



El Camino College  
 COURSE OUTLINE OF RECORD – Official

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| <b>Course Acronym:</b>              | MTT                                                                                                                                                                                                                                                                                                                                      |
| <b>Course Number:</b>               | 46                                                                                                                                                                                                                                                                                                                                       |
| <b>Descriptive Title:</b>           | Basic Machine Tool Operation                                                                                                                                                                                                                                                                                                             |
| <b>Division:</b>                    | Industry and Technology                                                                                                                                                                                                                                                                                                                  |
| <b>Department:</b>                  | Machine Tool Technology                                                                                                                                                                                                                                                                                                                  |
| <b>Course Disciplines:</b>          | Machine Tool Technology                                                                                                                                                                                                                                                                                                                  |
| <b>Catalog Description:</b>         | Students are introduced to the basic principles and operation of machine tools with a focus on bench operations, drilling, engine lathes, mills, and grinding machines. Standard industry practices and tool set-ups used are emphasized. Laboratory projects and exercises related to the lectures and demonstrations will be assigned. |
| <b>Prerequisite:</b>                |                                                                                                                                                                                                                                                                                                                                          |
| <b>Co-requisite:</b>                |                                                                                                                                                                                                                                                                                                                                          |
| <b>Recommended Preparation:</b>     |                                                                                                                                                                                                                                                                                                                                          |
| <b>Enrollment Limitation:</b>       |                                                                                                                                                                                                                                                                                                                                          |
| <b>Hours Lecture (per week):</b>    | 2                                                                                                                                                                                                                                                                                                                                        |
| <b>Hours Laboratory (per week):</b> | 4                                                                                                                                                                                                                                                                                                                                        |
| <b>Outside Study Hours:</b>         | 4                                                                                                                                                                                                                                                                                                                                        |
| <b>Total Course Hours:</b>          | 108                                                                                                                                                                                                                                                                                                                                      |
| <b>Course Units:</b>                | 3                                                                                                                                                                                                                                                                                                                                        |
| <b>Grading Method:</b>              | Letter Grade and Pass/No Pass                                                                                                                                                                                                                                                                                                            |
| <b>Credit Status:</b>               | Credit, degree applicable                                                                                                                                                                                                                                                                                                                |
| <b>Transfer CSU:</b>                | Yes                                                                                                                                                                                                                                                                                                                                      |
| <b>Effective Date:</b>              | Prior to July 1992                                                                                                                                                                                                                                                                                                                       |
| <b>Transfer UC:</b>                 | No                                                                                                                                                                                                                                                                                                                                       |
| <b>Effective Date:</b>              |                                                                                                                                                                                                                                                                                                                                          |
| <b>General Education:</b><br>ECC    |                                                                                                                                                                                                                                                                                                                                          |
| <b>Term:</b>                        |                                                                                                                                                                                                                                                                                                                                          |
| <b>Other:</b>                       |                                                                                                                                                                                                                                                                                                                                          |
| <b>CSU GE:</b>                      |                                                                                                                                                                                                                                                                                                                                          |
| <b>Term:</b>                        |                                                                                                                                                                                                                                                                                                                                          |
| <b>Other:</b>                       |                                                                                                                                                                                                                                                                                                                                          |

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| <b>IGETC:</b>                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Term:</b>                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Other:</b>                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Student Learning Outcomes:</b> | <p><b>SLO #1 HSS Setting the Milling Machine</b></p> <p>Student will calculate the correct rotations per minute (rpm) for a high speed steel end mill using the correct cutting speed and end mill diameter. Then the student will demonstrate setting the speed of the milling machine.</p> <p><b>SLO #2 Micrometers &amp; Measuring</b></p> <p>The student will be able to use and read micrometers, vernier measuring tools, semi-precision and precision measuring tools to measure and produce projects within the tolerances specified by engineering requirements.</p> <p><b>SLO #3 Power Machines</b></p> <p>Using proper safety procedures and precautions, students will be able to set up and operate drilling machines, engine lathes, vertical and horizontal milling machines, and grinding machines to produce projects within the tolerances specified by engineering requirements.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Objectives:</b>         | <ol style="list-style-type: none"> <li>1. Demonstrate manufacturing shop safety practices with 100% accuracy.</li> <li>2. Use and read micrometers and vernier measuring tools to measure projects within the tolerances specified by engineering requirements.</li> <li>3. Select and use metal working hand tools to produce projects within the tolerances specified by engineering requirements.</li> <li>4. Measure and layout utilizing semi-precision and precision measuring tools to produce projects within the tolerances specified by engineering requirements.</li> <li>5. Weld band saw blades and use power saws to rough finish projects within a minimum of 1/32 of an inch over the dimensions required by engineering requirements.</li> <li>6. Set up and operate drilling machines to center drill, drill, ream, countersink, counterbore, and tap threads to produce projects within the tolerances specified by engineering requirements.</li> <li>7. Set up and operate engine lathes to turn, face, center drill, thread, and cut off to produce projects within the tolerances on the engineering requirements.</li> <li>8. Set up and operate vertical and horizontal milling machines to square stock, mill flat surfaces, side mill, end mill, fly cut and slot to produce projects within the tolerances specified on the engineering requirements.</li> <li>9. Set up and operate grinding machines to sharpen lathe tool bits, twist drills, and surface grind to produce projects within the tolerances specified by engineering requirements.</li> </ol> |

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|                             | <p>10. Heat treat low carbon steel projects so that they will meet engineering specifications.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>Major Topics:</b></p> | <p><b>I. OVERVIEW OF BASIC MACHINE TOOL OPERATION (2 hours, lecture)</b></p> <ul style="list-style-type: none"> <li>A. Machine tool technology careers</li> <li>B. Safety</li> </ul> <p><b>II. OVERVIEW OF BASIC MACHINE TOOL OPERATION (4 hours, lab)</b></p> <ul style="list-style-type: none"> <li>A. Machine tool technology careers</li> <li>B. Safety</li> </ul> <p><b>III. MEASURING TOOLS (1 hour, lecture)</b></p> <ul style="list-style-type: none"> <li>A. Rulers</li> <li>B. Micrometers</li> <li>C. Verniers</li> <li>D. Calipers</li> <li>E. Scales</li> </ul> <p><b>IV. MEASURING TOOLS (2 hours, lab)</b></p> <ul style="list-style-type: none"> <li>A. Rulers</li> <li>B. Micrometers</li> <li>C. Verniers</li> <li>D. Calipers</li> <li>E. Scales</li> </ul> <p><b>V. SPEEDS AND FEEDS (1 hour, lecture)</b></p> <ul style="list-style-type: none"> <li>A. Cutting speeds</li> <li>B. Diameters</li> <li>C. Workpiece materials</li> </ul> <p><b>VI. SPEEDS AND FEEDS - LAB (2 hours, lab)</b></p> <ul style="list-style-type: none"> <li>A. Cutting speeds</li> <li>B. Diameters</li> <li>C. Workpiece materials</li> </ul> <p><b>VII. LATHE TOOL GEOMETRY (1 hour, lecture)</b></p> <ul style="list-style-type: none"> <li>A. Materials</li> <li>B. Cutting angles</li> </ul> <p><b>VIII. LATHE TOOL GEOMETRY - LAB (2 hours, lab)</b></p> <ul style="list-style-type: none"> <li>A. Materials</li> <li>B. Cutting angles</li> </ul> |

**IX. HANDTOOLS AND BENCHWORK (1 hour, lecture)**

- A. Materials
- B. Angles

**X. HAND TOOLS AND BENCH WORK (2 hours, lab)**

- A. Materials
- B. Angles

**XI. LAYOUT (2 hours, lecture)**

- A. Parallels
- B. Work holding devices

**XII. LAYOUT (4 hours, lab)**

- A. Parallels
- B. Work holding devices

**XIII. ENGINE LATHES (8 hours, lecture)**

- A. Lathe set-up
- B. Work holding devices

**XIV. ENGINE LATHES (16 hours, lab)**

- A. Lathe set-up
- B. Work holding devices

**XV. MATERIALS OF MANUFACTURE (2 hours, lecture)**

- A. Ferrous
  - 1. Carbon
  - 2. Stainless steel
  - 3. Cast iron
- B. Non Ferrous
  - 1. Aluminum
  - 2. Brass
  - 3. Bronze
- C. Heat treatment
  - 1. Carburizing
  - 2. Furnaces

**XVI. MATERIALS OF MANUFACTURE (4 hours, lab)**

- A. Ferrous
  - 1. Carbon
  - 2. Stainless steel
  - 3. Cast iron

- B. Non Ferrous
  - 1. Aluminum
  - 2. Brass
  - 3. Bronze
- C. Heat treatment
  - 1. Carburizing
  - 2. Furnaces

**XVII. DRILLING OPERATIONS (4 hours, lecture)**

- A. Drilling
- B. Milling
- C. Lathes

**XVIII. DRILLING OPERATIONS (8 hours, lab)**

- A. Drilling
- B. Milling
- C. Lathes

**XIX. POWER SAWS (2 hours, lecture)**

- A. Hacksaws
- B. Bandsaws

**XX. POWER SAWS (4 hours, lab)**

- A. Hacksaws
- B. Bandsaws

**XXI. MILLING MACHINES (6 hours, lecture)**

- A. Vertical
- B. Horizontal

**XXII. MILLING MACHINES (12 hours, lab)**

- A. Vertical
- B. Horizontal

**XXIII. COMPUTER NUMERICAL CONTROL (CNC) MILLING MACHINES (4 hours, lecture)**

- A. Programming
- B. Set-ups
- C. Operations

**XXIV. GRINDING MACHINES (2 hours, lecture)**

- A. Grinding wheels
- B. Magnetic chucks
- C. Ferrous materials

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|                                                               | <p><b>XXV. GRINDING MACHINES (4 hours, lab)</b></p> <p>A. Grinding wheels<br/>B. Magnetic chucks<br/>C. Ferrous materials</p> <p><b>XXVI. CNC MILLING MACHINES (8 hours, lab)</b></p> <p>A. Programming<br/>B. Set-ups<br/>C. Operations</p>                                                                                                                                                                                                                                                                 |
| <b>Total Lecture Hours:</b>                                   | 36                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Total Laboratory Hours:</b>                                | 72                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Total Hours:</b>                                           | 108                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Primary Method of Evaluation:</b>                          | 2) Problem solving demonstrations (computational or non-computational)                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Typical Assignment Using Primary Method of Evaluation:</b> | <p>A drilling machine is to be set up for drilling a .75 diameter hole in a piece of 6061 T-6 aluminum:</p> <ol style="list-style-type: none"> <li>1. What is the Cutting Speed (CS) and Feed per tooth (FPT) for 6061 T-6 aluminum?</li> <li>2. What are the formulas for calculating Revolutions Per Minute (RPM) and feed?</li> <li>3. What is the calculated RPM and feed for the above problem?</li> </ol> <p>Write calculations and results on a one-page lab report and submit to the instructor.</p> |
| <b>Critical Thinking Assignment 1:</b>                        | Write manufacturing procedures to machine the brass mallet specified on the engineering drawing provided. Write a one-page lab report to specify each machining operation and the tools needed to complete the part. Submit completed lab report to the instructor.                                                                                                                                                                                                                                          |
| <b>Critical Thinking Assignment 2:</b>                        | After completing the brass mallet project, enter each dimension specified on the blueprint on the Inspection Report and enter the tolerances and actual dimensions in the space provided. Make a notation for each measurement not within the specified tolerance in the notes column. Submit the project and inspection report to the instructor.                                                                                                                                                           |
| <b>Other Evaluation Methods:</b>                              | <p>Performance exams<br/>Other exams<br/>Class Performance<br/>Multiple Choice<br/>Completion<br/>True/False</p>                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Instructional Methods:</b>                                 | <p>Demonstration<br/>Discussion</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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|                                                                                                                                | Laboratory<br>Lecture                                                                                                                                                                                            |
| <b>If other:</b>                                                                                                               |                                                                                                                                                                                                                  |
| <b>Work Outside of Class:</b>                                                                                                  | Study<br><br>Answer questions<br><br>Required reading<br><br>Problem solving activities                                                                                                                          |
| <b>If Other:</b>                                                                                                               |                                                                                                                                                                                                                  |
| <b>Up-To-Date Representative Textbooks:</b>                                                                                    | Stephen Krar, <u>TECHNOLOGY OF MACHINE TOOLS</u> . 8 <sup>th</sup> edition. McGraw Hill, 2020                                                                                                                    |
| <b>Alternative Textbooks:</b>                                                                                                  |                                                                                                                                                                                                                  |
| <b>Required Supplementary Readings:</b>                                                                                        |                                                                                                                                                                                                                  |
| <b>Other Required Materials:</b>                                                                                               | Safety glasses or goggles<br><br>Steel rule - flexible - 6"<br><br>Clean shop coat/apron<br><br>Lathe tool bits- 3/8" square - High Speed Steel (HSS)<br><br>Materials for projects<br><br>Scientific calculator |
| <b>Requisite:</b>                                                                                                              |                                                                                                                                                                                                                  |
| <b>Category:</b>                                                                                                               |                                                                                                                                                                                                                  |
| <b>Requisite course(s):<br/>List both prerequisites and corequisites in this box.</b>                                          |                                                                                                                                                                                                                  |
| <b>Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).</b> |                                                                                                                                                                                                                  |
| <b>Requisite Skill:</b>                                                                                                        |                                                                                                                                                                                                                  |
| <b>Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable</b>                                       |                                                                                                                                                                                                                  |
| <b>Requisite course:</b>                                                                                                       |                                                                                                                                                                                                                  |

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| <b>Requisite and Matching skill(s):</b> Bold the requisite skill. List the corresponding course objective under each skill(s).                     |              |
| <b>Requisite Skill:</b>                                                                                                                            |              |
| <b>Requisite Skill and Matching skill(s):</b> Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable |              |
| <b>Enrollment Limitations and Category:</b>                                                                                                        |              |
| <b>Enrollment Limitations Impact:</b>                                                                                                              |              |
| <b>Course Created by:</b>                                                                                                                          | Jerry Kinnan |
| <b>Date:</b>                                                                                                                                       | 09/01/1982   |
| <b>Original Board Approval Date:</b>                                                                                                               |              |
| <b>Last Reviewed and/or Revised by:</b>                                                                                                            | Eric Carlson |
| <b>Date:</b>                                                                                                                                       | 03/02/2022   |
| <b>Last Board Approval Date:</b>                                                                                                                   | 04/18/2022   |