

Machine Tool

Little Chute

Department

Grades:11-12, Credits

Course Overview/Description

Machine tool is FVTC Dual Credit Coursework. Students have the option to take 1 of 3 different courses focusing on beginning areas of Machine Tool courses. Measurement and Benchwork, Engine Lathe, and Print Reading for Machine Tool are the areas of focus. Students that complete all 3 of the FVTC course will earn the FVTC Machinist Helper certificate, which is Act 59 grant eligible. All students interested the trades, manufacturing, or engineering will gain very useful knowledge and skills.

Course Essential Standards

Scope and Sequence

Timeframe	Unit	Instructional Topics	Formative Assessment Strategies
Ex: 5 weeks (October 1 - November 2)	Ex: Unit 1 - Narrative: Small Moments	Ex: Components of Narrative Writing	
9 Weeks	Measurement and Benchwork	<ul style="list-style-type: none">• Precision Measurement• Layout• Threading	Periodic Reviews Hands on Activities Unit Tests
9 Weeks	Engine Lathe	<ul style="list-style-type: none">• Lathe Safety• Lathe Construction & Maintenance• Lathe Tooling• Speeds and Feeds• Lathe Operations	Periodic Reviews Hands on Activities Application Projects Unit Tests
7 Weeks	Basic Blueprint Reading for Machine Tool	<ul style="list-style-type: none">• Drawing Basics & Sketching• Dimensioning• Symbols, Section Views, Revisions• Machining Processes• Thread Specifications• Bearings	Sketches Blueprint Reading Activities Drawing Quizzes

Course Details

UNIT: Measurement and Benchwork -- 18 Weeks

Essential Standards Addressed -

Measurement and Benchwork in the first Course in the FVTC Machine Tool program. It encompasses learning to use many precision measuring tools to accurately measure to the one-thousandth of an inch, learning to layout and plan a project, and how to identify and use threads and threading tools.

INSTRUCTIONAL TOPIC: Precision Measurement Tools --28 Days

During this unit students will learn how to read and use Steel rules, Micrometers, Vernier Calipers, Vernier Height Gauges, Vernier Protractors, Dial Calipers, Dial Indicators, Small Hole Gauges, Telescoping Gauges, Adjustable Parallels, and Fixed Gauges. For each type of precision measuring tools student will learn how the tool works, how to read the tool, and measure specific parts to check for practical knowledge.

All of these tools are used regularly in the Machine Tool industry. Student will be able to have practical work skills after completing this unit.

Learning Targets

Mastery of application and use of precision measurement tools:

- Steel rules
- Micrometers
- Vernier Calipers
- Vernier Height Gauge
- Vernier Protractors
- Dial Calipers
- Dial Indicators
- Small Hole Gauges
- Telescoping Gauges
- Adjustable Parallels
- Fixed Gauges

INSTRUCTIONAL TOPIC: Layout Tools and Procedures --10 Days

During this unit students will learn the use of layout tools and proper procedures for laying out a project. They will learn to use scribes, awls, center punches, and protractors. Students will be able to learn how each tool works and layout multiple projects to

Learning Targets

- Identify and use the main basic layout tool and accessories.
- List the correct sequence for laying out a part using various types of lines.
- Prepare a workpiece for layout.
- Measure for and scribe layout lines.
- Locate and establish hole centers using a prick punch and center punch.
- Locate and establish arcs and circles.

INSTRUCTIONAL TOPIC: Threading and Fasteners --<7 Days

The screw thread is an extremely important mechanical device. The screw thread and it's application are found throughout nearly every aspect of the machine shop. There are many different types of screw threads, fasteners and thread systems. It is important that the machine shop student understand the different types available and the correct terminology associated with threads, threaded fasteners and other mechanical hardware used in manufacturing.

Internal and external threads may be cut using taps and dies. This module will examine types and terminology of taps and dies.

The student will learn how to select the proper drill for a given thread size and specification.

Learning Targets

- Explain the general applications of a screw thread
- Differentiate between the different thread forms.
- Interpret the meaning of the Unified Screw Thread Form thread designations.
- Identify the major parts of a thread.
- Differentiate between a left-hand and a right-hand thread.
- Differentiate between the different thread series.
- Differentiate between fractional and machine screw sizes.
- Describe what is meant by multiple threads and how the lead is affected by the multiplicity of threads.
- Determine the thread sizes of bolts using standard measuring devices.
- Identify and explain the use of various thread measurement tools such as pitch gage, thread micrometers etc.
- Identify threads and threaded fasteners.
- Identify and describe applications of common mechanical hardware found in the machine shop.
- Explain the general applications of a screw thread
- Differentiate between the different thread forms.
- Interpret the meaning of the Unified Screw Thread Form thread designations.
- Identify the major parts of a thread.
- Differentiate between a left-hand and a right-hand thread.
- Differentiate between the different thread series.
- Differentiate between fractional and machine screw sizes.
- Describe what is meant by multiple threads and how the lead is affected by the multiplicity of threads.
- Determine the thread sizes of bolts using standard measuring devices.
- Identify and explain the use of various thread measurement tools such as pitch gage, thread micrometers etc.
- Identify threads and threaded fasteners.
- Identify and describe applications of common mechanical hardware found in the machine shop.

End of Week One;

Part time students should have completed thru MB1 Project 3D Metric Steel Rule Measurement.

Full time students should have completed thru MB1 Project 4E Depth Micrometer

End of Week Two;

Part time students should have completed thru MB1 Project 4E Depth Micrometer.

Full time students should have completed thru MB1 Project 6B Indirect/Comparison Measurement (part 4)

End of Week Three;

Part time students should have completed thru MB1 Project 5C Measuring with a Vernier Caliper.

Full time students should have completed thru

End of Week Four;

Part time students should have completed thru MB1 Project 6B Indirect/Comparison Measurement (part 4)

Full time students should have completed thru MB1-13C Threading Tools and Procedure Test

End of Week Five;

Part time students should have completed thru MB1-9A Fixed Gage Review

Full time students should have moved onto Measurement and Benchwork 2

End of Week Six;

Part time students should have completed thru MB1 – 11A file Review

Full time students should have moved onto Measurement and Benchwork 2

End of Week Seven;

Part time students should have completed thru MB1-12C Metric Thread Size Identification

Full time students should have moved onto Measurement and Benchwork 2

End of Week Eight;

Part time students should have completed thru MB1-13C Threading Tools and Procedure Test

Full time students should have moved onto Measurement and Benchwork 2

UNIT: Engine Lathe -- Time Frame: 18 Weeks

Essential Standards Addressed -

Engine Lathe 1 is the second course in the FVTC Machine Tool program. Students are focused on learning how Engine Lathes work, how to operate them, and how to create usable parts.

INSTRUCTIONAL TOPIC: Lathe Safety --<5 Days>

This unit will cover safety as applied to the operation of a metal cutting lathe.

Learning Targets

- List the common safety hazards associated with lathe operation.
- Identify safety rule violations.
- Adhere to clothing and personal safety equipment rules for lathe operation.
- Apply rules of housekeeping while working in the machine shop.
- Identify personal safety equipment items and know when there are to be used.
- Discriminate between acceptable and unacceptable rules for lockout/tagout procedures for the lathe.
- Be aware of the length of chips and the dangers associated with long chips.

INSTRUCTIONAL TOPIC: Lathe Construction and Maintenance --<10 Days>

This unit will examine the parts and functions of the engine lathe and the correct procedures for cleaning, lubricating, adjusting, and trouble shooting the engine lathe.

Learning Targets

- Match parts of a lathe with the names of the parts.
- Identify the five main parts of the lathe.
- State the functions of the main parts of the lathe.
- Apply safe practices relative to lathe maintenance duties.
- Explain the importance of a clean and well-maintained machine.
- Communicate procedures and instructions relating to cleaning and maintaining a lathe.
- Assess the condition of the equipment prior to operating.
- Refer to lathe maintenance reference manual, understand the material, and apply the information.
- Carry out oiling, cleaning, and gib adjustments as required.

INSTRUCTIONAL TOPIC: Lathe Tooling --<10 Days>

This unit covers the various lathe cutting tools, their correct use, proper tool geometry, and grinding fundamentals. Knowledge of tool function and geometry is essential to correct use and sharpening. It will also cover choosing the correct holding devices and available attachments. An awareness of available lathe accessories is vital to the machinist.

Learning Targets

- Identify the name and application of various types of lathe cutting tools.
- State the difference between a left-hand and a right-hand turning tool.
- State three things that affect the surface finish when turning on a lathe.
- Identify and give the purpose for rake and relief angles, chip breakers, and form tools.
- Correctly grind various types of cutting tools used on the lathe
- Identify various types of collet chucks.
- Describe the correct usage of various types of collet chuck systems.
- Identify the various types of lathe chucks.
- Describe the use of various types of lathe chucks.
- Identify the parts of standard tool posts.
- Identify a turret type toolpost.
- Identify a quick change tool post.
- Describe the difference between tool holding devices used for high speed steel and carbide.
- Install and remove various types of work holding devices.
- Perform routine maintenance on lathe chucks.

INSTRUCTIONAL TOPIC:Speeds and Feeds --<5 Days>

Speeds and feeds are of crucial importance in machining. Improper speed and/or feed can cause excessive tool wear, heat, and/or tool breakage. The student must master the calculation of speeds and feeds to be valuable in the machine shop.

Learning Targets

- Define “speed” as it is applied to the lathe.
- Define “feed” as it is applied to the lathe.
- Define “surface feet per minute”.
- Calculate the correct RPM for a given machining scenario.
- State how the surface finish may be affected by a change in speed or feed.
- State what is done to the speed and feed rates to improve the workpiece finish on the final cut.

INSTRUCTIONAL TOPIC: Lathe Operations --<15 Days>

Before using any machine, you must be able to use the controls properly. This unit will familiarize the student with the controls of the lathe and prepare him/her for lathe operation.

Many lathe jobs require the use of centers. Turning between centers can help keep the diameters of the part concentric. In this unit the student will learn how to correctly set up and perform cutting operations between centers.

Learning Targets

- Explain drives and shifting procedures for changing speeds on the lathe.
- Describe the use of various feed control levers.
- Explain the difference between longitudinal feeds and cross feeds.
- State the difference between the types of cross feed screw micrometer collars.
- Perform the setting of speeds and feeds on a variety of lathes.

- Perform spindle starting and stopping procedures on a variety of lathes.
- Perform automatic feeding operations on a variety of lathes
- Correctly set up a workpiece and face the ends.
- Correctly center drill the ends of the workpiece.
- Correctly identify lathe accessories associated with turning between centers.
- State the proper use and care of lathe accessories associated with turning between centers.
- Determine the proper speeds and feeds for a workpiece.
- Explain how to set up and make facing cuts to a given depth and how to measure them.
- Describe and perform the correct setup for turning between centers.
- Detail the steps necessary for turning to size predictably.
- Turn a series of parts between centers to specified sizes.
- Explain and correctly perform recessing or grooving on a lathe.
- Correctly calculate, set up, and cut chamfers on the lathe using the compound rest.

Week	Learning Plan	Reading Assignment/ Video	Reviews (Blackboard)	Tests (Blackboard)	Projects	
1	1	Part C. Reading Assignment		Part F. Policies	Part I. EL1 LP3B	
	2	Part D. Reading Assignment				
	2	Part E. Reading Assignment	Part E. Study Review Part F. Review	Part G. Test		
	3	Part C. Reading Assignment Part D. Reading Assignment	Part G. Study Rev. Part H. Review			
		Part C. Reading Assignment Part D. Reading Assignment Part E. Reading Assignment Part F. Video				
2	4	Part C. Reading Assignment Part D. Reading Assignment Part E. Video Part F. Video Part G. Video	Part I. Study Review Part J. Review	Part K. Test	Part J. EL1-LP5B	
	5	Part H. Video Part C. Reading Assignment Part D. Reading Assignment Part E. Reading Assignment	Part H. Study Review Part I. Review	Part K. Test		

		Part F. Reading Assignment Part G. Video				
3	6	Part C. Reading Assignment Part D. Reading Assignment Part E. Reading Assignment Part F. Reading Assignment Part G. Video	Part H. Study Review Part I. Review	Part K. Test	Part J. EL1-LP6B	
Week	Learning Plan	Reading Assignment/ Video	Reviews (Blackboard)	Tests (Blackboard)	Projects	
4	7	Part C. Reading Assignment Part D. Reading Assignment Part E. Reading Assignment Part F. Video Part G. Video	Part H. Study Review Part I. Review		Part J. EL1-LP7B Part K. EL1-LP7C Part L. EL1-LP7D	
5	7			Part N. Test	Part M. EL1-LP7E	
	8	Part C. Reading Assignment Part D. Reading Assignment Part E. Reading Assignment	Part F. Study Review Part G. Review	Part H. Test		
6	9	Part C. Reading Assignment Part D. Reading Assignment Part E. Video	Part F. Review	Part G. Test		
	10	Part C. Reading Assignment Part D. Reading Assignment Part E. Reading Assignment Part F. Reading Assignment Part G. Video Part H. Video Part I. Video	Part L. Study Review Part M. Review		Part N. EL1-LP10B	

		Part J. Video Part K. Video				
7	10				Part O. EL1-LP10C Part P. EL1-LP10D	
8	10			Part R. Test	Part Q. EL1-LP10E	

UNIT: Print Reading for Machine Tool -- 10 Weeks

Essential Standards Addressed -

Description

INSTRUCTIONAL TOPIC: Drawing Basics and Sketching --<8 Days>

Different features are represented by different types of lines. Therefore line types need to be recognized and understood. Title blocks contain a great deal of information about the part that is being represented on the print. Understanding title block information is a necessary component of print reading.

Learning Targets

- Understand and Use the alphabet of lines
- Understand and use different components of a drawing
- Be able to create 2D and 3D Sketches

INSTRUCTIONAL TOPIC: Dimensioning --<8 Days>

Print reading involves the visualization of shapes and the locations of features. The size and location of part features is especially important to those in the manufacturing. Workers involved in fabricating and machining parts from a print need to be able to understand dimensions.

Learning Targets

- Understand and use different types and Styles of Dimensions
- Read and Interpret different types and Styles of Dimensions to understand a part

INSTRUCTIONAL TOPIC: Symbols, Section Views, Revisions --<7 Days>

Machining allowance symbols tell the machinist the finish requirements of the part. Parts that have internal features that are too complicated to be shown with hidden lines are shown more clearly by using sectional views.

Learning Targets

- Identify and use the machining the symbols and values that control surface roughness, waviness, and lay
- Identify and use the information on a title and revision blocks
- Identify and use; full, half, offset, aligned, revolved, and broken-out sectional views used in engineering drawings

INSTRUCTIONAL TOPIC: Machining Processes --<7 Days>

Machining processes such as chamfering, undercutting and tapering are done to help the assembler put the parts together. The machining process known as knurling permits the user to get a better grip on the part. Most drawings seen in industry are multi-view drawings.

Learning Targets

- Understand and be able to calculate Tapers
- Understand and be able to calculate Chamfers
- Understand and be able to calculate Undercuts
- Understand and be able to use the symbols and values that control surface roughness, waviness, and lay

INSTRUCTIONAL TOPIC: Thread Specifications --<7 Days>

Fastening devices are an important part of the manufacturing world. Most semi-permanent fasteners use threads. It is very important that the machinist understand all facets of threading and threaded fasteners. On many drawing there may be a small portion of the part which is not shown clearly on one of the regular views. In such cases, revolved and removed sections are used to clarify the shape or size of the part. When there are many repetitive features (holes) on the part coordinate dimensioning is used to avoid clutter on the drawing

Learning Targets

- Understand and be able to read and apply Thread Specifications

INSTRUCTIONAL TOPIC: Bearings --<7 Days>

Rotating machinery parts are supported by bearings. Understanding complex prints can be made easier by having an understanding of the types and uses of bearings.

Learning Targets

- Identify and understand the function and use of Plain Bearings
- Identify and understand the function and use of Pillow Block Bearings
- Identify and understand the function and use of Fluid Film Bearings

Content Outline/Content Outline with Schedule

Refer to Blackboard Calendar in addition to schedule shown below of when assignments are due.

Content Outline and Schedule – 1 Credit *(see notes at bottom of schedule)*

Dates	Topics/Blackboard Location	Work Due	Estimated Effort (hours)
Learning Plan 1 8/27/21 -9/3/21	Class Meeting and Orientation Basics types of Projections	<ul style="list-style-type: none"> ● Read and Reflect on* Required textbook reading ● Review Online learning activities ● Print A-7 ● Print A-8 	6.0
Learning Plan 2 9/3/21 – 9/10/21	Sketching	<ul style="list-style-type: none"> ● Read and Reflect on* Required textbook reading ● Review Online learning activities ● Sketch 1 ● Sketch 2 ● Sketch 5 	7.0
Learning Plan 3 9/10/21 – 9/17/21	Relationships of Views Bolt Circle Calculations	<ul style="list-style-type: none"> ● Read and Reflect on* Required textbook reading ● Review Online learning activities ● Print A-14 ● Print A-18 ● Print 11A004 	7.0
Learning Plan 4 9/17/21 – 9/24/21	Sectional Views	<ul style="list-style-type: none"> ● Read and Reflect on* Required textbook reading ● Review Online learning activities ● Print A-15 ● Print A-29 ● Print A-34 	8.0
9/24/21	Quiz 1	<ul style="list-style-type: none"> ● Class Will Meet and complete Quiz 1 	2.0
Learning Plan 5 9/24/21 – 10/1/21	Tapers, Chamfers and Undercuts	<ul style="list-style-type: none"> ● Read and Reflect on* Required textbook reading ● Review Online learning activities ● Print A-39 	6.0
Learning Plan 6 10/1/21 – 10/8/21	Thread Specifications Coordinate Dimensioning	<ul style="list-style-type: none"> ● Read and Reflect on* Required textbook reading ● Review Online learning activities ● Print A-45 ● Print A-52 	8.0
Learning Plan 7 10/8/21 -10/15/21	Auxiliary Views Bearings	<ul style="list-style-type: none"> ● Read and Reflect on* Required textbook reading ● Review Online learning activities ● Print A-69 ● Print A-71 	7.0
10/15/21	Final Exam	Review Assignments, and complete Final Exam	3.0 Total= 54