Course Acronym:	MTT
Course Number:	103
Descriptive Title:	Conventional and CNC Turning
Division:	Industry and Technology
Department:	Machine Tool Technology
Course Disciplines:	Machine Tool Technology
Catalog Description:	In this course, students will study at an advanced level. the principles and operation of conventional and Computer Numerically Controlled (CNC) machine tools with an emphasis on the set up and operation of lathes. Topics will include safety, turning, drilling, boring, threading, cutting tools, CNC programming practices, and setups as applied in industry.
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:	**SLO #1 Lathe Dimension** Students will turn a part on the lathe to a given drawing dimension to an accuracy of +/- .001 inches. **SLO #2 CNC Lathe Programs** Read, de-bug and edit CNC lathe word address programs and enter Manual Data Input (MDI) CNC word address lathe programs to produce work within the tolerances on engineering drawings. **SLO #3 Shop Math** Solve shop math problems that include speeds and feeds, trigonometry, tapers, threads, engineering drawing interpretation and calculations relating to machine tools.
Course Objectives:	1. Correctly apply machine shop safety practices with 100% accuracy. 2. Correctly use hand tools, layout tools, measuring tools, power saws, drilling machines, milling machines and grinding machines. 3. Set up and operate engine lathes to perform the operations of straight and taper turning, form turning, facing, center drilling, drilling, reaming, boring, knurling, threading and cutoff processes to produce assigned work within the tolerances specified on engineering drawings. 4. Set up and operate a CNC lathe to perform straight and taper turning, radius turning, facing, center drilling, drilling, reaming, boring, and cutoff processes to produce assigned work within tolerances specified on engineering drawings. 5. Read, de-bug and edit CNC lathe word address programs to produce assigned work within the tolerances specified on engineering drawings. 6. Enter Manual Data Input (MDI) CNC word address lathe programs to produce work within the tolerances on engineering drawings. 7. Solve shop math problems that include speeds and feeds, trigonometry, tapers, threads, engineering drawing interpretation and calculations relating to machine tools.
Major Topics:	**I. Overview of Conventional and CNC Turning (2 hours, lecture)** A. Machine tool technology analysis B. Safe shop practices in metalworking C. Hand tool and bench work

D. Safety test

II. Overview of Conventional and CNC Turning (6 hours, lab)

A. Machine tool technology analysis

B. Safe shop practices in metalworking

C. Hand tool and bench work

D. Safety test

III. Review - Basic Machining and Supplemental Processes (4 hours, lecture)

A. Measurement

B. Basic lathe

C. Basic milling machines

D. Basic grinding

E. Print reading

F. Procedures

IV. Review - Basic Machining and Supplemental Processes (6 hours, lab)

A. Measurement

B. Basic lathe

C. Basic milling machines

D. Basic grinding

E. Print reading

F. Procedures

V. External Lathe Operations (4 hours, lecture)

A. Facing

B. Parallel turning

C. Shoulder turning

D. Knurling

E. Grooving

F. Cutting off

G. Filing and polishing

H. Grinding

I. Taper turning

J. Threading

K. Form turning

VI. External Lathe Operations (12 hours, lab)

A. Facing

B. Parallel turning

C. Shoulder turning

D. Knurling

E. Grooving

F. Cutting off

G. Filing and polishing

H. Grinding

I. Taper turning

J. Threading

VII. Internal Lathe Operations (4 hours, lecture)

A. Center drilling

B. Drilling

C. Reaming

D. Boring

E. Internal threading

F. Internal taper turning

G. Tapping

H. Honing

VIII. Internal Lathe Operations (12 hours, lab)

A. Center drilling

B. Drilling

C. Reaming

D. Boring

E. Internal threading

F. Internal taper turning

G. Tapping

H. Honing

IX. Work-holding Devices and Tooling (2 hours, lecture)

A. Three-jaw universal chuck

B. Four-jaw independent chuck

C. Collet chuck

D. Quick release collet

E. Magnetic chuck

F. Faceplates and lathe dogs

G. Jigs, fixtures and angle plates

H. Steadyrest, follower rest, and mandrel

I. Cutting tool holding devices

J. Quick-change tooling

X. Work-holding Devices and Tooling (12 hours, lab)

A. Three-jaw universal chuck

B. Four-jaw independent chuck

C. Collet chuck

D. Quick release collet

E. Magnetic chuck

F. Faceplates and lathe dogs

G. Jigs, fixtures and angle plates

H. Steadyrest, follower rest, and mandrel

I. Cutting tool holding devices

J. Quick-change tooling

XI. Threading Operations (2 hours, lecture)

A. Thread terminology

B. Thread forms

C. Thread fits and classifications

D. Thread calculations

E. Thread-cutting operation

F. Thread measurement

G. Internal threading

H. Tapping

XII. Threading Operations (6 hours, lab)

A. Thread terminology

B. Thread forms

C. Thread fits and classifications

D. Thread calculations

E. Thread-cutting operation

F. Thread measurement

G. Internal threading

H. Tapping

XIII. CNC Programming, Commands, Formats, Input, Proofing, Editing (2 hours, lecture)

A. Word address programming

B. Intuitive Programming System (IPS)

C. Cartesian coordinates

D. Machine tool axes

E. Lathe format and words

F. MDI

G. Computer download

H. Methods of program proofing

I. Methods of editing

XIV. CNC Programming, Commands, Formats, Input, Proofing, Editing (6 hours, lab)

A. Word address programming

B. IPS

C. Cartesian coordinates

D. Machine tool axes

E. Lathe format and words

F. MDI

G. Computer download

H. Methods of program proofing

I. Methods of editing

XV. Applied Trigonometry (4 hours, lecture)

A. Trigonometry formulas

B. Trigonometry calculations

C. Angle cutting

D. Taper turning

E. Thread calculations

F. Toolbit grinding

G. Angle measurement

XVI. Applied Trigonometry (12 hours, lab)

A. Trigonometry formulas

B. Trigonometry calculations

C. Angle cutting

D. Taper turning

E. Thread calculations

F. Toolbit grinding

G. Angle measurement

XVII. Tapers, Taper Calculations and Inspection (2 hours, lecture)

A. Standard tapers

B. Self-holding tapers and self-releasing tapers

C. Taper calculations

D. Taper attachment

E. Tailstock offset

F. Form turning

G. Compound rest

H. Taper inspection

XVIII. Tapers, Taper Calculations and Inspection (6 hours, lab)

A. Standard tapers

B. Self-holding tapers and self-releasing tapers

C. Taper calculations

D. Taper attachment

E. Tailstock offset

F. Form turning

G. Compound rest

H. Taper inspection

XIX. Machine Control Units (MCU), MDI (2 hours, lecture)

A. Control panel

B. Manual operation

C. Offset menus

D. Program library

E. Displays

F. Feed hold

G. Emergency stop

XX. MCU, MDI (6 hours, lab)

A. Control panel

B. Manual operation

C. Offset menus

D. Program library

E. Displays

F. Feed hold

G. Emergency stop

XXI. Tool Offsets and Tool Holding Devices (2 hours, lecture)

A. Tool change code

B. Tool offset code

C. Tool offset measurement

D. Tool offset storage

E. Tool holders

F. Carbide tool holders

G. Quick change tool holders

XXII. Tool Offsets and Tool Holding Devices (6 hours, lab)

A. Tool change code

B. Tool offset code

C. Tool offset measurement

D. Tool offset storage

E. Tool holders

	F. Carbide tool holders G. Quick change tool holders **XXIII. Set up and CNC Lathe Operation (6 hours, lecture)** A. CNC performance B. Advantages and disadvantages of CNC C. Power up D. Setting part zero E. Setting tool length offset F. Downloading program G. Automatic operation **XXIV. Set up and CNC Lathe Operation (18 hours, lab)** A. CNC performance B. Advantages and disadvantages of CNC C. Power up D. Setting part zero E. Setting tool length offset F. Downloading program G. Automatic operation
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:	A CNC Turning Center is to be set up for boring a 50mm diameter hole in a part made from A-4130 alloy steel, with a High Speed Steed (HSS) boring tool: 1. What is the Cutting Speed (CS) and recommended feedrate for this application? 2. What is the formula for calculating Revolutions Per Minute (RPM)?

	3. Calculate the RPM for the above problem, record in a one-page report and submit to the instructor for evaluation.
Critical Thinking Assignment 1:	Analyze the manufacturing procedures for the "Bell Housing," and determine the replaceable insert cutting tools needed to machine the interior features on a CNC Turning Center. Install the tools in the turret, calculate the tool offsets and input the offsets via the machine control unit. Perform a trial run of the CNC program prior to machining the first part. Consult instructor for evaluation.
Critical Thinking Assignment 2:	Perform a complete inspection of all dimensioned features of the machined "Bell Housing," comparing the measured dimensions with the engineering specifications. Complete a one-page inspection report and submit to the instructor for evaluation.
Other Evaluation Methods:	Performance Exams Objective Exams Other Exams Quizzes Written Homework Laboratory Reports Class Performance Homework Problems Multiple Choice Completion Matching Items True/False
Instructional Methods:	Demonstration Discussion Laboratory Lecture Multimedia presentations
If other:	
Work Outside of Class:	Study Answer questions Required reading Problem solving activities
If Other:	
Up-To-Date Representative Textbooks:	Stephen Krar, TECHNOLOGY OF MACHINE TOOLS. 8th edition. McGraw Hill, 2020.
Alternative Textbooks:	
Required Supplementary Readings:	
Other Required Materials:	Scientific calculator (trigonometry functions) Safety glasses or goggles Flexible 6 inch steel rule Clean shop coat or apron

	Lathe tool bits (3/8" square) Materials for projects
Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Machine Tool Technology-46 or 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. 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.** 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. 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.** 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.

	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.** 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. 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.** 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. 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 perform shop math calculations for speed and feeds and thread measurement.** MTT 46 -Measure and layout utilizing semi-precision and precision measuring tools to produce projects within the tolerances specified by engineering requirements. MTT 101 -Solve shop math problems that involve speeds and feeds, threads, engineering drawing interpretation and calculations relating to machine tools.
Requisite Skill:	or equivalent
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	If a student has taken an equivalent course at another college or has basic machining experience, the student will be qualified to enroll in this course. Students must have basic machining skills 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:	Harold Hofmann/Eric Carlson
Date:	02/01/2007
Original Board Approval Date:	03/19/2007
Last Reviewed and/or Revised by:	ERIC CARLSON
Date:	03/02/2022
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