Modesto Junior College  
Course Outline of Record  
MFGA 302

I. **OVERVIEW**  
The following information will appear in the 2011 - 2012 catalog

MFGA 302  *Machine Shop 2*  
3 Units

*Also offered as:* MACH - 302: Machine Shop 2  
*Formerly listed as:* MACH - 302: Machine Shop 2  
*Prerequisite:* Satisfactory completion of MACH 211 or MACH 301 or MFGA 301.

This class is intended to address the needs of the working student who has had some experience in the manufacturing areas of the economy and has completed MACH 301. The principles and fundamental use of precision grinders and advanced applications of the manual engine lathe and milling machine are a primary focus. Advanced levels of measuring systems, the study of basic metallurgy, and the techniques of heat treating to enhance the properties of metallic parts are addressed.

*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:**

Note: The content of this class is basically the same as MACH 212, as are the Objectives. The sequential 300 series of classes (MACH 302) have been developed to meet the needs and time constraints of the older, working student, who is currently involved in a manufacturing industry and needs to further develop skills to maintain employability or position themselves for advancement. This student typically is not available to take daytime classes, has had considerable exposure to the subject matter, is likely to be familiar with the equipment, and is able to move through the curriculum at a much faster pace. It is the intent in each series of classes to address the same topics and at the end of each sequential course advance the student to the same level of competency.

a. Milling machines
   i. Construction: Horizontal, Vertical
   ii. Cutters: Slab, Plain, Face, Form, Fly Cutters and End Mills
   iii. Work Holding Devices: Vises, Fixtures, Clamping
   iv. Attachments: Dividing Head, Rotary Table, Vertical Shaper
   v. Hole Machining
      a. Reaming
      b. Boring
c. Counter Sinking

d. Counter Boring

vi. Speeds and Feeds

vii. Setups and Operations
   a. Square Stock
   b. Milling Keyways
   c. Angular Cuts

b. Abrasive Metal Removal
   i. Honing
   ii. Grinding
   iii. Setups and operations

c. Dial indicators
   i. Types
   ii. Applications

d. Precision layout
   i. Height gage
   ii. Gage blocks
   iii. Sine bar
   iv. Surface plate

e. Metallurgy
   i. Ferrous and Non Ferrous Properties
   ii. Effect of alloying elements

f. Heat Treatment of Metallic Parts
   i. Process
   ii. Hardness testing to determine properties

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. Mill Equipment Projects
b. Engine Lathe Equipment Projects
c. Machining Projects requiring abrasive metal removal
d. Heat treatment based projects

B. ENROLLMENT RESTRICTIONS

1. Prerequisites

Satisfactory completion of MACH 211 or MACH 301 or MFGA 301.

2. Requisite Skills

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

- a. Identify the setup and proper use of the various work holding devices used with the lathe.
- b. Calculate the appropriate cutting speed, spindle speed and feed rates for all cuts.
- c. Turn cylindrical and conical surfaces both internal and external.
- d. Determine proper size and be able to cut key seats using an end mill cutter and vertical milling machine.
- e. Identify correct screw thread terminology and means by which screw threads are produced and measured.
- f. Conduct precision and semi-precision measurement in the traditional inch system.
- g. Measure with steel rules to 1/64" and with micrometers and vernier calipers to .001 inch.
- h. Interpret lines, symbols and notes on one and two view mechanical drawings.
- i. Identify cutting tool geometry and grind single point lathe tools and twist drills.
- j. Operate safely the bandsaw, drill press, pedestal grinder, engine lathe, and vertical milling machine.
- k. Inspect and evaluate finished workpieces utilizing precision measuring tools.

C. HOURS AND UNITS

<table>
<thead>
<tr>
<th>INST METHOD</th>
<th>TERM HOURS</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lect</td>
<td>36</td>
<td>2.00</td>
</tr>
<tr>
<td>Lab</td>
<td>54</td>
<td>1.00</td>
</tr>
<tr>
<td>Disc</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

D. METHODS OF INSTRUCTION (TYPICAL)

*Instructors of the course might conduct the course using the following method:*

1. Class Lecture
3. Class and laboratory demonstrations.
4. Group Discussions
5. Immediate lab feedback to student during inspection of work.

E. 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 Question: Describe the of heat treatment process of metals and its place in advanced manufacturing.
   b. 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.

F. TEXTS AND OTHER READINGS (TYPICAL)

4. Other: Weaver, Jeff. MACH 302 Syllabus
5. Other: Protective Eye Wear

III. DESIRED LEARNING

A. COURSE GOAL
   *As a result of satisfactory completion of this course, the student should be prepared to:*
   
   (1) given a surface grinder with the necessary tooling and measuring tools, the student will be able to grind the outside surfaces of a 1"x2"x3" hardened steel part to within a tolerance of .0004" within four hours and (2) Given a manual engine lathe with the necessary tooling and measuring tools, the student will be able to cut unified form class 2A threads on two areas of a shaft to stated tolerances 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. Identify the operational components of horizontal and vertical milling machines.

b. Identify, know the functions of, and operate standard and special milling cutters.

c. Identify and correct causes of milling cutter failure.

d. Identify the correct cutters for reaming, boring, counter-boring, and counter-sinking holes.

e. Explain the construction and safe operation of standard surface grinders.

f. Categorize grinding wheels according to composition, characteristics, and shapes.

g. Classify ferrous metals according to composition using SAE system.

h. Conduct hardness tests on metallic parts, both ferrous and non ferrous.

i. Describe the effect of alloying elements on steel.

2. **Lab Learning Goals**

   *Upon satisfactory completion of the lab portion of this course, the student will be able to:*

   a. Select the proper feed, speed and depth of cut for various milling operations.

   b. Apply various work holding devices utilized in milling operations and be able to set up the machine to allow their use.

   c. Identify and apply the correct cutters for reaming, boring, counter-boring, and counter-sinking holes.

   d. Apply a selection of dial indicators, inside micrometers, surface plates, and gage blocks in machine setups and inspection work.

   e. Demonstrate the use of a surface grinder to machine a rectangular workpiece square and parallel.

   f. Generate close tolerance holes by honing.

   g. Select and apply the proper heat treating procedures for various types of steel.

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