Course Outline

Manufacturing and Product Development **REVISED: August/2017**

Job Title
Machinist

Career Pathway:
Machining and Forming Technologies

Industry Sector:
Manufacturing and Product Development

O*NET-SOC CODE:
51-4041.00

CBEDS Title:
Machining and Forming Technologies

CBEDS No.:
5635

77-85-60

Machinist / 2

Credits: 15 **Hours:** 180

Course Description:
This competency-based course is the second in a sequence of two designed for machine and forming technology. It provides students with project-based experiences in basic machining. Technical instruction includes an introduction, reviews of safety policies and procedures, resource management, employability skills, and introduction to entrepreneurship. Emphasis is placed on math and science principles, operational/maintenance/storage techniques for precision tools and CNC equipment, selection and application of metals and alloys, blueprint reading – part II, communication media, programming, and introductory robotics. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

Prerequisites:
Enrollment requires the successful completion of the Machinist/1 (77-85-50) course.

NOTE: For Perkins purposes this course has been designated as a **concentrator / capstone** course.

This course cannot be repeated once a student receives a Certificate of Completion.

Los Angeles Unified School District
Division of Adult and Career Education
Instructional and Couseling Services Unit
Adult Curriculum Office
www.wearedace.org

COURSE OUTLINE COMPETENCY-BASED COMPONENTS

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

COURSE OUTLINE COMPONENTS	**LOCATION**
GOALS AND PURPOSES	Cover
The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.	
The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.	
PERFORMANCE OBJECTIVES OR COMPETENCIES	pp. 8-14
Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.	
Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.	
Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.	
Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.	

COURSE OUTLINE COMPETENCY-BASED COMPONENTS (continued)

COURSE OUTLINE COMPONENTS	LOCATION
INSTRUCTIONAL STRATEGIES	p. 16
Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom. Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.	
UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT	Cover
The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level. Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.	pp. 8-15
EVALUATION PROCEDURES	p. 16-17
The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved. Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.	
REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT	Cover
After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.	

ACKNOWLEDGMENTS

Thanks to JOHN ALVAREZ for developing and editing this course outline. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

ANA MARTINEZ
Specialist
Career Technical Education

ROSARIO GALVAN
Administrator
Division of Adult and Career Education

APPROVED:

JOE STARK
Executive Director
Division of Adult and Career Education

1.0 Academics
Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Manufacturing and Product Development academic alignment matrix for identification of standards.

2.0 Communications
Acquire and accurately use Manufacturing and Product Design 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
Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology
Use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the Manufacturing and Product Design sector workplace environment.

5.0 Problem Solving and Critical Thinking
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 Design sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety
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 Design sector workplace environment.

7.0 Responsibility and Flexibility
Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Manufacturing and Product Design sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities
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
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
Apply essential technical knowledge and skills common to all pathways in the Manufacturing and Product Design sector, following procedures when carrying out experiments or performing technical tasks.

11.0 Demonstration and Application
Demonstrate and apply the knowledge and skills contained in the Manufacturing and Product Design anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organizations.

B. Machining and Forming Technologies Pathway

The Machine and Forming Technologies pathway provides students with an understanding of manufacturing processes and systems common to careers in machine tool and materials forming industries. Representative topics include: trade vocabulary; shop math; basic material identification; proper use of hand and machine tools; reading precision measuring tools within .001" and the interpretation of machined and formed-part prints; the cutting, shaping, fastening, and finishing of machined parts; fixtures: forging, molding (casting), cold forming, and shearing processes.

Sample occupations associated with this pathway:

- CAD/CAM Specialist
- CNC Machinist
- Manufacturing Engineer
- Materials/Supply Management Specialist
- Quality Assurance Technician

B1.0 Validate that a provided part meets specifications from its engineering drawing by comparing specifications (geometric dimensioning and tolerancing) and by demonstrating proper technique using appropriate precision measuring tools.

B2.0 Describe and layout a project according to specifications or engineering drawings. Demonstrate proper technique with layout tools and work-holding devices such as: three- and four-jaw chucks, collet chucks, angle plates, sine bars, parallels, and v-blocks to machine a real part.

B3.0 Research and compare the properties of two metals using two different material specifications and a process specification.

B4.0 Demonstrate a cutoff saw operation(s) to produce a length of bar stock to specification.

B5.0 Demonstrate bending, shaping, other metal forming, and fabrication techniques, including processes such as basic hand filing, knurling on a lathe, forging metal shapes or objects, green sand casting, sheet metal machines, spot welding equipment or rivets, cold form bending with cold forming machinery or homemade devices, and shapes (tooling) to achieve a specific design specification.

B6.0 Identify and select the right grinding wheel; perform wheel dressing; and grind the provided part/material to the size and surface finish specifications provided.

B7.0 Perform a series of routine boring operations from a set of specifications or a drawing and explain the selection of proper tools (drill, reamer, countersink, spot facer, counter bore, tap, and center drill) for each step of the process.

B8.0 Describe and demonstrate the machining of an external and internal taper, knurled part, and threaded and bored part on an engine lathe to plan specification or drawing to produce a part and measure each end diameter within tolerance.

B9.0 Produce parts to specification using a boring head or angular cutting with a sine bar, a keyway, and pockets with a typical vertical mill.

B10.0 Produce parts to specifications or drawings provided on a computer numerical controlled (CNC) mill or lathe. Demonstrate common functions or controls through manual input and through programmed (stored) input. Introduce basic G and M Code Programming focusing on the use of the Cartesian coordinate system and machine axis.

B11.0 Understand and defend the purposes and processes of inspection and quality control in machining and forming processes.

COMPETENCY-BASED COMPONENTS
for the Machinist/2 Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
A. INTRODUCTION Review, apply, and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations. (5 hours)	1. Review the scope and purpose of the course. 2. Review the overall course content as a part of the Linked Learning Initiative. 3. Review classroom policies and techniques. 4. Review the different occupations in the Manufacturing and Product Development Industry Sector which have an impact on the role of machinists. 5. Review the opportunities available for women in the machine and forming technology field. 6. Review the purpose of the California Occupational Safety and Health Administration (Cal-OSHA) and its laws governing machinists. 7. Review the impact of Environmental Protection Agency (EPA) legislation on the Manufacturing and Product Development Industry Sector techniques. 8. Review and demonstrate the techniques for contacting proper authorities for the removal of hazardous materials based on the EPA standards. 9. Review and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the machine and forming technology industry. 10. Review classroom and workplace first aid and emergency procedures according to American Red Cross (ARC) standards. 11. Review how each of the following insures a safe workplace: a. employees' rights as they apply to job safety b. employers' obligations as they apply to job safety c. role of the Division of Workers' Compensation (DWC) d. safe use and storage of flammable liquids, materials, and safety supplies e. wearing of eye protection f. removal of jewelry g. avoidance of loose clothing h. never leaving an operating machine unattended i. not stopping and starting a machine for someone else j. never leaving a chuck wrench in the chuck of a machine 12. Pass the safety test with 100% accuracy.	**Career Ready Practice:** 1, 2, 3, 4, 5, 7, 9, 10, 12 **CTE Anchor:** Career Planning and Management: 3.2, 3.4, 3.5, 3.7, 3.9 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8 Ethics and Legal Responsibilities: 8.1, 8.2, 8.3, 8.4 Technical Knowledge and Skills: 10.1, 10.2, 10.3 Demonstration and Application: 11.2 **CTE Pathway:** B1.1, B2.5, B3.1, B3.2, B4.1, B5.1, B5.6, B5.8, B6.1, B7.1, B8.1, B8.2, B9.1, B10.1, B10.3

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
B. RESOURCE MANAGEMENT REVIEW Understand, apply, and evaluate the basic principles of resource management in the machine and forming technology business. (1 hour)	1. Review the following: a. resources b. management c. sustainability d. Critical Path Method (CPM) 2. Review the management of the following resources in the machine and forming technology business: a. time b. materials c. personnel Review the following components of CPM and how they impact project management: a. work breakdown structure b. duration c. dependencies 4. List specific examples of effective management of the following resources in the machine and forming technology business: a. time b. materials c. personnel 5. Review the benefits of effective resource management in the machine and forming technology business: a. profitability b. sustainability c. company growth 6. Review the economic benefits and liabilities of managing resources in an environmentally responsible way.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10, 12 **CTE Anchor:** Problem Solving and Critical Thinking: 5.4 Responsibility and Flexibility: 7.1, 7.4, 7.6 Leadership and Teamwork: 9.2, 9.3 Technical Knowledge and Skills: 10.1 **CTE Pathway:** B11.3, B11.4, B11.5, B11.6
C. MATH AND SCIENCE PRINCIPLES Understand, apply, and evaluate the mathematical and scientific concepts required for machine trades.	1. Review the practical applications of math in the machining industry. 2. Review and demonstrate problem-solving techniques involving whole number problems using arithmetic operations (addition, subtraction, multiplication, and division). 3. Review and demonstrate problem-solving techniques involving various fraction problems using arithmetic operations. 4. Review and demonstrate problem-solving techniques involving various decimal problems using arithmetic operations. 5. Review and demonstrate techniques for changing fractions to decimals. 6. Review and demonstrate techniques for changing decimals to fractions. 7. Review the English and metric systems of measuring length. 8. Review the English and metric systems of measuring weight. 9. Review the English and metric systems of measuring volume or capacity.	**Career Ready Practice:** 1, 4, 5 **CTE Anchor:** Technical Knowledge and Skills: 10.1 **CTE Pathway:** B1.1, B1.2, B2.3, B2.4

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)	10. Review and demonstrate English and metric problem-solving techniques for various measuring problems using arithmetic operations. 11. Review and demonstrate English and metric measuring techniques of objects by using tools common to the industry. 12. Review metric units in ascending and descending powers of ten. 13. Review and convert measurements in the English numbering system to metric system. 14. Review and convert measurements in the metric system to the English numbering system. 15. Review and calculate the square roots of English numbers. 16. Review and demonstrate problem-solving techniques for geometric problems. 17. Review and demonstrate problem-solving techniques for algebraic problems. 18. Review and demonstrate problem-solving techniques using percentages. 19. Review and demonstrate techniques for reading and interpreting graphs. 20. Review and demonstrate techniques for using a calculator. 21. Describe and demonstrate chemistry principles as applied to machining. 22. Describe and demonstrate physics principles as applied to machining.	
D. PRECISION TOOLS Understand, apply, and evaluate the safe use, maintenance, and storage techniques for precision, measuring, and precision tools. (10 hours)	1. Review and demonstrate the proper use, maintenance, and storage of the different types of hand tools. 2. Review and demonstrate the proper use, maintenance, and storage of the following precision measuring tools: a. steel rules b. calipers c. dial caliper d. digital (electronic) caliper e. micrometers f. protractors g. depth gauges h. combination squares i. surface gauges 3. identify and demonstrate the proper use, storage, and maintenance of the following precision measuring tools: a. height gauges b. telescoping gauges c. dial indicators d. Johannson blocks e. comparator	**Career Ready Practice:** 1 **CTE Anchor:** Health and Safety: 6.3 Technical Knowledge and Skills: 10.1 **CTE Pathway:** B1.1, B1.2, B1.3, B2.1, B2.4

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
E. CNC EQUIPMENT Understand, apply, and evaluate the techniques for the basic use, maintenance, and storage of computer numerical controlled (CNC) equipment. (10 hours)	1. Identify and describe the features, functions, proper use, maintenance, and storage of the following: a. drill press b. electrical discharge machines (EDMs) c. lathes d. milling machines e. wood routers f. punch press g. brake press h. wire bending machines i. hot-wire foam cutters j. plasma cutters k. water jet cutters l. laser cutters m. oxy-fuel cutters n. surface grinders o. cylindrical grinders 2. Describe the potential and limitations of CNC equipment. 3. Identify and describe the methods used in CNC. 4. Describe the retrofitting techniques used to convert conventional equipment into CNC equipment.	**Career Ready Practice:** 1 **CTE Anchor:** Technical Knowledge and Skills: 10.1 **CTE Pathway:** B5.1, B5.2, B7.3, B7.5, B8.1, B9.1, B10.1, B10.2, B10.3, B10.4, B10.5
F. METALS AND ALLOYS Understand and apply the selection techniques used for various combinations of metals and alloys required for industrial functions. (10 hours)	1. Identify and discuss the features and functions of the following in CNC: a. steel alloys b. cast iron c. aluminum alloys d. nickel alloys e. copper f. brass 2. Define metal coding. 3. Discuss the role of metals in the CNC process.	**Career Ready Practice:** 1 **CTE Anchor:** Technical Knowledge and Skills: 10.1 **CTE Pathway:** B3.1, B3.2, B10.1, B10.3
G. BLUEPRINT READING Understand, apply, and evaluate the techniques used in deciphering blueprint or working drawings and assembly drawings, including information sections.	1. Review the four information blocks: a. title block b. material block c. tolerance block d. change block e. gear and spine data f. notes 2. Explain view or projections. 3. Review the following types of lines used:	**Career Ready Practice:** 1, 5 **CTE Anchor:** Technical Knowledge and Skills: 10.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(15 hours)	a. outline or visible b. section c. hidden d. center e. dimension f. cutting plane g. break line 4. Explain dimension using the following terms: a. fractional b. decimal c. angular 5. Explain tolerance using the following terms: a. fractional b. decimal c. angular 6. Identify symbols and abbreviations used in blueprint reading. 7. Pass a written exam in orthographic projection with a score of 80% or higher. 8. Pass a written exam in dimensions and notes with a score of 80% or higher.	**CTE Pathway:** B1.1, B1.2, B1.3, B2.1, B2.2, B2.3, B2.4
H. COMMUNICATIONS MEDIA Understand and apply the techniques used in drilling machine operations. (10 hours)	1. Identify the following: a. CNC drawing specifications b. tolerances c. electronic data d. G-codes 2. Identify ways to control the possibilities of human error. 3. Identify and describe the various coding systems. 4. Define coordinates. 5. Differentiate language of G-codes such as: a. word address b. block address c. tab sequential 6. Identify and describe the differences in: a. G-code format b. auxiliary codes	**Career Ready Practice:** 1 **CTE Anchor:** Technical Knowledge and Skills: 10.1 **CTE Pathway:** B10.2, B10.3
I. PROGRAMMING Understand and apply the techniques used in metal-cutting operations.	1. Define and describe the following manuscript preparation operations: a. point identification b. feed and speed specifications c. tool location and positioning 2. Define the following types of programming: 1. continuous path 2. point-to-point	**Career Ready Practice:** 1 **CTE Anchor:** Technical Knowledge and Skills: 10.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(95 hours)	3. Define tape shortage/breakage. 4. Describe and demonstrate the following: a. file preparation techniques b. operation of perforation equipment c. point-to-point programming of: i. language code ii. file formats iii. writing programs d. file verification e. file mounting f. tool adjustment g. testing tool performance h. material preparation for parts fabrication	**CTE Pathway:** B10.1, B10.2, B10.3, B10.4, B10.5
J. ROBOTICS Understand and apply the techniques used in lathe operations. (5 hours)	1. Define robotics. 2. Describe robotics as an aspect of CNC. 3. Describe the relationship of robotics with the following: a. electronics b. mechanics c. software 4. Identify and describe the following structural parts of a robot: a. links b. effectors (hands) i. mechanical grippers ii. mechanical grippers iii. vacuum grippers iv. general purpose effectors c. actuators (muscles) d. joints 5. Define and describe the following power sources for a robot: a. pneumatic b. hydraulics c. flywheel energy storage d. organic garbage e. radioactive source	**Career Ready Practice:** 1 **CTE Anchor:** Technical Knowledge and Skills: 10.1 **CTE Pathway:** B10.1
K. EMPLOYABILITY SKILLS REVIEW Understand, apply, and evaluate the employability skills required in the machining industry.	1. Review employer requirements for the following: a. punctuality b. attendance c. attitude toward work d. quality of work e. teamwork f. responsibility g. timeliness h. communication skills	**Career Ready Practice:** 1, 3, 7 **CTE Anchor:** Communications: 2.3, 2.4 Career Planning and Management: 3.3, 3.4, 3.7, 3.8, 3.9

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)	2. Update the list of potential employers through traditional and internet sources. 3. Review the role of social media in job search. 4. Update sample résumés and cover letters. 5. Review the importance of filling out a job application legibly, with accurate and complete information. 6. Complete sample job application forms correctly. 7. Review the importance of enthusiasm in the interview and on a job. 8. Review the importance of appropriate appearance in the interview and on a job. 9. Review the importance of the continuous upgrading of job skills. 10. Review the importance of customer service as a method of building permanent relationships between the organization and the customer. 11. Review and demonstrate appropriate interviewing techniques. 12. Review the informational materials and resources needed to be successful in an interview. 13. Update sample follow-up letters. 14. Review and demonstrate appropriate follow-up procedures.	Responsibility and Flexibility: 7.2, 7.7 Leadership and Teamwork: 9.2, 9.3 Technical Knowledge and Skills: 10.1 **CTE Pathway:** B11.5
L. ENTREPRENEURIAL SKILLS Understand, apply, and evaluate the process involved in becoming an entrepreneur in the machining industry. (4 hours)	1. Define entrepreneurship. 2. Identify the necessary characteristics of successful entrepreneurs. 3. Describe the contributions of entrepreneurs to the machining industry. 4. Explain the purpose and components of a business plan. 5. Examine personal goals prior to starting a business. 6. Evaluate sources of monetary investment in a business opportunity. 7. Describe various licensing requirements in the machining business. 8. Develop a scenario depicting the student as the machining business owner. 9. Differentiate between Leadership in Energy and Environmental Design (LEED) business practices and standard business practices.	**Career Ready Practice:** 3, 12 **CTE Anchor:** Career Planning and Management: 3.7 Demonstration and Application: 11.2, 11.3, 11.4 **CTE Pathway:** B9.2

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTBOOKS

Boothroyd, Geoffrey and Winston A. Knight. Fundamentals of Machining and Machine Tools, 3rd Edition. Taylor and Francis, Inc. November 2005.

Oberg, Erik, Franklin D. Jones, Holbrook L. Horton, et al. Machinery's Handbook, 27th Edition. Industrial Press, Inc. April 2004.

Taylor, David L. Elementary Blueprint Reading for Machinist, 5th Edition. Cengage Learning, June 2003.

Walker, John R. Machining Fundamentals. Goodheart-Wilcox Publisher, January 2004.

RESOURCES

Employer Advisory Board members

CTE Model Curriculum Standards for Manufacturing and Product Development:
http://www.cde.ca.gov/ci/ct/sf/documents/manproddev.pdf

National Tooling and Machining Association (NTMA), 9300 Livingston Rd., Fort Washington, MD 20744. Phone: (800) 248-6862.
Precision Machined Products Association (PMPA), 6700 West Snowville Rd., Brecksville, OH 44141-3292. Phone: (440) 526-0300. Fax: (440) 526-5803.
Precision Metalforming Association Educational Foundation (PMAEF), 6363 Oak Tree Blvd., Independence, OH 44131-2500. Phone: (216) 901-8800. Fax: (216) 901-9190.

COMPETENCY CHECKLIST

TEACHING STRATEGIES and EVALUATION

METHODS AND PROCEDURES

A. Lectures and discussions

B. Demonstrations and participation

C. Multimedia presentations

D. Individualized instruction

E. Role-playing

F. Guest speakers

G. Field trips and field study experiences

H. Projects

EVALUATION

SECTION A – Introduction – Pass the safety test with 100% accuracy.

SECTION B – Resource Management Review – Pass all assignments and exams on resource management reviewwith a minimum score of 80% or higher.

SECTION C – Math and Science Principles – Pass all assignments and exams on math and science principles with a minimum score of 80% or higher.

SECTION D – Precision Tools – Pass all assignments and exams on precision tools with a minimum score of 80% or higher.

SECTION E – CNC Equipment– Pass all assignments and exams on CNC equipment with a minimum score of 80% or higher.

SECTION F – Metals and Alloys– Pass all assignments and exams on metals and alloys with a minimum score of 80% or higher.

SECTION G – Blueprint Reading – Pass all assignments and exams on blueprint reading with a minimum score of 80% or higher.

SECTION H – Communications Media– Pass all assignments and exams on communications media with a minimum score of 80% or higher.

SECTION I – Programming– Pass all assignments and exams on programming with a minimum score of 80% or higher.

SECTION J – Robotics– Pass all assignments and exams on robotics with a minimum score of 80% or higher.

SECTION K –Employability Skills Review – Pass all assignments and exams on employability skills review with a minimum score of 80% or higher.

SECTION L –Entrepreneurial Skills– Pass all assignments and exams on entrepreneurial skills with a minimum score of 80% or higher.

Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.