VALLEY ROP COURSE OUTLINE

COURSE TITLE: **Computer Aided Manufacturing I (CAM I)**

VALLEY ROP #: MPD-5603-CAM1
CDE #: 1319

CBEDS TITLE: Computer Numerical Control
CBEDS #: 5603

CTE SECTOR: Manufacturing & Product Development
CTE PATHWAY: Machine & Forming Technology

JOB TITLES:

Machinists	51-4041.00
Computor Controlled Machine Tool Operators Metal & Plastics	51-4011.00

COURSE DESCRIPTION:
This competency-based course prepares students for entry-level positions in the computerized manufacturing industry. This course will introduce the student to the high tech field of computer aided manufacturing. Students will learn CAD/CAM and CNC machining using Mastercam software on PC-based computers. Students will design and manufacturing products using a CNC router.

DATE APPROVED: December 2000
REVISED DATE(S): January 2006; March 2009/ Oct. 2009

HOURS: 180
CREDITS: 10

PREREQUISITES: None

GRADE LEVEL: 11-12

ARTICULATION(S): 2+2+2 articulation with Fresno City College pending.

TEXTBOOKS: *CAM 10 Workbook* by Mark McCollough, Fresno City College

COURSE COMPETENCIES:

Upon completion of this course, the student will:

- Have a thorough understanding of all aspects of safety operations and instructions involving the woodworking construction industry by: reading materials which conveys the absolute need for safety awareness, discussing and demonstrating his/her understanding of general shop safety, hand tool safety, passing a safety test covering general shop safety, hand tool safety portable power tools, and each of the stationary power tools. (Construction Technology, Standard #2)
- Have an understanding of the principles of mass production and the impact it has on the lives of people in the world today by: explaining the importance of quality control, being able to set up fixtures and jigs, understanding the purpose and importance of mass production, being able to organize a mass production run in sequential order. (Construction technology, Standard #14)
- Develop and demonstrate a working knowledge in the use of a variety of measuring instruments. The student will develop an understanding of fractions, decimals, and mathematical formulas as used in manufacturing by: identifying various measuring devices used, demonstrating the proper use of the measuring devices commonly used, selecting the proper measuring device, and demonstrating knowledge of basic math skills necessary for manufacturing. (Manufacturing Technology, Standard #5)
- Take written instruction and convert them to a language that can be understood by the computer by: explaining how computers control machines and demonstrating program writing for a CNC router. (Manufacturing Technology , Standard #27)
- Gain an understanding and appreciation of the increased productivity and greater accuracy made possible through the application of computer-aided design and drafting by: explaining the purpose of computer-aided design and drafting, explaining how a CAD benefits manufacturing, and explaining how to revise a CAD file without redrawing the entire project. (Manufacturing Technology , Standard #30)
- Students will understand the planning and layout processes (including designing, print reading, measuring, etc) used in manufacturing. They will read prints and use the information to plan, layout and produce parts or products. (Manufacturing Technology, Standard #1)
- Students will understand how materials can be processed using tools and machines. They will use tools and the processes of cutting, shaping, combining, forming, etc., of materials to manufacture a part or product. (Manufacturing Technology, Standard #2)
- Students will understand various types of assembling processes (mechanical fastening, mechanical force, joining, fusion bonding, adhesive bonding, etc.) used in manufacturing. They will apply appropriate fastening or joining procedures to the design and production of a manufactured part or product. (Manufacturing Technology, Standard #3)
- Students will understand finishing processes (types of finishing materials, surface preparation, methods of application, etc.) used in manufacturing. They will select a finishing process for a product in terms appropriate to the job it must perform, environment in which it functions, and its aesthetic appeal. (M anufacturing Technology, Standard #4)
- Students will understand inspection and quality control in the manufacturing process. They will perform continuos on line inspections to ensure that parts or products meet design specifications. (Manufacturing Technology, Standard #5)
- Students will learn and understand math problems to assist them on their CaHSEE and CAT 6 exams through a school-wide ISA Focus program. Students will demonstrate this knowledge by showing improvement on their test scores.

INSTRUCTIONAL METHODS:

- Lecture
- Demonstrations
- Multi-media aids
- Cooperative group learning
- Note taking
- Reading
- Project construction
- Homework

EVALUATION METHODS:

Assessment opportunities, which allow continuous evaluation of students' progress, will be embedded throughout the course and should be a learning experience. All students will be expected to achieve mastery of all topics; often, demonstrations of mastery will occur in a public forum. The following strategies, which include both formal and informal assessment techniques will include, but are not limited to:

- Projects (mass-production projects, community service project, CNC generated products, and student designed projects)
- Chapter tests and quizzes (t/f, multiple choice, identification, matching, and manual)
- Class participation (attendance, homework, and group participation)
- Semester final (t/f, multiple choice, identification, and manual)
- Chapter questions and problems (short answer, definitions, and critical thinking)
- CAD drawings

COURSE OUTLINE:

Unit of Instruction	Estimated Hours	Standards
Orientation	**5**	
• What the student can expect from this course		
• What the ROP program expects from the student		
• The shop facilities		
• Shop management		
Safety	**10**	**HS6.1,6.2,6.6 C11.3**
• Dress and personal safety equipment		
• Housekeeping		
• Fire prevention		
• Solvents and toxic vapors		
• Emergency procedures		
• First aid procedures		
• General safety factors		
• Machine and tool safety		
• General safety test		
Mass Production	**20**	**LTW9.1,9.5,C10.2, H-SS11.5.7**
• Mass production techniques		
• Assemble line procedures		
• Quality control		
• Job requirements		
• Set ups and jigs		
• Sequence of processes		
• Production project		
Measurement	**5**	**M1.3, C1.2**
• Measuring devices (identify, use)		
• Math (fractions, decimals, basic formulas)		
Computer-Aided Manufacturing	**20**	**TKS10.8,10.6 C8.1,8.2,7.3**
• How computers control machines		
• CAM software		
• Posts		
• NC files		
• CNC router		
Computer-Aided Design and Drafting	**50**	**CR2.6, CW1.2, PS-CT5.1 TKS10.5,C1.1,1.2,1.3,7.3**
• Purpose		
• Ease of revision		
• Storage of information		
• Reproduction		
• Methods of transportation (disks, modem, network)		
• Accuracy		
Planning and Layout	**10**	**C1.1**
• Layout tools (identify, use)		
• Sketching		
• Print reading		
• Dimensioning		
• Tolerances		

Material Processing • Cutting tools and equipment • Types of materials • Cutting and shaping techniques	**20**	**C2.1,2.2**
Assembling Processes • Assembly tools (identify, use) • Fasteners • Procedures	**18**	**LS1.2,TKS10** **C3.1,3.2,9.1.1,10.2,10.3**
Finishing Processes • Tools and equipment (identify, use) • Surface preparation • Finishing materials • Procedures • Methods and techniques of application	**8**	**C4.1**
Quality Control • Purpose • Tools (identify, use) • Measuring and inspection	**8**	**C5.1, 5.2**
ISA Focus lessons • Algebra • Number sense • Probability • Geometry	**6**	**M1.1,1.3,1.4,1.5,1.6,1.7** **2.5,4.0,5.0,15.0,PC-CT5.1** **C1.1**
Total Hours	**180 Total Hours**	

PROJECT FEES:

- There are no fees for assigned projects.

Students are required to pay for materials used in projects for themselves

CAREER PREPARATION STANDARDS:

A. **PERSONAL SKILLS -** Students will understand how personal skill development affects their employability. This skill includes positive attitudes, self-confidence, honesty, responsibility, initiative, self-discipline, personal hygiene, time management, and the capacity for lifelong learning.

1. Demonstrate an understanding of classroom policies and procedures.
2. Discuss importance of the following personal skills in the business environment:
   a. positive attitude
   b. self-confidence
   c. honesty
   d. perseverance
   e. self-management/work ethic
   f. pride in product/work
   g. dependability
3. Identify acceptable work attire.
4. Establish goals for self-improvement and further education/training.
5. Prioritize tasks and meet deadlines.
6. Understand the importance of initiative and leadership.
7. Understand the importance of lifelong learning in a world of constantly changing technology.

B. **INTERPERSONAL SKILLS** - Students will understand key concepts on group dynamics, conflict resolution, and negotiation. This skill includes the ability to work cooperatively, accept supervision, assume leadership roles, and show respect for others. This standard includes an understanding of sexual harassment laws and an appreciation of cultural diversity in the workplace.

1. Identify and discuss behaviors of an effective team.
2. Explain the central importance of mutual respect in the workplace relations.
3. Discuss and demonstrate strategies for conflict resolution and negotiation, and explain their importance within the business environment.
4. Understand laws that apply to sexual harassment in the workplace, and identify tactics for handling harassment situations.
5. Work cooperatively, share responsibilities, accept supervision and assume leadership roles.
6. Demonstrate cooperative working relationships and proper etiquette across gender and cultural groups.

C. **THINKING AND PROBLEM-SOLVING SKILLS** - Students will exhibit critical and creative thinking skills, logical reasoning, and problem-solving. These skills include applying basic skills in order to calculate, estimate, measure; identify, locate, and organize information/data; interpret and follow directions from manuals, labels, and other sources; analyze and evaluate information and solutions.

1. Recognize the importance of good academic skills and implement a plan for self-improvement as needed.
2. Read, write, and give directions.
3. Exhibit critical and creative thinking skills and logical reasoning skills, and employ these skills for problem solving.
   a. Work as a team member in solving problems.
   b. Diagnose the problem, its urgency, and its causes.
   c. Identify alternatives and their consequences.
   d. Explore possible solutions.
   e. Compare/contrast the advantages and disadvantages of alternatives.
   f. Determine appropriate action(s).
   g. Implement action(s).
   h. Evaluate results of action(s) taken.

D. **COMMUNICATION SKILLS** - Students will understand principles of effective communication. This standard includes effective oral and written communication, listening skills, following and giving directions, requesting and giving information, asking questions.

1. Use communication concepts in application of skills, techniques, and operations.
   a. Prepare written material.
   b. Analyze written material.
2. Understand and implement written instructions, from technical manuals, written communications, and reference books.
3. Present a positive image through verbal and nonverbal communication, and understand the power of body language in communication.
4. Demonstrate active listening through oral and written feedback.
5. Give and receive feedback.
6. Demonstrate assertive communications (both oral and written).
7. Demonstrate proper etiquette in workplace communications, including an awareness of requisites for international communications (languages, customs, time zones, currency and exchange rates).
8. Demonstrate writing/editing skills as follows:
   a. Write, proofread, and edit work.
   b. Use correct grammar, punctuation, capitalization, vocabulary, and spelling.
   c. Select and use appropriate forms of technology for communication.
9. Exhibit a proficiency in the use of reference books.
10. Research, compose, and orally present information for a variety of business situations utilizing appropriate technology.

E. **OCCUPATIONAL SAFETY** - Students will understand occupational safety issues, including the avoidance of physical hazards in the work environment. This includes the safe operation of equipment, proper handling of hazardous materials, appropriate attire and safety accessories, avoidance of physical injuries, interpretation of warning and hazard signs and terminology, and following and understanding safety-related directions.

1. Discuss and implement good safety practices, including the following (if applicable to course):
   a. personal
   b. lab
   c. fire
   d. electrical
   e. equipment
   f. tools
   g. interpretation of Material Safety Data Sheets (MSDSs)
   h. Environmental Protection Agency (EPA)
   i. Occupational Safety and Health Administration (OSHA)
   j. American Red Cross Standards (ARC)
   k. Networking Safety Standards
2. Apply sound ergonomic principles in organizing one's work space.

F. **EMPLOYMENT LITERACY** - Students will understand career paths and strategies for obtaining employment within their chosen field. This includes traditional job preparation skills, such as resumes, application forms, cover letters, sources of employment information, and interviewing skills, but also includes an overview of the industry and an understanding of labor market trends.

1. Explore career opportunities and projected trends; investigate required education, training and experience; and develop an individual education plan.
2. Identify steps for setting goals and writing personal goals and objectives.
3. Examine aptitudes related to career options; relate personal characteristics and interests to educational and occupational opportunities.
4. Develop a career portfolio, including the following documents:

a. job application
b. resume(s)
c. appropriate cover and follow-up correspondence

5. Identify and demonstrate effective interviewing techniques.

G. **TECHNOLOGY LITERACY** - Students will understand and adapt to changing technology by identifying, learning, and applying new skills to improve job performance. Students should understand the role of technology in their chosen field and should be able to use all appropriate technology. Students should also feel confident in their ability to learn new technology by generalizing from what they know, adapting skills to new situations, and identifying and using sources of information and of further learning.

1. Demonstrate the ability to use personal computers for loading and retrieving data, information gathering, measurements, and writing.
2. Identify the characteristics and explain the importance of adapting to changes, being flexible, and evaluating goals when working in the industry.
3. Understand the importance of lifelong learning in adapting to changing technology.

H. **IMPORTANCE OF ETHICS** – Students will understand proper ethics in the workplace.

1. Discuss social and ethical responsibilities in the industry.
2. Demonstrate ethical choices in workplace situations.