I. **OVERVIEW**

The following information will appear in the 2011 - 2012 catalog

**MFGA 303  Machine Shop 3  3 Units**

*Also offered as:* MACH - 303: Machine Shop 3  
*Formerly listed as:* MACH - 303: Machine Shop 3  
*Prerequisite:* Satisfactory completion of MFGA 302 or MACH 302.

This class is intended to address the needs of the working student who has some experience in the manufacturing areas of the economy and has completed MACH 302. The theory and practice in the use of the dividing head, gearing systems, tool and cutter grinding, and non-traditional machining systems is addressed. Carbine tooling emphasized.

**Materials Fee Required**

Field trips are not required. (A-F or P/NP - Student choice) Lecture /Lab

II. **LEARNING CONTEXT**

Given the following learning context, the student who satisfactorily completes this course should be able to achieve the goals specified in Section III, Desired Learning:

A. **COURSE CONTENT**

1. **Required Content:**

   a. Metric Measurement
      
      i. Advantages over inch system
      
      ii. Scales
      
      iii. Micrometers
      
      iv. Conversion to inches
      
      v. S.I. threads
      
      vi. Prefixes

   b. Advanced milling operations
      
      i. Indexing
      
      ii. Hole patterns
      
      iii. Use of 2 axis CNC Mill using Conversational Programming

   c. Abrasive metal removal
      
      i. Lapping
      
      ii. Grinding
2. **Required Lab Content:**

   The laboratory content provides students with the hands-on experience and time on using various precision measuring tools and equipment. The exposure via these assigned metallurgy projects develop student confidence for the machining trade:

   a. Dove tail and T Slots (Mill)
   b. Application of Jig Boring (Mill)
   c. Layout and Production of Hole Patterns
   d. Angular Ground Surface
   e. 2 Axis CNC

**B. ENROLLMENT RESTRICTIONS**

1. **Prerequisites**

   Satisfactory completion of MFGA 302 or MACH 302.

2. **Requisite Skills**

   *Before entering the course, the student will be able to:*

   a. Identify the operational components of horizontal and vertical milling machines.
   b. Identify, know the functions of, and operate standard and special milling cutters.
   c. Select the proper feed, speed and depth of cut for various milling operations.
   d. Apply various work holding devices utilized in milling operations and be able to set up the machine to allow their use.
   e. Identify and correct causes of milling cutter failure.
   f. Identify and apply the correct cutters for reaming, boring, counter-boring and counter-sinking holes.
   g. Apply a selection of dial indicators, inside micrometers, surface plates and gage blocks in machine setups and inspection work.
   h. Demonstrate the use of a surface grinder to machine a rectangular workpiece square and parallel.
   i. Categorize grinding wheels according to composition, characteristics, and shapes.
   j. Classify ferrous metals according to composition using SAE system.
   k. Conduct hardness tests on metallic parts, both ferrous and non ferrous.
   l. Describe the effect of alloying elements on steel.
   m. Select and apply the proper heat treating procedures for various types of steel.
   n. Cut and measure standard English threads by single point method using the engine lathe.

**C. HOURS AND UNITS**
### METHODS OF INSTRUCTION (TYPICAL)

Instructors of the course might conduct the course using the following methods:

1. Classroom Lecture
2. Group Discussion
3. Instructor Equipment Demonstrations
5. Guest Speakers
6. Individualized student feedback on lab assignments
7. Individualized student feedback on machine equipment and tool technique

### ASSIGNMENTS (TYPICAL)

1. **EVIDENCE OF APPROPRIATE WORKLOAD FOR COURSE UNITS**

   *Time spent on coursework in addition to hours of instruction (lecture hours)*

   a. Weekly Chapter Reading Assignments
   b. Weekly Homework Assignments
   c. Per Term preparation for Mid Term Exam
   d. Per Term preparation for Final Exam

2. **EVIDENCE OF CRITICAL THINKING**

   *Assignments require the appropriate level of critical thinking*

   a. Typical Test Question: Name four common boring tools and explain the advantage of each.
   b. Typical Test Question: Explain why longitudinal and crossfeed settings may be set quickly and accurately to .0001 in. (.002mm)
   c. Typical Test Question: How does a vertical machining center provide for Z axis movement?
   d. Typical MACH Laboratory Approach: (1) Student, weighing options, plots the most efficient and appropriate operations sequence; (2) Student inspects, evaluates, and if necessary, reworks project and (3) Student submits project and completed operational sequence form and inspection report

### TEXTS AND OTHER READINGS (TYPICAL)

III. DESIRED LEARNING

A. COURSE GOAL
   As a result of satisfactory completion of this course, the student should be prepared to:

   (1) given a manual engine lathe with the necessary tooling and measuring tools, the student will be able to cut an Acme form class 3G thread on a shaft to stated tolerances within one hour and (2) given a horizontal milling machine with the necessary tooling and measuring tools, the student will be able to set up and cut a 19 tooth, 10 diametral pitch involute gear on a shaft within two hours.

B. STUDENT LEARNING GOALS
   Mastery of the following learning goals will enable the student to achieve the overall course goal.

1. Required Learning Goals
   Upon satisfactory completion of this course, the student will be able to:
   a. Define the application of different gear types and be able to calculate final ratios of gear trains.
   b. Identify gear tooth geometry and apply formulas for calculating dimensions of gear teeth and splines.
   c. Identify methods by which gears may be produced in industry.
   d. Interpret linear measurements with metric scales and micrometers.
   e. Determine dimensions, select cutters and produce key ways in shafts and bores.
   f. Identify common carbide inserts by industry typical identification system.
   g. Calculate effective speeds and feeds necessary to efficiently cut metallic materials using carbide cutting tools.

2. Lab Learning Goals
   Upon satisfactory completion of the lab portion of this course, the student will be able to:
   a. Use a vertical milling machine to produce dove tails and T-slots.
   b. Apply the principles of jig-boring to vertical milling machines.
   c. Cut a gear and spline utilizing the milling machine and direct and simple indexing with the dividing head.
   d. Layout and produce hole patterns using a rotary table or polar to rectangular coordinate conversion.
   e. Produce angular ground surfaces using sine vices, sine chucks, and by modifying grinding wheels.
   f. Properly install the correct indexable insert in both turning and milling tools.

IV. METHODS OF ASSESSMENT (TYPICAL)

A. FORMATIVE ASSESSMENT
1. Observation of performance and work habits
2. Mechanical inspection and measurement of projects

B. **SUMMATIVE ASSESSMENT**
1. Midterm and final exams
2. Use of performance rating sheets to judge safety, accuracy and workmanship