



El Camino College
COURSE OUTLINE OF RECORD – Official

Course Acronym:	MTT
Course Number:	107
Descriptive Title:	Advanced Manufacturing Processes
Division:	Industry and Technology
Department:	Machine Tool Technology
Course Disciplines:	Machine Tool Technology
Catalog Description:	In this course, students will study the principles and operation of machine tools with an emphasis on advanced manufacturing processes and machines, such as Electrical Discharge Machines (EDM), water abrasive jet machines, and grinding machines. Additional topics will include abrasives, coordinate measuring machines, advanced precision measurement, Geometric Dimensioning and Tolerancing (GD&T), optical comparators, and practices and setups as applied in industry. Note: Letter grade or pass/no pass option.
Prerequisite:	Machine Tool Technology 46 or Machine Tool Technology 101 with a minimum grade of C in prerequisite or equivalent
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	2
Hours Laboratory (per week):	6
Outside Study Hours:	4
Total Course Hours:	144
Course Units:	4
Grading Method:	Letter Grade and Pass/No Pass
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	3/19/2007
Transfer UC:	No
Effective Date:	
General Education:	ECC
Term:	
Other:	
CSU GE:	
Term:	
Other:	
IGETC:	

Term:	
Other:	
Student Learning Outcomes:	<p>SLO #1 Pros and Cons of Cuttings</p> <p>Record the benefits and downsides of the following processes: Waterjet cutting, EDM wire cutting, Plasma cutting and Laser cutting.</p> <p>SLO #2 Measuring & Inspection</p> <p>Students will be able to select and use cylindrical squares, precision height gauges, vernier bevel protractors, gauge blocks and sine bars to inspect assigned work within the tolerances specified on engineering drawings.</p> <p>SLO #3 Grinding and Cutting Machinery</p> <p>Using proper safety procedures and precautions, students will be able to set up and operate surface grinders, cylindrical grinders, coordinate measuring machines, optical comparators, sinkers, wire electrical discharge machines, and abrasive water jet machines to produce assigned work within the tolerances specified on engineering drawings.</p>
Course Objectives:	<ol style="list-style-type: none"> 1. Correctly apply machine shop safety practices with 100% accuracy 2. Correctly use hand tools, measuring tools, layout tools, power saws, drilling machines, engine lathes, and milling machines to perform supplemental machine tool operations on assigned work within the tolerances specified on engineering drawings. 3. Select and use cylindrical squares, precision height gauges, Vernier bevel protractors, gauge blocks and sine bars to inspect assigned work within the tolerances specified on engineering drawings. 4. Interpret geometrically dimensioned and toleranced engineering drawings to assist in producing assigned work within the tolerances specified on engineering drawings. 5. Solve shop mathematics problems involving trigonometry and its application to sine bars, speeds and feeds, grinding machines, precision measurement, and engineering drawing interpretation. 6. Set up and operate surface grinders and cylindrical grinders to produce assigned work within the tolerances specified on engineering drawings. 7. Set up and operate a coordinate measuring machine and optical comparator to inspect assigned work within the tolerances specified on engineering drawings. 8. Set up and operate sinker and wire electrical discharge machines to produce assigned work within the tolerances specified on engineering drawings. 9. Set up and operate abrasive water jet machines to produce assigned work within the tolerances specified on engineering drawings.
Major Topics:	<p>I. Safety (2 hours, lecture)</p> <ol style="list-style-type: none"> A. Machine tool technology analysis B. Safe shop practices in metalworking C. Hand tool and benchwork D. Safety test <p>II. Safety (6 hours, lab)</p> <ol style="list-style-type: none"> A. Machine tool technology analysis B. Safe shop practices in metalworking C. Hand tool and bench work D. Safety test <p>III. Basic Machining and Supplemental Processes (2 hours, lecture)</p> <ol style="list-style-type: none"> A. Measurement B. Basic lathe

- C. Basic milling machines
- D. Basic grinding
- E. Print reading
- F. Procedures
- IV. Review of Machining and Supplemental Processes (6 hours, lab)**
 - A. Measurement
 - B. Lathe
 - C. Milling machines
 - D. Grinding
 - E. Print reading
 - F. Procedures
- V. Grinding Operations (2 hours, lecture)**
 - A. Surface grinding
 - B. Cylindrical grinding
 - C. Tool and cutter grinding
- VI. Grinding Operations (6 hours, lab)**
 - A. Surface grinding
 - B. Cylindrical grinding
 - C. Tool and cutter grinding
- VII. Abrasives (2 hours, lecture)**
 - A. Coated
 - B. Bonded
- VIII. Abrasives (6 hours, lab)**
 - A. Coated
 - B. Bonded
- IX. Advanced Precision Measurement (6 hours, lecture)**
 - A. Coordinate measuring machine
 - B. Optical comparator
 - C. Hardness testing
 - D. Cylindrical square
 - E. Vernier protractor
 - F. Fixed gages
- X. Advanced Precision Measurement (18 hours, lab)**
 - A. Coordinate measuring machine
 - B. Optical comparator
 - C. Hardness testing
 - D. Cylindrical square
 - E. Vernier protractor
 - F. Fixed gages
- XI. Applied Trigonometry (6 hours, lecture)**
 - A. Sine bars and plates
 - B. Gage blocks
 - C. Engineering drawing applications
- XII. Applied Trigonometry (18 hours, lab)**
 - A. Sine bars and plates
 - B. Gage blocks
 - C. Engineering drawing applications
- XIII. Geometric Dimensioning and Tolerancing (GD&T) (2 hours, lecture)**
 - A. General rules
 - B. Datums
 - C. Modifiers
- XIV. GD&T (6 hours, lab)**
 - A. General rules

	<p>B. Datums C. Modifiers</p> <p>XV. Electrical Discharge Machines (EDM) (8 hours, lecture)</p> <p>A. Cutting process and procedures B. Dielectric fluids C. Overcut and tolerances D. Sinker E. Wire</p> <p>XVI. EDM (24 hours, lab)</p> <p>A. Cutting process and procedures B. Dielectric fluids C. Overcut and tolerances D. Sinker E. Wire</p> <p>XVII. Abrasive Water Jet Machines (6 hours, lecture)</p> <p>A. Cutting process and procedures B. Stream and kerf width C. Abrasive types D. Piercing E. Cutting techniques</p> <p>XVIII. Abrasive Water Jet Machines (18 hours, lab)</p> <p>A. Cutting process and procedures B. Stream and kerf width C. Abrasive types D. Piercing E. Cutting techniques</p>
Total Lecture Hours:	36
Total Laboratory Hours:	108
Total Hours:	144
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	Design and fabricate a fixture to surface grind the 45 degree angle on the class project "CNC Triangles". Include a quick clamp technique to facilitate grinding 20 parts, one part at a time. Machine the first part and submit to the inspection team for first article approval.
Critical Thinking Assignment 1:	A matching punch and die are to be produced from a single tool steel plate for stamping the gasket for the robot arm specified in zone B5 of the engineering drawing MS-3006. Calculate the draft angle based on the clearance needed for material thickness of 0.125 inch . Set up and machine the matched parts on the wire EDM machine and inspect both pieces. Record the measured dimensions on a one-page inspection report form and submit to the instructor for evaluation.
Critical Thinking Assignment 2:	The C-Clamp frame represented on the engineering drawing MS-13 specifies datums and features to be inspected. Set up a machined frame for inspection on a coordinate measuring machine. Measure the perpendicularity feature by clamping the part on Datum A and measuring the perpendicularity to Datum B. Record the measured perpendicularity on a one-page inspection report and submit to the instructor for evaluation.
Other Evaluation Methods:	Class Performance, Completion, Homework Problems, Laboratory Reports, Matching Items, Multiple Choice, Objective Exam, Other Exams, Performance Exams, Quizzes, Term or Other Papers, True/False, Written Homework

Instructional Methods:	Demonstration, Discussion, Group Activities, Lab, Lecture, Multimedia presentations
If other:	Internet Presentation/Resources
Work Outside of Class:	Answer questions, Problem solving activity, Required reading, Study, Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Texts:	Stephen F. Krar, Arthur R. Gill and Peter Smid. <u>Technology of Machine Tools</u> . 9 th Edition McGraw Hill, 2023
Alternative Texts:	
Required Supplementary Readings:	
Other Required Materials:	Safety glasses or goggles Steel rule - flexible - 6" Clean shop coat/apron Lathe tool bits - 3/8" square Materials for projects Scientific calculator
Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Machine Tool Technology-46 Machine Tool Technology-101
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	Work in a manufacturing environment safely. MTT 101 -Correctly apply machine shop safety practices with 100% accuracy. MTT 46 -Demonstrate manufacturing shop safety practices with 100% accuracy. Read basic detail engineering drawings for machined parts. MTT 101 -Interpret orthographic projection engineering drawings that incorporate geometric dimensioning and tolerancing to produce assigned work within the tolerances specified on engineering drawings. Identify and use metal working hand tools. MTT 101 -Select and use metal working hand tools to produce assigned work within the tolerances specified on engineering drawings. MTT 46 -Select and use metal working hand tools to produce projects within the tolerances specified by engineering requirements. Measure and layout using semi-precision and precision measuring tools. MTT 101 -Measure and layout utilizing semi-precision and precision measuring tools to produce assigned work within the tolerances specified on engineering drawings.

	<p>MTT 46 -Measure and layout utilizing semi-precision and precision measuring tools to produce projects within the tolerances specified by engineering requirements. Use power saws to rough shape stock.</p> <p>MTT 101 -Set up and operate power saws to rough finish assigned work within a minimum of 1/32 of an inch over the dimensions required on engineering drawings.</p> <p>MTT 46 -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. Perform basic machining operations using an engine lathe.</p> <p>MTT 101 -Set up and operate engine lathes to turn, face, center drill, thread, and cut off to produce assigned work within the tolerances specified on engineering drawings.</p> <p>MTT 46 -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. Perform basic machining operations using a vertical milling machine.</p> <p>MTT 101 -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 assigned work within the tolerances specified on engineering drawings.</p> <p>MTT 46 -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. Perform basic machining operations using a grinding machine.</p> <p>MTT 101 -Set up and operate grinding machines to sharpen lathe tool bits, and surface grind to produce assigned work within the tolerances specified on the engineering drawings.</p> <p>MTT 46 -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. Ability to solve shop math calculations for speed and feeds and thread measurement.</p> <p>MTT 46 -Use and read micrometers and vernier measuring tools to measure projects within the tolerances specified by engineering requirements.</p> <p>MTT 101 -Solve shop math problems that involve speeds and feeds, threads, engineering drawing interpretation and calculations relating to machine tools.</p>
Requisite Skill:	or equivalent
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	If students have not taken MTT 101 or MTT 46 but have taken similar courses at another college or have basic machining work experience, students will have the skills needed to take this course. Students must have basic machining skills or they will not be able to succeed in this course.
Requisite course:	
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding	

course objective under each skill(s).	
Requisite Skill:	
Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable	
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Jerry Kinnan
Date:	10/27/2015
Original Board Approval Date:	03/19/2007
Last Reviewed and/or Revised by:	Eric Carlson
Date:	10/03/2023
Last Board Approval Date:	01/13/2025
Effective Term:	FA 2025