



High School Course of Study Approval Request Form

High School Site	Signature - Principal or Academic AP Designee	Signature - Teacher Leader (enter N/A if no Teacher Leader)	Comments:
American Canyon HS	Andrew Goff	NA	
<b>Napa HS</b>	Ean Ainsworth	Ron Solomon	
Napa Valley Independent Studies	Susan Wilson	NA	
New Tech HS	Riley Johnson	NA	
Valley Oak HS	Maria Cisneros	NA	
Vintage HS	Katelyn Estudillo	Brady Mitchell	

Course submitted by:	Gillie Miller	School Site:	NCOE CTE Office
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Executive Director, Secondary Education: 

Review resources:

[Rubric for Evaluating Digital Content & Technology Tools in Relation to CCSS for ELA \(Grades 6-12\)](#)

[State Math criteria](#)

[Technology in Teaching Math](#)

[Other criteria and decision making tools](#)

Please review following high school course outline and sign above if you approve or write reason in comment if you do not.

New  Revised outline - new course number to be issued due to change in course titles, UC/CSU and college prep designations, and vocational ed level

COMPUTER (Short) TITLE: CTE MMPD 2 [New: P CTE MPD 2]  
 COURSE (Long) TITLE: CTE Machining, Manufacturing & Product Development 2  
 [New: P CTE Manufacturing & Product Development 2]  
 AERIES TITLE: CTE Mach Mfg & Prod Dev 2 [New: P CTE Mfg & Prod Dev 2]  
 COURSE NUMBER: CTE909  
 GRADE LEVEL: 10 - 12  
 LENGTH OF COURSE: 1 year/10 credits (5 credits/semester)  
 GRAD REQUIREMENT: Elective (Z)  
 CSU/UC REQUIREMENT: No [New: "g" (College Preparatory Elective)]  
 COLLEGE PREP: No [New: Yes]  
 VOCATIONAL ED: Concentrator [New: Capstone/Completer]  
 CALPADS CODE: 8221

**PATHWAY CODE:**           **MAN 212**  
**NCLB :**                   **No**

## **COURSE OVERVIEW**

### **DESCRIPTION OF COURSE**

This course builds on the skills and knowledge from Manufacturing and Product Development 1.

Students will advance their manufacturing skills with traditional machine tools and will progress to designing and building projects using computer aided design (CAD), computer aided manufacturing (CAM), and computer numerical control (CNC) machines using more technical machining and manufacturing techniques.

Students will be introduced to quality control techniques and will demonstrate increased levels of precision and accuracy using rigorous measurement techniques.

Students will explore the financial side of manufacturing, machining and product development. They will learn principles of project management, product costing, justification, and will hone basic entrepreneurial skills by building business plans.

A goal of this class is to have students design, build, and take products to market.

Pathway graduates will be college and career ready.

**SAFETY IS A MUST.** Students are expected to rigorously follow all safety rules and will be dismissed if they are out of compliance.

### **GOALS OF THE COURSE**

Upon completion of Manufacturing, and Product Development 2, the following competencies should be demonstrated:

Machine shop safety and use of personal protective equipment.

Semi-precision and precision measurements, scale measurement, and care of instruments.

Machining mathematics concepts related to industry standards and operation.

Job planning, print reading, basic drafting, layout and bench work.

Geometric symbols and terminology, technical reading and writing.

Identification and proper use and care of hand tools.

Identification and operation of traditional machine tools (drill press, saws, milling machines, lathes).

Identification and operation of advanced manufacturing tools (CNC, CAD, CAM, 3-D Printing)

Fundamentals of Project Management including management of: process groups, project integration, scope, time, quality, human resources, communications, risk, and project stakeholders.

Basic business and entrepreneurial skills including creating a business plan, and participating in running a successful student enterprise.

Leadership skills as they relate to the manufacturing industry and running a successful student enterprise.

Career and college readiness to include identification of Machining, Manufacturing, Product Development, Project Management, and Engineering careers. Understand the education and training needed for each of these careers.

## **COURSE CONTENT**

### **Unit 1: Safety Rules and Conditions**

**Learning Objectives:** Students understand the importance of and demonstrate shop safety practices at all times. This includes the use of personal protective equipment. Students understand what to do in case of injury. Students demonstrate knowledge of good housekeeping practices and will work as a team to maintain a clean and safe shop environment.

#### **Sample Assignment/Project**

Review safety procedures from last year.

Poster or presentation: Students list the 5 most hazardous conditions for each tool

Industry certification Students complete an industry certification such as OSHA or NIMS

Anchor Standards 2.1, 2.3, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 7.7, 8.2, 8.3, 8.4, 10.2, 11.2

Pathway Standards B2.1, B6.1, B7.1, B8.2, B9.1

### **Unit 2: Precision Measurement (Metrology = the science of measurement)**

**Learning Objectives:** Students demonstrate mastery of scale measurement and functional gauging. Students accurately read measuring tools such as: rulers, gauges, dial calipers and micrometers. Students manually take precise linear, square and cubic measurements using appropriate tools. Students demonstrate knowledge and use of weights and measures standards. Validate that a part meets specifications.

#### **Sample Assignment/Project**

Students are given a unique machined component/object and are asked to perform various measurements such as length, thickness, diameter, angle, etc on different features of the object. The measurements are done using all types of measuring tools and the results are recorded. Students then exchange components and repeat the process. The results are compared with the engineered drawings and with other students' results, any discrepancies are cleared up by demonstrating the proper measuring technique.

Anchor Standards 5.1, 5.2, 9.7

Pathway Standards B1.1, B1.2, B1.3, B1.4

### **Unit 3: Shop Math**

**Learning Objectives:** Students demonstrate the ability to add, subtract, multiply, and divide fractions and decimals as well as make conversions to and from fractions and decimals, inches and the metric system. Students understand plane geometry and trigonometry functions applicable to manufacturing processes.

#### **Sample Assignment/Project:**

Given simulated data/problems from industry, students solve those problems using the math skills above. Students give rational and explain their process for reaching conclusions.

Quiz is given, students show their calculations

Anchor Standards 5.2, 5.3, 5.4, 9.7, 11.1

Pathway Standards B1.1, B1.2, B1.4, B2.2, B2.3, B2.4, B4.1

### **Unit 4: Job Planning and Layout**

**Learning Objectives:** Students demonstrate competence in job planning, creating and reading drawings (Blueprints), basic drafting and drawing techniques, identify material specifications and tolerances,

demonstrate proper layout and bench work. Students understand geometric and drawing symbols and terminology related to manufacturing, show competency in technical reading (operating manuals, software tutorials, etc) and technical writing.

#### **Sample Assignment/Project**

**Product Proposal:** Students write a proposal for an object or product to be manufactured including the reasons for the product (revision of existing or a new product) and a plan for the design process. Students have voice and choice. Students then use proper layout techniques and tools and workholding devices to machine the part.

**Anchor Standards:** 1.0, 2.2, 2.4, 2.5, 2.6, 4.1, 4.6, 5.1, 5.2, 5.3, 5.4, 6.4, 6.5, 7.2, 7.3, 7.4, 7.7, 8.1, 8.2, 8.3, 8.4, 8.6, 9.1, 9.2, 9.5, 9.7, 10.1, 10.2, 10.3, 10.4, 11.1, 11.2, 11.3, 11.4, 11.5

**Pathway Standards:** B1.1, B1.2, B1.4, B2.2, B2.3, B2.4, B4.1

### **Unit 5: Materials Science and Other Manufacturing Processes**

**Learning Objectives:** Students will understand the different properties and chemical composition of various manufacturing materials such as: ferrous and non-ferrous metals, plastics and plastic processes, foundry, forging, bending, shaping, and fabrication techniques, and heat treating steel.

#### **Sample Assignment/Project**

**Research:** Students research and compare the properties of two metals using two different material specifications and a process specification. Students write or present their findings.

**Revised Product Proposal:** Students revise their product proposals by suggesting materials and techniques, giving rationale for their choice.

**Anchor Standards:** 1.0, 2.2, 2.4, 2.5, 2.6, 4.1, 4.6, 5.1, 5.2, 5.3, 5.4, 6.4, 6.5, 7.2, 7.3, 7.4, 7.7, 8.1, 8.2, 8.3, 8.4, 8.6, 9.1, 9.2, 9.5, 9.7, 10.1, 10.2, 10.3, 10.4, 11.1, 11.2, 11.3, 11.4, 11.5

**Pathway Standards:** B3.3, B5.1, B5.2, B5.3, B5.5

### **Unit 6: Tool Identification and Advanced Operations**

**Learning Objectives:** Students demonstrate competence, skill, safe use, and maintenance of:

**Hand Tools** (wrenches, screwdrivers, pliers, files, scribes etc).

**Power Hand Tools** (sanders, grinders).

**Traditional Machine Tools** (drilling tools, sharpening drills, drill press operations, speeds and feeds, turning tools, lathe operations, workholding /tool holding, cutting tools, setup, facing, boring, threading, tapping, chamfering, grooving, knurling, radius-cutting, tapers and angles, milling operations, climb vs. conventional milling, slotting, and squaring).

**Advanced Manufacturing Tools** (CNC, CAD, CAM, 3-D Printing).

#### **Sample Assignment/Project**

**Student Projects:** Students hone their skills and demonstrate a higher level of competency and skill in the use of hand, power and advanced manufacturing tools while manufacturing their products. Students start to specialize in certain areas based on their individual skills and interests.

**Anchor Standards:** 3.1, 5.1, 5.2, 5.3, 5.4, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 8.1, 8.3, 8.4, 8.6, 10.1, 10.2, 10.3, 10.4, 11.1, 11.2, 11.3, 11.4, 11.5

**Pathway Standards:** B1.1, B1.2, B1.4, B2.2, B2.3, B2.4, B3.3, B4.1, B5.1, B5.2, B5.3, B5.5, B5.6, B5.8, B5.9, B7.1, B7.2, B7.3, B7.5, B7.6, B8.1, B8.2, B8.3, B9.1, B9.2, B9.3, B10.1, B10.2, B10.3, B10.4, B10.5, B11.1,

B11.3, B11.4, B11.5, B11.6

## **Unit 7: Advanced New Product Introduction (NPI) and Process Improvement**

Learning Objectives: Students will demonstrate knowledge of:

Product Concept Generation and Refinement (Sketching, Drafting, CAD)

Develop Materials List (B.O.M.)

Calculate Product Costs (Material, Labor, Burden)

Select machining processes to create project

Select machines and tooling needed

Produce prototype models

Manufacture Product

Take Product to Market

Analyze production process (follow the dollars)

Formulate adjustments to improve process

Perform process adjustments

Evaluate effectiveness

Know when and how to do proper notification of supervisor and employees

Sample Assignment/Project

Student Projects: Students produce inventory to be sold in student-run enterprise.

Students solve real world problems presented by industry professionals. Students understand and defend the purposes and processes of inspection and quality control.

Anchor Standards: 1.0, 2.5, 2.6, 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 8.1, 8.3, 8.4, 8.6, 8.7, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 10.1, 10.2, 10.3, 10.4, 11.1, 11.2, 11.3, 11.4, 11.5

Pathway Standards: B1.1, B1.2, B1.4, B2.2, B2.3, B2.4, B3.3, B4.1, B5.1, B5.2, B5.3, B5.5, B5.6, B5.8, B5.9, B7.1, B7.2, B7.3, B7.5, B7.6, B8.1, B8.2, B8.3, B9.1, B9.2, B9.3, B10.1, B10.2, B10.3, B10.4, B10.5, B11.1, B11.3, B11.4, B11.5, B11.6

## **Unit 8: Fundamentals of Project Management**

Learning Objectives: Students will demonstrate knowledge of project management using the PMief badging course materials:

Project Management Foundational Knowledge

Process Groups

Project Integration Management

Project Scope Management

Project Time Management

Project Quality Management

Project Human Resource Management

Project Communications Management

Project Risk Management

Project Stakeholder Management

Sample Assignment/Project

Review PMI learning modules and sample test questions. Students will incorporate and demonstrate PM knowledge and steps into their projects.

**Student Presentation:** students present slides and explain how they used the PM process including the the various components.

Students will be eligible to take the PMI badging exam through NOCTI in the spring.

**Anchor Standards:** 2.4, 2.5, 4.3, 5.1, 5.2, 5.3, 5.4, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 8.3, 8.4, 8.6, 8.7, 9.7, 10.1, 10.2, 10.3, 10.4, 11.1, 11.2, 11.3, 11.4, 11.5

**Pathway Standards:** B11.1, B11.3, B11.4, B11.5, B11.6

### **Unit 9: Manufacturing Finance, Leadership and Entrepreneurial Skills**

**Learning Objectives:** Students will sell their products through a business/enterprise. Students will develop and hone their entrepreneurial and leadership skills. Students will apply financial concepts to the student-run enterprise: profit and loss statements, balance sheets, project justification, equipment depreciation.

#### **Sample Assignment/Project**

**Business Plan:** Students collaborate with each other and with the small business department at NVC. Students will collaborate to create a business plan or “Lean Canvas” and will present to a panel of authentic judges or a potential customer. Students may compete at the Young Entrepreneurs competition at NVC or other competition.

**Student Projects:** Students design, plan, manufacture, and market products to be sold through the student-run enterprise. Students evaluate and revise the enterprise’s business plan each year.

**Anchor Standards:** 2.5, 3.7, 5.1, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 10.1, 10.2, 10.3, 10.4, 11.1, 11.2, 11.3, 11.4, 11.5

**Pathway Standards:** none

### **Unit 10: Career and College Readiness**

**Learning Objectives:** Students demonstrate career awareness that manufacturing has changed from the repetitive monotonous jobs of the past and now involve highly skilled and knowledgeable employees who work in clean high-tech environments. Students identify the different types of manufacturing facilities: food/beverage (wine), textiles, wood/paper/printing, petroleum, plastics, electronics, industrial, agricultural, automotive, warehouse, etc. and the types of equipment and processes used. Students understand the career preparation/educational requirements for careers related to manufacturing. Students research post secondary programs in manufacturing, engineering, machining, welding, robotics, etc. as well as research on manufacturing employers. Senior projects or portfolios will demonstrate students’ knowledge, skills, and accomplishments. Students will demonstrate 21st century skills: communication, creativity, collaboration and critical thinking.

#### **Sample Assignment/Project**

Students will tour programs at Napa Valley College: Welding, Machining, Digital Design, and will research other post-secondary education options.

Students will interact with industry experts by participating in work-based learning.

Students research, interview and report on an employer/company: what they produce, equipment used, job titles and responsibilities, working conditions, salary, benefits, job outlook, who they hire, etc.

Students write resumes, cover letters, and participate in mock interviews with industry experts.

Students will complete a professional portfolio with samples of their work.

**Anchor Standards:** 2.5, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.2, 4.4, 4.5

**Pathway Standards:** none

## **INSTRUCTIONAL STRATEGIES**

Projects, Lecture and Demonstrations

Multimedia Sources

Project-Based Learning

Work-Based Learning

## **INSTRUCTIONAL MATERIALS / TEXTBOOKS**

### **TEXTBOOK:**

Title: Precision Machining Technologies

Edition: 1st Edition

Date: 2011

Publisher: Delmar Centgage

Author(s): Hoffman, Hopewell, Janes, Sharp

## **SUPPLEMENTAL INSTRUCTIONAL MATERIALS**

Solid Works Tutorials

Microsoft Inventor Tutorials

Microsoft HMS Works

CAM Tutorials

Machine Lab

PMlef curriculum

"Turning Risk into Success (TRIS), An Entrepreneurship Program for Teenagers", Curtis DeBerg, 2012

Sageglobal

Entrepreneurship modules with NVC

## **STANDARDS SUMMARY**

Manufacturing and Product Development Knowledge and Performance Anchor Standards: All anchor standards met

Machining and Forming Technologies Pathway Standards: B1.1, B1.2, B1.4, B2.2-B2.4, B3.3, B4.1, B5.1-B5.3, B5.5, B5.6, B5.8, B5.9, B7.1-B7.3, B7.5, B7.6, B8.1-B8.3, B9.1-B9.3, B10.1-B10.5, B11.1, B11.3-B11.6

Common Core and Academic Standards: RSIT 11-12.7, RLST 11-12.3, 11-12.4, 11-12.6, 11-12.7, 11-12.10, WS 11-12.3, 11-12.6, 11-12.7, 11-12.8, 11-12.9 WHSST 11-12.7, 11-12.8, 11-12.9, A-CED2, 4, A-REI 6, 9, F-IF 4, GC2, G-CO 1, 2, 5, 12, N-Q1, 2, 3, S-IC 6, S-ID1, C 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, SEP 1, 2, 4, 5, 6, 8, CC 1, 3, 6, 7, PS1.A, ETS1, ETS2, WH10.11,