

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT



Advanced Manufacturing and Product Design

Board Approval Date: November 19, 2020	Course Length: 2 Semesters
Grading: A-F	Credits: 5 Credits per Semester
Proposed Grade Level(s): 10, 11, 12	Subject Area: Elective Elective Area (if applicable): Career Technical Education
Prerequisite(s): Manufacturing and Product Design	Corequisite(s): None
CTE Sector/Pathway: Manufacturing and Product Development/Product Innovation and Design	
Intent to Pursue 'A-G' College Prep Status: Yes	
A-G Course Identifier: (g) College-preparatory elective	
Graduation Requirement: No	
Course Intent: Site Specific Program (if applicable): CTE	

COURSE DESCRIPTION:

The Advanced Manufacturing and Product Design course provides intermediate-level training in Manufacturing occupations. Building on previous skills acquired in Manufacturing and Product Design, students will gain the skills to earn industry credentials at no cost to them from the National Institute for Metalworking Skills (NIMS) on the vertical milling machine and lathe. These machining credentials are recognized by industry when hiring new employees. They will also receive an introduction to Computer Aided Design (CAD) via Solid-works and Computer Aided Machining (CAM). Instruction covers the following areas: safety in the workplace, precision measurement, vertical MIG, Arc, Oxy-Act, and Flux-cored, and TIG welding, Oxy-Fuel cutting, layout and design, grinding/finishing, tool making and sharpening, sawing/cutting, threading, drill presses, press brake, sheet metal, forge, fabrication, lathe, vertical mill, and Computer Numeric Controlled machining. Print reading, technical math instruction and an introduction to Computer Assisted Design/Computer Assisted Machine systems. Students use equipment such as measuring and layout tools, welding and metal working machines, drill presses, saws, lathes, vertical mills and computer numerical controlled machines.

DETAILED UNITS OF INSTRUCTION:

Unit Number/Title	Unit Essential Questions	Examples of Formative Assessments	Examples of Summative Assessment
1. Workplace Safety	What are the safety and use policies, procedures and practices in Manufacturing? How do you examine work spaces for safety and/or health concerns?	*Quiz: Review safety procedures and practices	*Test: Identify unsafe scenarios in the shop
2. Materials and Measurement	What were the technical drawing components learned in the Manufacturing and Product Design class? How do you perform various precision measurements? How do you select and illustrate appropriate project parameters for jobs to scale?	*Group Measurement Project	*Project: Measure items within 0.005 tolerance
3. Job Planning, Benchwork and Layout	*What are the elements of engineering drawings? *How do you create a layout utilizing hand tools? *How do you use both hand and power saws to perform secondary operations on a workpiece after cutting to size?	*Identify components of industry standard drawings.	Project: Create an engineering drawing from a given item
4. Turning	*What are the safety principles and what knowledge do you need to pass an industry-approved safety test? *How do you operate a lathe at both intermediate and advanced levels? *How do you use turning skills to create two measured spindles utilizing two work-holding methods	*Accurate set-up of lathe for an assigned project	*Project: Create a product using a lathe

	(chucking and between centers) as well as an engineered bushing? *How do you create a hex nut according to ANSI standards?		
5. Milling	How do you safely operate a vertical milling machine? How do you improve the level of operations from intermediate to advanced levels on the vertical milling machine? How do you square a block of metal and achieve accuracy to the dimension of +/- 0.003"? How do you program a conversational CNC mill to produce a "hands-off" part?	*Properly square-up a vise on a milling machine	*Project: Create a product using a milling machine
6. Oxy-Acetylene Gas Welding Process	How do you distinguish between a well-cut surface and a poorly cut surface? How do you adjust to perform a good cut? What are the components of the safety testing and use of OFC equipment? How do you identify the correct brazing applications in welding ferrous and non-ferrous metals? What are the proper cutting tips and working pressures for cutting specific materials?	*Inspect and set-up Oxy-Acetylene kit *Check fuel levels	*Project: Use Oxy-Acetylene welding process to complete assigned project
7. Shielded Metal-Arc Welding	How do you produce flat welds proficiently based on visual testing using various sized rods? How do you produce horizontal welds proficiently based on visual testing using various sized rods?	*Properly set-up welding power supply	*Project: Use Shielded Metal-Arc welding process to complete assigned project

	How do you produce vertical welds proficiently based on visual testing using various sized rods? How do you produce overhead welds proficiently based on visual testing using various sized rods? How do you run a continuous bead with the ability to restart a weld? What are the five common joints and their appropriate application?		
8. Gas Metal Arc Welding	How do you produce a flat weld proficiently based on visual testing using micro-wire? How do you produce a horizontal weld proficiently based on visual testing using micro-wire? How do you produce a vertical weld proficiently based on visual testing using micro-wire? How do you produce an overhead weld proficiently based on visual testing using micro-wire? How do you identify and safely use GMAW equipment?	*Complete a design project list for six different items of increased difficulty	*Project: Use Gas metal-arc welding process to complete assigned project
9. Gas Tungsten Arc Welding	What are the appropriate accessories for TIG applications? How to identify and safely use TIG equipment? How do you produce a flat weld proficiently based on visual testing? How do you produce a horizontal weld proficiently based on visual testing? How do you produce a vertical weld proficiently	*Properly set-up welding power supply	*Project: Use Gas Tungsten Arc welding process to complete assigned project

	based on visual testing? How do you produce an overhead weld proficiently based on visual testing?		
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ESSENTIAL STANDARDS:

<https://www.cde.ca.gov/ci/ct/sf/documents/manproddev.pdf>

D1.0 Understand the basic product design and development process as it relates to the design of a product, line of products, system design, or services.

D2.0 Understand and apply research methodologies as a means to identify a need, problem, or opportunity for a new product, product line, system design, or service.

D3.0 Understand and apply various ideation techniques to develop ideas and concepts.

D4.0 Apply various two-dimensional (2-D) graphic and/or three-dimensional (3-D) modeling techniques to develop concepts.

D5.0 Develop the concept into a well-defined product for prototyping.

D6.0 Produce a prototype of a product.

D7.0 Evaluate the prototype to determine if it meets the requirements and objectives.

D8.0 Understand and apply basic business and entrepreneurial principles and identify potential markets and/or other business opportunities for distribution of the product.

D9.0 Produce a package design concept for a product or line of products.

D10.0 Produce a presentation of the product, product line, system design, or service.

RELEVANT STANDARDS AND FRAMEWORKS, CONTENT/PROGRAM SPECIFIC STANDARDS:

Link to Common Core Standards (if applicable):

Educational standards describe what students should know and be able to do in each subject in each grade. In California, the State Board of Education decides on the standards for all students, from kindergarten through high school.

<https://www.cde.ca.gov/be/st/ss/documents/finaelacssstandards.pdf>

Link to Framework (if applicable):

Curriculum frameworks provide guidance for implementing the content standards adopted by the State Board of Education (SBE). Frameworks are developed by the Instructional Quality Commission, formerly known as the Curriculum Development and Supplemental Materials Commission, which also reviews and recommends textbooks and other instructional materials to be adopted by the SBE.

Link to Subject Area Content Standards (if applicable):

Content standards were designed to encourage the highest achievement of every student, by defining the knowledge, concepts, and skills that students should acquire at each grade level.

<https://www.cde.ca.gov/ci/ct/sf/documents/ctescrpflyer.pdf> and

<https://www.cde.ca.gov/ci/ct/sf/documents/manproddev.pdf> (pages 17-19)

Link to Program Content Area Standards (if applicable):

Program Content Area Standards applies to programs such as International Baccalaureate, Advanced Placement, Career and Technical Education, etc.

TEXTBOOKS AND RESOURCE MATERIALS:

Textbooks

Board Approved	Pilot Completion Date (If applicable)	Textbook Title	Author(s)	Publisher	Edition	Date
		<i>N/A</i>				

Other Resource Materials

Groover, Mikell. Fundamentals of Modern Manufacturing. Wiley, 2019. Autodesk. Fundamentals of CNC Machining. Autodesk, 2014.

Supplemental Materials

Board approved supplemental materials (Including but not limited to: Film Clips, Digital Resources, Supplemental texts, DVDs, Programs (Pebble Creek, DBQ, etc.):

Machinery Handbook, Pocket Companion, 2016

The Folsom Cordova Unified School District prohibits discrimination, intimidation, harassment (including sexual harassment) or bullying based on a person's actual or perceived ancestry, color, disability, race or ethnicity, religion, gender, gender identity or gender expression, immigration status, national origin, sex, sexual orientation, or association with a person or group with one or more of these actual or perceived characteristics. **For concerns/questions or complaints, contact the Title IX Coordinator(s) and Equity Compliance Officer(s): Curtis Wilson, cmwilson@fcusd.org (grades K-5) and Jim Huber, ED. D., jhuber@fcusd.org (grades 6-12), 1965 Birkmont Drive, Rancho Cordova, CA 96742, 916-294-9000 ext.104625**