quality control in welding manufacturing processes.

C5.1 Identify and explain weld imperfections and their causes.

C5.2 Identify and explain destructive and nondestructive examination practices.

C5.3 Describe the reasons for inspection and quality control in the manufacturing of welded parts.

C5.4 Analyze and identify the steps to check for distortion, joint misalignment, and poor fit-up before and after welding.

C5.5 Perform continuous online quality control inspections of welded parts.

C5.6 Evaluate and know how to troubleshoot performance problems of welding systems.

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.

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.

C6.3 Research new and emerging welding systems and their effects on the standard hand and machine manufacturing industry.

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.

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.

DISTRICT ESLRS TO BE ADDRESSED:

Students will be:

- **Self-Directed Learners:** Students will utilize their knowledge of design and manufacturing to effectively complete learning goals and objectives. This will require students to apply multiple attempts to test and verify concepts through application.
- **Constructive Thinkers:** Design and product development will need to be accomplished with a group setting where communication and group accountability will be critical for success. Students will also learn how to effectively apply learned curriculum to real world applications and how to best research, request information, interpret, and display information correctly.
- **Effective Communicators:** Students will be expected to design original products, and students will provide information on designing and developing creative and efficient ways to develop products.
- **Collaborative Workers:** Using curriculum fundamentals of designing and manufacturing, students will collaboratively work in groups to design and develop original products; as a team they will need to develop their own unique product. They will establish group responsibilities and processes to function effectively and develop within a timely manner.
- **Quality Producers/Performers:** Students will use knowledge from the course to safely and appropriately design and develop original products.
- **Responsible Citizens:** Students will develop and practice processes to create products within their groups.

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