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I. COURSE DESCRIPTION: This course is designed to teach the student more advanced skills that will be used in the Machine Shop. The student will be required to use mathematical calculations to solve various machining problems common to the industry. The students will learn at an advanced level to use precision measuring tools, detailing the many common methods of machining and shaping parts to given specification. All material covered in first semester(MCH-117) will be reinforced and expanded on during this course. It also gives an overview of newer processes such as, laser machining and welding, water-jet cutting, high energy rate forming(HERF), cryogenics, chipless machining, electrical discharge machining(EDM), electrical discharge wiring cutting(EDWC), electrochemical machining(ECM), robotics, rapid prototype forming, and the importance of computers in the operation of most of these machines.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course the student will demonstrate the ability to:

- 1) Learn to utilize the numerous types of fasteners that a machinist will use as well as their proper handling and installation.

Potential Elements of the Performance:

- ◆ Identify several types of fasteners.
- ◆ Explain why inch-based fasteners are not interchangeable with metric based fasteners.
- ◆ Describe how some fasteners are used.
- ◆ Select the proper fastening techniques for a specific job.
- ◆ Describe chemical fastening techniques.

- 2) Utilize different types of jigs and fixtures in the machining industry.

Potential Elements of the Performance:

- ◆ Explain why jigs and fixtures are used.
- ◆ Describe a jig.
- ◆ Describe a fixture.
- ◆ Elaborate on the classification of jigs and fixtures.

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- 3) To understand the selection and use of different types of cutting fluids and oils

Potential Elements of the Performance:

- ◆ Explain why cutting fluids are necessary.
- ◆ List the types of cutting fluids.
- ◆ Describe each type of cutting fluid
- ◆ Explain how cutting fluid should be applied
- ◆ Compare the different manufacturers of cutting fluids and oils.

- 4) Comprehend common lathe functions

Potential Elements of the Performance:

- ◆ Realize the importance of cleaning the lathe
- ◆ Calculate cutting speeds and feeds (high speed steel tools vs. carbide cutting tools)
- ◆ Demonstrate work holding attachments
- ◆ Discuss parting and grooving operations (thread clearance, o-ring grooves, mechanical seals etc.)

- 5) Rationalize more advanced lathe operations

Potential Elements of the Performance:

- ◆ Describe how to safely set up a lathe using various work holding devices.
- ◆ Learn to set up steady and follower rests.
- ◆ Compare and contrast drilling, boring, knurling, grinding, milling operations on a lathe.
- ◆ Demonstrate familiarity with industrial application of the lathe.
- ◆ Illustrate cat-head and spider applications for machining long shafts.

- 6) Learn various broaching operations

Potential Elements of the Performance:

- ◆ Describe the broaching operation
- ◆ Explain the advantages of broaching
- ◆ Illustrate the set up and cutting of a keyway using a keyway broach and an arbor press

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7) Rationalize more advanced milling operations

Potential Elements of the Performance:

- ◆ Describe how milling machines operate
- ◆ Identify different milling operations(cutting, drilling, slotting and boring)
- ◆ Describe various ways to cut an angle on a mill
- ◆ Perform the calculations for all types of gears(spur, bevel, and helical gears)
- ◆ Review the use of indexing on a mill (linear, simple, differential, and angular)

8) Explain various methods of precision grinding

Potential Elements of the Performance:

- ◆ Explain how precision grinders operate(cylindrical, centerless, surface, tool and cutter).
- ◆ Select the proper grinding wheel for each operation
- ◆ Learn the different ways to test, balance and true a grinding wheel
- ◆ Identify various work holding devices use on a surface grinder
- ◆ Solve common surface grinding problems
- ◆ List safety rules that apply to precision grinding

9) Illustrate and select proper band saw blades

Potential Elements of the Performance

- Describe how contour band machines operate
- Explain the advantages of band machining
- Select the proper blade for the job to be done
- Describe how to weld a blade and mounting it on a band machine
- Explain the safe operation of a band machine

10) Learn about automation in the machining industry

Potential Elements of the Performance

- Define the term “ automation”
- Describe several automated production systems
- Define the term “industrial robot”
- Discuss the use of robotics in automated production systems

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- 11) Select proper heat treating techniques for different materials

Potential Elements of the Performance

- Explains why some metals are heat-treated
- List some of the metals that can be heat-treated
- Describe some types of heat-treating techniques and how they are performed
- Explain methods to case harden low-carbon steels
- Explain methods to harden and temper some tool steels
- Compare hardness testing techniques
- Point out the safety precautions that must be observed when heat-treating metals

- 12) Identify various metal finishes

Potential Elements of the Performance

- Describe how the quality of a machined surface is determined
- Explain why the quality of a machined surface has a direct bearing on production costs
- Describe some metal finishing techniques

- 13) Become familiar with some more advanced machining processes

Potential Elements of the Performance

- Explain the advantages and disadvantages of the electromachining processes
- Describe electrical discharge machining
- Explain electrical discharge wire cutting
- Describe electrochemical machining

- 14) Identify the non-traditional machining techniques

Potential Elements of the Performance

- Describe several nontraditional machining techniques
- Explain how nontraditional machining techniques differ from traditional machining processes
- Summarize how to perform several nontraditional machining techniques
- List the advantages and disadvantages of several of the nontraditional machining techniques

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15) Discuss machining of other materials

Potential Elements of the Performance

- Discuss the general machining characteristics of various plastics
- Describe the hazards associated with machining plastics
- Sharpen cutting tools to machine plastics
- Describe the five basic operations of chipless machining and their variations
- Explain how the intraform process differs from other chipless machining techniques
- Describe how powder metallurgy parts are produced
- Relate how powder metallurgy parts can be machined
- Compare the advantages and disadvantages of various HERF techniques
- Explain how the science of cryogenics is used in industry, and list some applications

16) Study different occupations in machining technology

Potential Elements of the Performance

- List the requirements for the various machining technology occupations.
- Explain where to obtain information on occupations in machining technology
- State what industry expects of an employee.
- Describe what an employee should expect from industry
- Summarize the information given on a resume

III. TOPICS:

- 1) Fasteners
- 2) Jigs and Fixtures
- 3) Cutting Fluids
- 4) The Lathe
- 5) Other Lather Operations
- 6) Broaching Operations
- 7) Milling Machine Operations
- 8) Precision Grinding
- 9) Band Machining
- 10) Automated Manufacturing
- 11) Heat Treatment of Metals
- 12) Metal Finishing
- 13) Electromachining Processes
- 14) Nontraditional Machining Techniques
- 15) Other Processes
- 16) Occupations in Technology

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IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Machining Fundamentals, John R. Walker, G. W. Walker
 Machining Fundamentals Workbook, John R. Walker, G. W. Walker
 Calculator, binder, paper, pens

V. EVALUATION PROCESS/GRADING SYSTEM:

Evaluation:

Tests	70%
Quizzes & Assignments	20%
Organizational Skills	10%

In addition to completing the above requirements, students must be in attendance a minimum of 95% of all classes.

The following semester grades will be assigned to students in postsecondary courses:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 – 100%	4.00
A	80 - 89%	3.75
B	70 - 79%	3.00
C	60 - 69%	2.00
R (Repeat)	59% or below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field placement or non-graded subject areas.	
X	A temporary grade. This is used in limited situations with extenuating circumstances giving a student additional time to complete the requirements for a course (see <i>Policies & Procedures Manual – Deferred Grades and Make-up</i>).	
NR	Grade not reported to Registrar's office. This is used to facilitate transcript preparation when, for extenuating circumstances, it has been impossible for the faculty member to report grades.	

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VI. SPECIAL NOTES:

Bursary:

Two student bursaries are awarded each year to the students based on highest applied academic standards with perfect attendance.

Assignments & Projects:

Assignments and projects will be submitted to the professor at the time specified.

Late assignments and projects will receive a grade of zero except in the case where the student has experienced extenuating circumstances and has contacted the professor prior to the due date.

Guidelines on Conduct:

Reliability: Neither industrial work places of the College can or will tolerate tradesmen (students) taking time off without adequate reason or without maximum possible notice. A very real part of reliability is the ability to carry out responsibilities with minimum supervision.

Attendance/Punctuality: Attendance is mandatory for all classes unless specifically excused. This also includes any organized field trips both locally and out of town. Medical absence must be substantiated with a written note from either a Doctor or the College Health Nurse. Punctuality is important as demonstrations may occur at the beginning of classes. Although it is not recommended that students leave before the completion date of this program, permission may be granted to leave one week early for employment with professor approval and a signed letter from the employer.

Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493, 717, or 491 so that support services can be arranged for you.

Retention of course outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other post secondary institutions.

The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning will be given upon successful completion of the following:

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VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.