

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT



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): 9, 10, 11, 12	Subject Area: Elective Elective Area (if applicable): Career Technical Education
Prerequisite(s): None	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:

This course represents a contextualized, laboratory-based, integrated curriculum for students to learn about communication, energy production, integrated technology systems and manufacturing processes that effect their daily lives. Students develop critical thinking skills through a variety of multi-modal, problem-solving techniques. Students will receive introductory level exploratory instruction on topics including, various manufacturing processes, proper use of hand tools, machinery tools, print reading, technical writing, carpentry, metal fabrication, robotics, basic concepts of mechanical and electrical engineering, designing and creating prototypes using 3D printing, Computer Numerical Control (CNC) manufacturing and Computer-Aided Design (CAD). Integrated content focuses on how significant scientific advancements throughout history have advanced manufacturing processes; and provides students with the basis for making wise academic and career choices.

DETAILED UNITS OF INSTRUCTION:

Unit Number/Title	Unit Essential Questions	Examples of Formative Assessments	Examples of Summative Assessment
1. Lean Manufacturing	<p>What are the basic concepts of the manufacturing processes used to minimize waste and maximize efficiency using the 5S principles (Sort, Set In Order, Shine, Standardize, Sustain)?</p> <p>How would you identify the various styles of manufacturing processes by either observation or description?</p> <p>What are the benefits and constrictions of both additive and subtractive manufacturing processes?</p> <p>What are the areas of inefficiency of time and materials during the manufacturing process?</p> <p>How can the 5S principles apply to other academic and career endeavors?</p>	<p>*Quiz: Identify different manufacturing processes</p>	<p>*Design a manufacturing process for the Bird House project</p>
2. Precision Measurement	<p>What are the basic measurement techniques in both US customary units and metric units?</p> <p>How are rulers and measuring tapes able to measure down to 1/64 of an inch or .55mm?</p> <p>How do you convert between metric and imperial units?</p> <p>How are calipers and micrometers used to measure down to .001 inch?</p>	<p>*Using measurement tools to measure various items using metric and imperial units of measurement</p>	<p>*Project: Students are given an item, take accurate measurements and record their findings</p>

3. Careers in Manufacturing	<ul style="list-style-type: none"> *What are the various careers in the manufacturing industry? *What are the workforce projections, education requirements and salaries for careers in manufacturing? *What industry certifications are available in manufacturing? *What documents are required for employment and how do you create them? *What are the steps in a formal process? 	*On-line research (CA Career Zone, CA Career Resource Network), in Mock interviews	*Research Project: Employment portfolio
4. Mechanical Fabrication	<ul style="list-style-type: none"> *How do you use basic hand tools and threaded fasteners? *How do you distinguish between a flat head and Phillips screwdrivers? *How do you properly use adjustable and Allen wrenches? *What are the characteristics of a bolt which include type (metric or US customary), bolt size, and thread pitch? *When given a sample, how do you identify screw types and bolt types? *How do you properly assemble a hinge assembly using screwdrivers, wrenches, screws, bolts, washers, and flat washers? 	*Identify difference in screwdrivers, wrenches and bolts	*Project: Assembly of items using various types of mechanical fasteners and hand tools
5. Technical Writing	Why is technical writing important in the manufacturing process? How do you design a product and manufacturing process, and communicate how to duplicate the	*Project: Writing directions for an everyday task	*Project: Writing directions for a project that you will build

	<p>product using the same methods?</p> <p>How do you write clear and concise instructions for the product's end user?</p>		
6. Wood Technology	<p>How are wood products used in the manufacturing process?</p> <p>What are the various types of wood used in manufacturing and how do you select the appropriate materials?</p> <p>How do you design, shape and assemble wood products using specialty wood tools like saws, drills, sanders and mechanical fasteners?</p>	*Identification and demonstration of tools used in woodworking	*Project: Build a birdhouse using wood products
7. Metal Fabrication	<p>What are the various types of metals available for manufacturing?</p> <p>How do you select the appropriate material for a given project?</p> <p>How do you design, shape and assemble metal products using specialty wood tools like saws, drills, grinders, brakes, shears and mechanical fasteners?</p>	*Identification and demonstration on the safe use of metal materials and tools	*Project: Tool Tray Project
8. Computer Aided Manufacturing	<p>What is 3D printing, Computer-Aided Design (CAD) and Computer Numerical Control (CNC) manufacturing?</p> <p>How does computer modeling play a role in the manufacturing process?</p> <p>How are prototypes created using 3D printing technology?</p> <p>How is CNC equipment used in the manufacturing process?</p>	*Complete a design project list for six different items of increased difficulty	*Project: Design and manufacture a complex product using computer aided manufacturing

ESSENTIAL STANDARDS:

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

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

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.

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
		N/A				

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.):