

Total Machinist Course Objectives and Estimated Times

	Course:	Total Modules:	Estimate Time:
1	Introduction	4	30 minutes
2	Safety for Machining	3	3 hours
3	Benchwork	3	6 hours
4	Layout	2	4 hours
5	Materials	2	4 hours
6	Shop Mathematics Level I	5	5 hours
7	Shop Mathematics Level II	4	5 hours
8	Reading Manufacturing Blueprints	8	8 hours
9	Precision Measurement	3	4 hours
10	Speeds and Feeds	3	3 hours
11	3-Axis CNC Milling Machine Setup (old control)	8	8 hours
12	3-Axis CNC Milling Machine Setup (old control)	8	8 hours
13	3-Axis CNC Milling Machine Programming	8	8 hours
14	Haas Mill Intuitive Programming system	7	7 hours
15	CNC Mill Projects	3	9 hours
16	CNC Lathe Setup (old control)	8	8 hours
17	CNC Lathe Setup (new control)	8	8 hours
18	CNC Lathe Programming	6	6 hours
19	Haas Lathe Intuitive Programming System	9	4 hours
20	CNC Lathe Projects	3	9 hours
21	Renishaw Machine Tool Probing Systems	7	4 hours
22	Drill Press	8	6 hours
23	Manual Mill	5	7 hours
24	Manual Lathe	5	7 hours
25	Precision Grinding	8	7 hours
	Total Estimated Time:		142.5

Safety for Machining

This course provides comprehensive instruction and exercises on general safety information for running CNC machinery. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 3 hours

Module 1: Important Safety Information

Skills

- ☐ Demonstrate knowledge of dangerous situations.
- ☐ Demonstrate knowledge of safety procedures for emergency situations.
- ☐ Identify fire extinguishers and proper working condition.
- ☐ Demonstrate knowledge of use for fire extinguishers, first aid kits and other medical equipment.
- ☐ Identify hazardous locations.
- ☐ Demonstrate proper use of compressed air.
- ☐ Demonstrate proper use of personal tools.
- ☐ Demonstrate proper housekeeping practices.
- ☐ Identify basic OSHA requirements.

Module 2: Before Machining

Skills

- ☐ Identify the importance of a clean and organized work area.
- ☐ Demonstrate the importance of knowing a machine tool prior to operation.
- ☐ Demonstrate knowledge of safety shields and guards.
- ☐ Demonstrate proper handling techniques for raw materials.
- ☐ Demonstrate the importance of properly securing workpieces.
- ☐ Identify the importance of using tools that are not worn or damaged.

Module 3: During and After Machining

Skills

- ☐ Demonstrate proper safe machine operation.
- ☐ Identify dangerous sounds coming from a machine.
- ☐ Recognize the dangers of reaching into a running machine.
- ☐ Demonstrate the ability to avoid distractions while running a machine.
- ☐ Demonstrate the proper technique for removing metal chips from a machine.
- ☐ Demonstrate the ability to properly clean a work area.
- ☐ Demonstrate the ability to properly and safely shut down a machine.

Benchwork

This course provides comprehensive instruction and exercises on how to safely and properly do benchwork. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 6 hours

Student Skills Assessment Check List:

Module 1: Hand Tools

Skills

- ☐ Identify various types of hand tools that are used while doing Benchwork.
 - a. Bench Vise
 - b. Clamps
 - c. Wrenches
 - d. Pliers
 - e. Screwdrivers
 - f. Hammers
 - g. Files
 - h. Hacksaws
- ☐ Understand the mechanics of a bench vise.
- ☐ Physically mount a bench vise.
- ☐ Decipherer which hand tools will be needed for particular jobs.
- ☐ Understand how to safely and properly use all the necessary hand tools.

Module 2: Power Metal-Cutting Saws

Skills

- ☐ Understand the important safety rules for using power metal-cutting saws.
- ☐ Identify the different types of power metal-cutting saws.
 - a. Power Band Saw
 - b. Power Hacksaw
 - c. Circular Metal-Cutting Saw
 - i. Abrasive Cutoff Saws
 - ii. Cold Circular Saws
- ☐ Understand how to use each type of power metal-cutting saw to cut raw stock when creating a workpiece.

Module 3: Drilling, Threading, Tapping, and Reaming

Skills

- ☐ Understand the process of creating holes and modifying holes by using hand tools.

- a. Drilling
- b. Counterboring
- c. Countersinking

- d. Spotfacing
- e. Threading
- f. Tapping
- g. Reaming

- ☐ Understand the safety rules when manually creating and modifying holes in a workpiece.
 - ☐ Physically drill holes by hand.
 - ☐ Specify the different types of drills used for hand drilling.
 - ☐ Specify the type of material a specific drill is made of and understand what material it is best used for drilling through.
 - ☐ Understand how drill sizes are classified.
 - a. Letter Sizes
 - b. Number Range
 - c. Inches and Fractions
 - d. Metric
 - ☐ Understand how to measure drills.
 - ☐ Select a proper thread cutting tool and cut threads on a part.
 - ☐ Select a proper tap and tap a previously drilled hole.
 - ☐ Remove broken taps.
 - ☐ Select a proper reamer and ream a previously drilled hole.
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Layout

This course provides comprehensive instruction and exercises on how to precisely do a part layout. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 4 hours

Student Skills Assessment Check List:

Module 1: Layout Tools

Skills

- ☐ Identify each layout workholding tool.
 - a. Surface Plates
 - b. Angle Blocks
 - c. V-Blocks
 - d. Parallels
- ☐ Decipherer which layout workholding tools will be needed for particular layouts.
- ☐ Identify each semi-precision layout tool.
 - a. Layout Dye
 - b. Scribes

- c. Divider
- d. Trammel
- e. Surface Gage
- f. Combination Set
- g. Center Head
- h. Prick Punch
- i. Center Punch
- j. Hermaphrodite Caliper
- k. Plain Protractors
- ☐ Decipherer which semi-precision layout tools will be needed for particular layouts.
- ☐ Identify each precision layout tool.
 - a. Height Gage
 - b. Sine Bar
 - c. Vernier Bevel Protractors
- ☐ Decipherer which precision layout tools will be needed for particular layouts.

Module 2: Layout Procedure

Skills

- ☐ Understand the important safety rules for doing a layout.
 - ☐ Specify the general layout steps for particular layouts.
 - ☐ Physically layout particular jobs for parts to be machined.
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Materials

This course provides comprehensive instruction and exercises on the study of metals. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 4 hours

Student Skills Assessment Check List:

Module 1: Introduction to Metals

Skills

- ☐ Define metallurgy.
- ☐ Understand how metals are classified.
- ☐ Identify the different classification systems for metals.
 - a. Unified Numbering System
 - b. Color Coding
- ☐ Identify ferrous metals.
- ☐ Understand different techniques for machining diverse ferrous metals.
- ☐ Identify the different classifications of carbon steel.
- ☐ Understand the difference between hot-rolled steel and cold-rolled steel.
- ☐ Identify hot-rolled steel.
- ☐ Identify cold-rolled steel.
- ☐ Recognize the different characteristics of various types of ferrous metals.

- ☐ Recognize the different characteristics of various types of nonferrous metals.
- ☐ Recognize the different characteristics of various types of High Temperature Metals.
- ☐ Recognize the different characteristics of various types of rare metals.

Module 2: Workpiece Materials and Machinability

Skills

- ☐ Identify ISO standard material groups
- ☐ Understand how to determine machinability.
- ☐ Identify the factors which determine machinability.
- ☐ Identify workpiece material properties and characteristics using the MC code structure.
- ☐ Understand what type of chip formation is expected with different metals.
- ☐ Understand the cutting force and power necessary to machine different materials.
- ☐ Identify the alloy content of different metals.
- ☐ Understand how the alloy content of metals affects machinability.
- ☐ Understand how heat treatment affects chip breaking.
- ☐ Identify what industries work with what types of material.

Shop Mathematics Level I

This course provides comprehensive instruction and exercises on how to solve math problems faced in a manufacturing environment. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 5 hours

Student Skills Assessment Check List:

Module 1: Order of Operations

Skills

- ☐ Identify order of operations rules.
- ☐ Properly arrange the order of operations.
- ☐ Find the solution to problems which require the utilization of order of operations.

Module 2: Fractions

Skills

- ☐ Match important terms used in fractions with their definitions.
- ☐ Convert mixed numbers to improper fractions.
- ☐ Multiply fractions.
- ☐ Divide fractions.
- ☐ Cancel fractions to reduce to lowest terms.

Module 3: Degree, Minutes, and Seconds

Skills

- ☐ Match important terms used in degree, minutes, and seconds with their definitions.
- ☐ Identify the importance of converting degree, minutes, and seconds to decimal.
- ☐ Convert degrees, minutes, and seconds to decimal form.

Module 4: Rounding Decimal Numbers

Skills

- ☐ Round decimal numbers two places.
- ☐ Round decimal numbers three places.
- ☐ Round decimal numbers four places.

Module 5: Inch - Metric

Skills

- ☐ Identify terms used in the inch and metric system as they relate to common manufacturing methods.
 - ☐ Convert inch values to millimeters.
 - ☐ Convert millimeters to inch values.
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Shop Mathematics Level II

This course provides comprehensive instruction and exercises on how to solve math problems faced in a manufacturing environment. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 5 hours

Student Skills Assessment Check List:

Module 1: Geometry

Skills

- ☐ Identify different types of lines.
- ☐ Identify different types of angles.
- ☐ Solve for the perimeter of a polygon.
- ☐ Calculate the radius, diameter and circumference of a circle.

Module 2: Angles

Skills

- ☐ Identify the different components of an angle.
- ☐ Identify a central angle.
- ☐ Identify an angle in standard position.
- ☐ Recognize angle measurements.
- ☐ Convert degree and radian measurements.

Module 3: Triangles

Skills

- ☐ Identify right, equilateral and isosceles triangles.
- ☐ Match triangle notations with their purpose.
- ☐ Solve for missing lengths of a triangle using Pythagorean Theorem
- ☐ Solve for X and Y coordinates at 45° on the unit circle.

Module 4: Trigonometry of Angles and Triangles

Skills

- ☐ Solve for trigonometric functions cos, sin, and tan for different angles around the unit circle.
 - ☐ Use a calculator to solve for non-normal angles.
 - ☐ Use right angle trigonometry to solve for missing angles and lengths of a triangle.
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Reading Manufacturing Blueprints

This course provides comprehensive instruction and exercises on reading manufacturing blueprints. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 8 hours

Module 1: Blueprint Basics

Skills

- ☐ Understand industrial language terms.
- ☐ Understand the use of blueprints.
- ☐ Understand the basics of how a blueprint is laid out.

Module 2: Blueprint Standards

Skills

- ☐ Match ISO and ANSI with their definitions.
- ☐ Identify the symbols associated with ISO and ANSI standards.
- ☐ Identify the meaning of orthographic projection.
- ☐ Decipher the difference between 3rd and 1st angle projection.
- ☐ Identify where different standards are used throughout the world.

Module 3: Drawing Views

Skills

- ☐ List the six principle views associated with orthographic projection.
- ☐ Decipher the difference between 3rd and 1st angle projection.
- ☐ Decipher the difference between one, two and three view drawings.
- ☐ Identify what a section view represents.

Module 4: Drawing Types

Skills

- ☐ Identify section lines.
- ☐ Decipher the difference between engineering drawings and blueprints.
- ☐ Interpret detailed drawings.
- ☐ Identify shape and size descriptions of detailed drawings.
- ☐ Identify specifications of detailed drawings.
- ☐ Interpret assembly drawings.
- ☐ Identify assembly drawings.

Module 5: Blueprint Layout

Skills

- ☐ Identify the 5 standard paper sizes for blueprints.
- ☐ Decipher the different sections of a blueprint.
- ☐ Understand the basic blueprint template.
- ☐ Identify and interpret the seven different components of a blueprint title block.

Module 6: Line Styles

Skills

- ☐ Identify the 11 types of lines in a basic blueprint.
- ☐ Locate each line type on a blueprint.

Module 7: Fundamentals of Geometric Dimensioning

Skills

- ☐ Verify the purpose of dimensions in a drawing.
- ☐ Match commonly used dimension symbols and terminologies with their purpose.
- ☐ Identify size dimensions.
- ☐ Identify diameter dimensions.
- ☐ Identify radius dimensions.
- ☐ Identify angular dimensions.
- ☐ Identify datum dimensions.
- ☐ Identify location dimensions.
- ☐ Understand dimensioning standards for threaded fasteners.
- ☐ Calculate dimensions on a blueprint.
- ☐ Demonstrate how precision dimensions are expressed.
- ☐ Understand what the drawing scale means.

Module 8: Fundamentals of Geometric Tolerancing

Skills

- ☐ Verify different tolerancing methods used in GD&T.
- ☐ Identify tolerances located on an engineering drawing.
- ☐ Identify different tolerance types.
- ☐ Verify the purpose of tolerances.
- ☐ Identify the symbols used when tolerancing.
- ☐ Identify the terms used when tolerancing.
- ☐ Identify and interpret the different tolerancing methods.
- ☐ Interpret clearance fits.
- ☐ Interpret interference fits.
- ☐ Interpret transition fits.

Precision Measurement

This course provides comprehensive instruction and exercises on how to precisely use measurement tools to manufacture quality parts. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing.
Estimated time of completion: 4 hours

Student Skills Assessment Check List:

Module 1: Steel Rules

Skills

- ☐ Identify the types of measurements that can be measured accurately with steel rules.
- ☐ Understand the physical attributes of steel rules.
- ☐ Understand the different configurations of steel rules.
- ☐ Decipher between a fractional scale and a decimal scale.
- ☐ Identify what scale needs to be used based on the dimensional size on the part print.
- ☐ Understand how to properly position a steel rule on a part.
- ☐ Determine the measurement value using a fractional scale.
- ☐ Determine the measurement value using a decimal scale.

Module 2: Slide Calipers

Skills

- ☐ Decipher between a vernier, dial, and digital precision caliper.
- ☐ Identify the three different measurements that can be taken with precision calipers.
- ☐ Clean and calibrate precision calipers.
- ☐ Identify specifications that should be measured with a precision calipers.
- ☐ Identify the different components of precision calipers.
- ☐ Use, read and interpret an inch Vernier precision caliper.
- ☐ Use, read and interpret a metric Vernier precision caliper.
- ☐ Use, read and interpret a dial precision caliper.
- ☐ Use, read and interpret a digital precision caliper.

Module 3: Micrometers

Skills

- ☐ Identify different types of micrometers.
- ☐ Identify the different components of micrometers.
- ☐ Understand the mechanics of a micrometer.
- ☐ Properly handle and maintain micrometers.
- ☐ Properly test and calibrate micrometers.
- ☐ Use, read and interpret outside micrometers.
- ☐ Use, read and interpret depth micrometers.

Speeds and Feeds

This course provides comprehensive instruction and exercises on how to calculate speeds and feeds for milling and turning. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 3 hours

Student Skills Assessment Check List:

Module 1: Calculate Turning Speeds and Feeds

Skills

- ☐ Understand where to find the formula variables for both RPM and IPR.
- ☐ Interpret a cutting tool vendor table.
- ☐ Identify and use the turning RPM formula for spindle speed.
- ☐ Identify and use the turning IPR formula for feed rate.
- ☐ Identify and use the formula for converting IPM to IPR and vice versa.

Module 2: Calculate Milling Speeds and Feeds

Skills

- ☐ Understand where to find the formula variables for both RPM and IPM.
- ☐ Interpret a cutting tool vendor table.
- ☐ Understand what SFM is.
- ☐ Identify and use the milling RPM formula for spindle speed.
- ☐ Identify and use the milling IPM formula for feed rate.

Module 3: Calculate Drilling Speeds and Feeds

Skills

- ☐ Understand where to find the formula variables for both RPM and IPM.
 - ☐ Interpret a cutting tool vendor table.
 - ☐ Identify and use the drilling RPM formula for spindle speed.
 - ☐ Identify and use the drilling IPM formula for feed rate.
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Haas vertical 3 axis Milling Machine Setup

This course provides comprehensive instruction and exercises to setup a vertical 3 axis CNC milling machine with an industrial control panel. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing and virtual CNC operation. Students will receive an online certification by achieving 80% or greater assessment score. *Estimated time of completion: 8 hours*

Student Skills Assessment Check List:

Module 1: Machine Motion Description

Skills

- ☐ Provide the words associated with the acronym of CNC.
- ☐ Identify the machining motion of a 3 axis CNC mill.
- ☐ Identify the machine axis nomenclature.

- ☐ Identify the 4 quadrants of rectangular coordinate programming.
- ☐ Illustrate where the Haas machine table is in the rectangular coordinate system when the machine is in its home position.
- ☐ Identify Haas machine components.
- ☐ Recognize incremental and absolute positioning.

Module 2: Mill Control Panel

Skills

- ☐ Identify each of the 9 key button groups on the Haas mill control panel.
- ☐ Match control function definition to corresponding control button group.
- ☐ Match control function definition to corresponding operation modes.

Module 3: Machine Startup

Skills

- ☐ List the items on the pre-startup checklist.
- ☐ Identify the proper coolant, oil, and air supply levels.
- ☐ Perform the proper power up procedure.
- ☐ Verify correct tools and tool number assignments.
- ☐ Perform the procedure to load and unload tools through the machine spindle.

Module 4: Basic Manual Operations

Skills

- ☐ Utilize each of the hand jog mode speeds with the jog handle and the jog keys.
- ☐ Jog the 3 axis mill in all 6 directions using the jog keys.
- ☐ Jog the 3 axis mill in all 6 directions using the jog handle.
- ☐ Demonstrate the control of the feeds and speeds with the override buttons.
- ☐ Utilize MDI to turn the spindle on.
- ☐ Change tools using the automatic tool change buttons.

Module 5: Job Setup

Skills

- ☐ Identify the single key used to record the tool length.
- ☐ Identify the single key used to record the part zero.
- ☐ Setup tool length and tool size offsets.
- ☐ Setup the part zero or work offset.

Module 6: Edit Capabilities

Skills

- ☐ Perform the editing capabilities alter, insert, delete, and undo.
- ☐ Access the advanced editor menus.
- ☐ Perform the duplicate program function using the advanced editor.
- ☐ Perform the move program code function.
- ☐ Perform the copy program code function.

Module 7: Program Entry

Skills

- ☐ Input a program from a manuscript.
- ☐ Identify the difference between direct and distributive numerical control.
- ☐ List the accepted file extensions for the Haas controller.
- ☐ Transfer a program file from an external device such as a floppy or USB flash drive to the Haas controller.

Module 8: Program Run

Skills

- ☐ Perform the necessary steps to activate and run a program.
 - ☐ Utilize the correct buttons to stop and reset a program.
 - ☐ Restart a program at a safe tool change.
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Haas vertical 3 axis CNC Milling Machine Programming

This course provides comprehensive instruction and exercises to program a vertical 3 axis CNC milling machine. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing and virtual CNC operation. Students will receive an online certification by achieving 80% or greater assessment score.

Estimated time of completion: 7 hours

Student Skills Assessment Check List:

Module 1: Introduction to Codes and Programs

Skills

- ☐ Decipher M-codes and their functionality.
- ☐ Decipher G-codes which control rapid positioning motion, linear interpolation, circular interpolation, and dwell.
- ☐ Match G-codes associated with canned cycles to their functionality (G80-G89).
- ☐ Identify parameters associated with G-codes 00 – 04 and 80 – 89.
- ☐ Match G-code parameters with their functionality.

Module 2: Program Structure

Skills

- ☐ Interpret word addresses used in a CNC mill program.
- ☐ Identify the 3 distinct parts of a CNC mill program.
- ☐ Decipher the program codes used in the program introduction.
- ☐ Verify the body of a CNC mill program.
- ☐ Verify a properly programmed safe tool change.
- ☐ Decipher the program codes used in the program end.

Module 3: Cartesian Coordinate System and Programming Methods

Skills

- ☐ Draw the Cartesian coordinate system and identify the X and Y axes.
- ☐ Identify the 4 quadrants of the Cartesian coordinate system.
- ☐ Locate the part origin in the Cartesian coordinate system.
- ☐ Perform the right hand rule.
- ☐ Identify X or Y, negative or positive positions based on the part origin location on a work piece.
- ☐ Identify the G-codes associated with Absolute and Incremental programming.
- ☐ Match absolute and incremental programming methods with their definitions.
- ☐ Identify absolute locations in a Cartesian coordinate system.
- ☐ Identify incremental locations in a Cartesian coordinate system.

Module 4: Circular Interpolation

Skills

- ☐ Interpret clockwise circular interpolation and identify its associated G-code.
- ☐ Interpret counter clockwise circular interpolation and identify its associated G-code.
- ☐ Program an arc using the radius method of circular interpolation.
- ☐ Program an arc using the I, J, K method of circular interpolation.

Module 5: Cutter Compensation

Skills

- ☐ Decipher the different G-codes used to turn on and off cutter compensation.
- ☐ Interpret cutter compensation left and identify when it is used.
- ☐ Interpret cutter compensation right and identify when it is used.
- ☐ Program the steps necessary to turn cutter compensation on and off.
- ☐ Write a program that contours a part using cutter compensation.

Module 6: Hole Manufacturing

Skills

- ☐ Interpret the G-codes used with defining the rapid plane in a canned cycle.
- ☐ Program a drill cycle using the drill canned cycle.
- ☐ Program a drill cycle using the peck drill canned cycle.
- ☐ Program a drill cycle using the high speed peck drilling cycle.
- ☐ Calculate the proper speeds and feeds for tapping a hole.
- ☐ Program a hole to be tapped using the rigid tapping canned cycle.
- ☐ Calculate drill depths.
- ☐ Decipher the different G-codes used to program hole location routines.
- ☐ Program a bolt hole circle routine.
- ☐ Program an arc pattern routine.
- ☐ Program a linear pattern routine.

Module 7: Programming Labs

Skills

- ☐ Interpret a part print and process sheet.
 - ☐ Write a complete program using all the programming instructions illustrated throughout the course.
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Haas Mill Intuitive Programming System

This course provides comprehensive instruction and exercises on how to precisely use the Haas Mill Intuitive Programming System (IPS) to easily program and machine quality parts. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 4 hours

Student Skills Assessment Check List:

Module 1: Introduction to Haas Mill Intuitive Programming

Skills

- ☐ Define IPS and understand the principles of how IPS works.
- ☐ Specify the procedure to program apart using IPS.
- ☐ Decipher the difference between cutting specifications and feature specifications.
- ☐ Know each of the available cutting operations.

Module 2: Haas Mill IPS Basics

Skills

- ☐ Specify how to power up a Haas mill and access the IPS menus.
- ☐ Understand how to navigate through IPS menu tabs.
- ☐ Understand how to navigate through IPS sub-menu tabs.
- ☐ Define what a “Parameter” on an IPS menu is used for.
- ☐ Define what the “Manual Settings” display on an IPS menu.
- ☐ Define what the “Help Menu Display” on an IPS menu does.

Module 3: Manual Mode

Skills

- ☐ Identify how to navigate to the “Manual” tab.
- ☐ Understand what manual mode is used for.
- ☐ Specify how to jog the machine in manual mode.
- ☐ Specify how to control the spindle in manual mode.

Module 4: Setup Mode

Skills

- ☐ Identify how to navigate to the “Setup” mode tab.
- ☐ Understand what each of the “Setup” sub-menu tabs are used for.
- ☐ Specify the process of setting the work offset and other parameters on the “Work” sub-menu tab.
- ☐ Specify the process of setting tool offsets and other parameters on the “Tool” sub-menu tab.

Module 5: Face Mode

Skills

- ☐ Identify how to navigate to the “Face” mode tab.
- ☐ Understand each of the parameters on the “Face” menu tab.
- ☐ Demonstrate how to program a facing operation using the IPS “Face” menu tab.

Module 6: Drill Mode

Skills

- ☐ Identify how to navigate to the “Drill” mode tab.
- ☐ Understand what each of the “Drill” sub-menu tabs are used for.
- ☐ Understand each of the parameters of the “Drill” sub-menu tabs. Sub-menu tabs include: Bolt Circle, Bolt Line, Single Hole, and Multiple Holes.
- ☐ Demonstrate how to program a “Bolt Circle” drilling operation using the IPS “Drill” menu tab.
- ☐ Demonstrate how to program a “Bolt Line” drilling operation using the IPS “Drill” menu tab.
- ☐ Demonstrate how to program a “Single Hole” drilling operation using the IPS “Drill” menu tab.
- ☐ Demonstrate how to program “Multiple Holes” drilling operation using the IPS “Drill” menu tab.

Module 7: Pocket Milling Mode

Skills

- ☐ Identify how to navigate to the “Pocket Milling” mode tab.
- ☐ Understand what each of the “Pocket Milling” sub-menu tabs are used for.
- ☐ Understand each of the parameters of the “Pocket Milling” sub-menu tabs. Sub-menu tabs include: Circular, Rectangle, and Irregular.
- ☐ Demonstrate how to program a circular pocket operation using the IPS “Pocket Milling” menu tab.
- ☐ Demonstrate how to program a rectangular pocket operation using the IPS “Pocket Milling” menu tab.
- ☐ Demonstrate how to program an irregular pocket operation using the IPS “Pocket Milling” menu tab.
- ☐ Demonstrate how to use the “Shape Selector Window”
- ☐ Demonstrate how to use the “Shape Creation” tool.

Module 8: Engraving Mode

Skills

- ☐ Identify how to navigate to the “Engraving” mode tab.
 - ☐ Understand what each of the “Engraving” sub-menu tabs are used for.
 - ☐ Decipher the difference between “Straight Line” and “Serial number” engraving sub-menu tabs.
 - ☐ Demonstrate how to program a “Straight Line” engraving operation using the IPS “Engraving” menu.
 - ☐ Demonstrate how to program a “Serial Number” engraving operation using the IPS “Engraving” menu.
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CNC Mill Projects

CNC Milling Projects are designed to demonstrate the entire process of machining a part. Instructions will be given to create NC programs for 3 milling projects, followed by instructions to setup and run the program on a Haas vertical CNC milling machine, and inspect the finished parts

Estimated time of completion: 9 hours

Student Skills Assessment Check List:

Skills

- ☐ Programming NC code for the following machining operations:
 - Blueprint Reading
 - Facing
 - Contouring
 - Drilling
 - Slotting
 - ☐ Machine setup including the following skills:
 - Powering up the machine and executing a machine warm up cycle.
 - Workholding
 - Develop a tool list
 - Setting part zero offsets
 - Setting tool length offsets
 - Executing a dry run
 - Running the part program
 - ☐ Inspection using the following measurement tools:
 - Micrometers
 - Calipers
 - Gage Pins
 - Depth Micrometers
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Haas Lathe Setup

This course provides comprehensive instruction and exercises to setup a CNC lathe with an industrial control panel. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing and virtual CNC operation. Students will receive an online certification by achieving 80% or greater assessment score. *Estimated time of completion: 8 hours*

Student Skills Assessment Check List:

Module 1: Machine Motion Description

Skills

- ☐ Provide the words associated with the acronym of CNC.
- ☐ Identify the machining motion of a CNC lathe.
- ☐ Verify typical CNC lathe applications.
- ☐ Verify the direction of the axes on a CNC lathe.
- ☐ Identify the machine axis nomenclature.
- ☐ Identify Haas machine components.
- ☐ List the 3 distinct characteristics of CNC lathe tooling
- ☐ Identify the tool angle of a CNC lathe cutting tool.
- ☐ Identify the tip radius of a CNC lathe cutting tool.
- ☐ Identify the inscribed circle of a CNC lathe cutting tool.
- ☐ Identify the 3 important characteristics for calculating spindle speed (RPM).
- ☐ Calculate required spindle RPM.
- ☐ Identify the G codes which turn constant surface footage per minute on and off.

Module 2: Lathe Control Panel

Skills

- ☐ Identify each of the 9 key button groups on the Haas lathe control panel.
- ☐ Match control function definition to corresponding control button group.
- ☐ Match control function definition to corresponding operation modes.

Module 3: Machine Startup

Skills

- ☐ List the items on the pre-startup checklist.
- ☐ Identify the proper coolant, oil, and air supply levels.
- ☐ Perform the proper power up procedure.
- ☐ Verify correct tools and tool number assignments.
- ☐ Perform the procedure to load and unload tools onto the tool turret.

Module 4: Basic Manual Operations

Skills

- ☐ Utilize each of the hand jog mode speeds with the jog handle and the jog keys.
- ☐ Jog the CNC lathe in all 4 directions using the jog keys.
- ☐ Jog the CNC lathe in all 4 directions using the jog handle.
- ☐ Demonstrate the control of the feeds and speeds with the override buttons.
- ☐ Utilize MDI to turn the spindle on.

Module 5: Job Setup

Skills

- ☐ Perform the necessary steps to set up the X offsets for CNC turning and facing tools.
- ☐ Perform the necessary steps to set up the Z offsets for CNC turning and facing tools.
- ☐ Identify the 9 Haas tool tip directions.
- ☐ Input the tool tip position into the Haas controller
- ☐ Input the tool nose radius into the Haas controller.

Module 6: Edit Capabilities

Skills

- ☐ Perform the editing capabilities alter, insert, delete, and undo.
- ☐ Access the advanced editor menus.
- ☐ Perform the duplicate program function using the advanced editor.
- ☐ Perform the move program code function.
- ☐ Perform the copy program code function.

Module 7: Program Entry

Skills

- ☐ Input a program from a manuscript.
- ☐ Identify the difference between direct and distributive numerical control.
- ☐ List the accepted file extensions for the Haas controller.
- ☐ Transfer a program file from an external device such as a floppy or USB flash drive to the Haas controller.

Module 8: Program Run

Skills

- ☐ Perform the necessary steps to activate and run a program.
- ☐ Utilize the correct buttons to stop and reset a program.
- ☐ Restart a program at a safe tool change.

Haas CNC Lathe Programming

This course provides comprehensive instruction and exercises to program a CNC lathe. Upon completion of each module the student will be required to demonstrate knowledge comprehension and learned skills through online testing and virtual CNC operation. Students will receive an online certification by achieving 80% or greater assessment score.

Estimated time of completion: 6 hours

Student Skills Assessment Check List:

Module 1: Program Structure

Skills

- ☐ Interpret word addresses used in a CNC lathe program.
- ☐ Identify the 3 distinct parts of a CNC lathe program.
- ☐ Decipher the program codes used in the program introduction.
- ☐ Verify the body of a CNC lathe program.
- ☐ Decipher the program codes used in the program end.

Module 2: Programming Methods

Skills

- ☐ Match absolute and incremental programming methods with their definitions.
- ☐ Identify absolute locations in a Cartesian coordinate system.
- ☐ Identify incremental locations in a Cartesian coordinate system.

Module 3: Tool Motion and Tool Nose Radius (TNR) Compensation

Skills

- ☐ Match G-codes G00 – G03 with their functionality.
- ☐ Interpret rapid tool motion and verify its associated G-code.
- ☐ Interpret linear tool motion at a feed rate and verify its associated G-code.
- ☐ Interpret clockwise circular interpolation and identify its associated G-code.
- ☐ Interpret counter clockwise circular interpolation and identify its associated G-code.
- ☐ Decipher the 3 primary tool nose compensation G-codes and their functionality.
- ☐ Verify the proper situation to use right or left cutter compensation.
- ☐ Identify the 9 Haas tool tip positions.
- ☐ Program a fake move to turn on and off TNR compensation.

Module 4: Circular Interpolation

Skills

- ☐ Interpret clockwise circular interpolation and identify its associated G-code.
- ☐ Interpret counter clockwise circular interpolation and identify its associated G-code.
- ☐ Program an arc using the radius method of circular interpolation.

Module 5: Canned Cycles

Skills

- ☐ Program a tool path using the rough and finish turn canned cycles.
- ☐ Calculate the thread formulas for the parameters associated with the external threading canned cycle.
- ☐ Program a tool path using the external threading canned cycle.

Module 6: Hole Manufacturing

Skills

- ☐ Program a drill cycle using the drill canned cycle.

- ☐ Program a drill cycle using the peck drill canned cycle.
 - ☐ Calculate the proper speeds and feeds for tapping a hole.
 - ☐ Program a hole to be tapped using the rigid tapping canned cycle.
 - ☐ Interpret a part print and process sheet.
 - ☐ Write a complete program using all the programming instructions illustrated throughout the course.
-

Haas Lathe Intuitive Programming System

This course provides comprehensive instruction and exercises on how to precisely use the Haas Lathe Intuitive Programming System (IPS) to easily program and machine quality parts. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 4 hours

Student Skills Assessment Check List:

Module 1: Introduction to Haas Lathe Intuitive Programming System (IPS)

Skills

- ☐ Define IPS and understand the principles of how IPS works.
- ☐ Specify the procedure to program apart using IPS.
- ☐ Decipher the difference between cutting specifications and feature specifications.
- ☐ Know each of the available cutting operations.
- ☐ Specify how to power up a Haas Lathe and access the IPS menus.
- ☐ Understand how to navigate through IPS menu tabs.
- ☐ Understand how to navigate through IPS sub-menu tabs.
- ☐ Define what a “Parameter” on an IPS menu is used for.
- ☐ Define what the “Manual Settings” display on an IPS menu.
- ☐ Define what the “Help Menu Display” on an IPS menu does.

Module 2: Manual Mode Tab

Skills

- ☐ Identify how to navigate to the “Manual” tab.
- ☐ Understand what manual mode is used for.
- ☐ Specify how to jog the machine in manual mode.
- ☐ Specify how to control the spindle in manual mode.

Module 3: Setup Mode Tab

Skills

- ☐ Identify how to navigate to the “Setup” mode tab.
- ☐ Understand what each of the “Setup” sub-menu tabs are used for.
- ☐ Specify the process of setting the work offset and other parameters on the “Work” sub-menu tab.
- ☐ Specify the process of setting tool offsets and other parameters on the “Tool” sub-menu tab.
- ☐ Specify the process of setting up the tailstock and other parameters on the “Tailstock” sub-menu tab.

Module 4: Turn and Face Mode Tab

Skills

- ☐ Identify how to navigate to the “Turn and Face” mode tab.
- ☐ Specify each of the “Turn and Face” sub-menu tabs.
- ☐ Demonstrate how to approach a part with a tool using the “Rapid” sub-menu tab.
- ☐ Demonstrate how to utilize the “Feed” sub-menu tab.
- ☐ Demonstrate how to program an “O.D. Turn” operation using the “OD Turn” sub-menu tab.
- ☐ Demonstrate how to program an “I.D. Turn” operation using the “ID Turn” sub-menu tab.
- ☐ Demonstrate how to program a “Face” operation using the “Face” sub-menu tab.
- ☐ Specify the parameter which is used to create a part profile.
- ☐ Identify the profile creator’s hot keys.
- ☐ Understand the profile creator window layout.
- ☐ Demonstrate how to access the profile creator.
- ☐ Demonstrate how to program a part profile using the “Profile” sub-menu tab and the profile creator.

Module 5: Chamfer and Radius Mode Tab

Skills

- ☐ Identify how to navigate to the “Chamfer and Radius” mode tab.
- ☐ Understand each of the parameters on the “Chamfer and Radius” menu tab.
- ☐ Demonstrate how to program an O.D. chamfer using the IPS “Chamfer and Radius” menu tab.
- ☐ Demonstrate how to program an I.D. chamfer using the IPS “Chamfer and Radius” menu tab.
- ☐ Demonstrate how to program an O.D. radius using the IPS “Chamfer and Radius” menu tab.
- ☐ Demonstrate how to program an I.D. radius using the IPS “Chamfer and Radius” menu tab.

Module 6: Drill and Tap Mode Tab

Skills

- ☐ Identify how to navigate to the “Drill and Tap” mode tab.
- ☐ Understand what each of the “Drill and Tap” sub-menu tabs are used for.
- ☐ Understand each of the parameters of the “Drill” sub-menu tabs. Sub-menu tabs include: Drill, Peck Drill, Tap, and Reverse Tap
- ☐ Demonstrate how to program a “Drill” drilling operation using the IPS “Drill and Tap” menu tab.
- ☐ Demonstrate how to program a “Peck Drill” drilling operation using the IPS “Drill and Tap” menu tab.
- ☐ Demonstrate how to program a “Tap” drilling operation using the IPS “Drill and Tap” menu tab.
- ☐ Demonstrate how to program a “Reverse Tap” drilling operation using the IPS “Drill and Tap” menu tab.

Module 7: Threading Tab

Skills

- ☐ Identify how to navigate to the “Threading” mode tab.
- ☐ Understand what each of the “Threading” sub-menu tabs are used for.
- ☐ Understand each of the parameters of the “Threading” sub-menu tabs. Sub-menu tabs include: OD Thread, ID Thread, OD Thread Repair, and ID Thread Repair.
- ☐ Demonstrate how to program an “OD Thread” threading operation using the IPS “Threading” menu tab.
- ☐ Demonstrate how to program an “ID Thread” threading operation using the IPS “Threading” menu tab.
- ☐ Demonstrate how to program an “OD Thread Repair” threading operation using the IPS “Threading” menu tab.
- ☐ Demonstrate how to program an “ID Thread Repair” threading operation using the IPS “Threading” menu tab.

Module 8: Thread Re-Cut

Skills

- ☐ Identify how to navigate to the “Thread Re-Cut” mode tab.
- ☐ Understand what each of the “Thread Re-Cut” sub-menu tabs are used for.
- ☐ Understand each of the parameters of the “Thread Re-Cut” sub-menu tabs. Sub-menu tabs include: Set Offset and Pushback, Thread Teach Position, and Set Reference & Re-Cut.
- ☐ Demonstrate how to use the “Set Offset and Pushback” sub-menu tab.
- ☐ Demonstrate how to use the “Thread Teach Position” sub-menu tab.
- ☐ Demonstrate how to use the “Set Reference and Re-Cut” sub-menu tab.

Module 9: Grooving Tab

Skills

- ☐ Identify how to navigate to the “Grooving” mode tab.
- ☐ Understand what each of the “Grooving” sub-menu tabs are used for.
- ☐ Understand each of the parameters of the “Grooving” sub-menu tabs. Sub-menu tabs include: OD Groove, ID Groove, Part Off, and Part Off with Peck.
- ☐ Demonstrate how to use the “OD Groove” sub-menu tab.
- ☐ Demonstrate how to use the “ID Groove” sub-menu tab.
- ☐ Demonstrate how to use the “Part Off” sub-menu tab.
- ☐ Demonstrate how to use the “Part Off with Peck” sub-menu tab.

CNC Lathe Projects

CNC Lathe projects are designed to demonstrate the entire process of machining a part. Instructions will be given to create NC programs for 3 turning projects, followed by instructions to setup, run the program on a Haas vertical CNC milling machine, and inspect the finished parts.

Estimated time of completion: 9 hours

Student Skills Assessment Check List:

Skills

- ☐ Programming NC code for the following machining operations:
 - Blueprint Reading
 - Facing
 - Profiling
 - Drilling
 - Boring
 - Grooving
 - Threading
 - ☐ Machine setup including the following skills:
 - Powering up the machine and executing a machine warm up cycle.
 - Workholding
 - Develop a tool list
 - Setting part zero offsets
 - Setting tool length offsets
 - Running the part program
 - ☐ Inspection using the following measurement tools:
 - Micrometers
 - Calipers
 - Gage Pins
 - Depth Micrometers
-

Renishaw Machine Tool Probing System

This course provides comprehensive instruction and exercises on how to precisely use Renishaw machine tool probing systems. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 4 hours

Student Skills Assessment Check List:

Module 1: Overview

Skills

- ☐ Understand what machine tool probes are and what they are used for.
- ☐ Understand what tool setting probes are and what they are used for.
- ☐ Understand the Productive Process Pyramid™.

Module 2: Tool Setting

Skills

- ☐ Utilize tool setting probes to determine geometric information and cutting tool condition.
- ☐ Identify the benefits of tool setting.
- ☐ Identify the benefits of tool breakage detection.
- ☐ Identify Contact tool setters and Non-contact tool setters.
- ☐ Understand tool setting technology.
- ☐ Understand the kinematic contact tool setter design.

Module 3: Tool Setter Assembly and Usage

Skills

- ☐ Demonstrate the ability to assemble tool setters.
- ☐ Demonstrate the usage of tool setters.
- ☐ Demonstrate how to calibrate the OTS.

Module 4: Using the tool setter on a Haas CNC mill

Skills

- ☐ Demonstrate how to program a tool setter on a Haas CNC mill.

Module 5: Probe Anatomy

Skills

- ☐ Identify the major components of a machining center probe system.
- ☐ Understand the functions of a machining center probe system.
- ☐ Understand the naming convention of a probe system.
- ☐ Understand the probe power supply.

Module 6: Probe assembly and usage

Skills

- ☐ Understand how to assemble a machine tool probe system.
- ☐ Understand how to calibrate a machine tool probe system.

Module 7: Using the spindle probe on a Haas CNC mill

Skills

- ☐ Understand how to program a machine center spindle probe on a Haas CNC mill.
-

Drill Press

This course provides comprehensive instruction and exercises on how to precisely operate a drill press. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 6 hours

Student Skills Assessment Check List:

Module 1: Fundamentals

Skills

- ☐ Understand safety practices while operating a drill press.
- ☐ Determine proper cutting speeds and spindle speeds.
- ☐ Determine proper feed rates.
- ☐ Understand what operations can be achieved on a drill press.
- ☐ Identify different types of hand taps, tap drills, and tap wrenches.

Module 2: Setup

Skills

- ☐ Demonstrate how to indicate a vise.
- ☐ Demonstrate how to locate hole locations.

Module 3 - 8: Holes 1 – 5 and Backside of Part

Skills

- ☐ Demonstrate the following operation on a drill press:
 - a. Drilling
 - b. Reaming

- c. Countersinking
 - d. Tapping
 - e. Counter boring
 - ☐ Demonstrate how to inspect drill press operations.
 - ☐ Demonstrate how to flip a part, relocate holes, and machine backside of a part.
-

Manual Mill

This course provides comprehensive instruction and exercises on how to precisely operate a manual milling machine. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 7 hours

Student Skills Assessment Check List:

Module 1: Fundamentals

Skills

- ☐ Understand safety practices while operating a manual mill.
- ☐ Understand the concepts of a manual mill.
- ☐ Understand the different axial movement of a manual mill.
- ☐ Identify the different components of a manual mill.

Module 2: Machine Setup

Skills

- ☐ Understand the importance of accurately setting up a milling machine.
- ☐ Demonstrate how to tram the vertical milling machine head.
- ☐ Demonstrate how to verify the mill head is accurately trammed.
- ☐ Demonstrate how to prepare the milling machine table.
- ☐ Demonstrate how to align the vise.
- ☐ Demonstrate how to set the workpiece in a vise.
- ☐ Demonstrate how to load and setup a face mill.
- ☐ Demonstrate how to square the part.
- ☐ Demonstrate how to locate the part origin.
- ☐ Understand how to determine what tools should be used for each milling machine operation.

Module 3: Milling Operations

Skills

- ☐ Demonstrate how to setup an endmill.
- ☐ Demonstrate how to rough a slot.
- ☐ Demonstrate how to finish a slot.

Module 4: Drilling Operations

Skills

- ☐ Demonstrate how to machine the following operations on a manual mill:
 - a. Center Drilling
 - b. Drilling
 - c. Reaming
 - d. Countersinking
 - e. Tapping
 - f. Boring

Module 5: Backside of Part

Skills

- ☐ Demonstrate how to flip the part and locate the part origin on the backside of the part.

- ☐ Demonstrate how to countersink holes on the backside of the part.
-

Manual Lathe

This course provides comprehensive instruction and exercises on how to precisely operate a manual lathe. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 7 hours

Student Skills Assessment Check List:

Module 1: Safety

Skills

- ☐ Understand safety practices while operating a manual lathe.

Module 2: Fundamentals

Skills

- ☐ Understand the components of a 3-jaw chuck.
- ☐ Understand the mechanics of a 3-jaw chuck.
- ☐ Understand the uses of a 3-jaw chuck.
- ☐ Understand the components of a 4-jaw chuck.
- ☐ Understand the mechanics of a 4-jaw chuck.
- ☐ Understand the uses of a 4-jaw chuck.
- ☐ Understand the different types of tool holders.
- ☐ Understand the different types of cutting tools.
- ☐ Understand cutting tool materials.

Module 3, 4 & 5: Project 1 & 2

Skills

- ☐ Demonstrate the following operations on a manual lathe:
 - a. Facing
 - b. Centering
 - c. Roughing
 - d. Finishing
 - e. Grooving
 - f. Filing
 - g. Threading
 - h. Center Drilling
 - i. Drilling
 - j. Knurling
 - k. Boring
 - l. Internal Threading
 - m. Turning between centers.

Precision Grinding

This course provides comprehensive instruction and exercises on how to precisely operate a surface grinder. Upon completion of each lesson the student will be required to demonstrate knowledge comprehension and learned skills through online testing.

Estimated time of completion: 7 hours

Student Skills Assessment Check List:

Module 1: Grinding Fundamentals

Skills

- ☐ Define what precision grinding is and what part features are machined on a surface grinder.
- ☐ Understand safety precautions.
- ☐ Identify the types of precision grinders and what their uses are.
- ☐ Identify the components of a surface grinder.
- ☐ Understand how cutting fluids are used while grinding.
- ☐ Understand how and when to use different type of work holding devices.
- ☐ Demonstrate how to dress a grinding wheel.
- ☐ Demonstrate basic operations on a surface grinder.

Module 2: Project Introduction

Skills

- ☐ Understand the process plan for grinding the project part in the following modules.

Modules 3 – 8: Step-by-step Project

Skills

- ☐ Demonstrate the following operations on a surface grinder:
 - a. Machine preparation
 - b. Turn on hydraulics
 - c. Setup stop dogs
 - d. Start wheel
 - e. Part touch off
 - f. Spark out
 - g. Grinding vice setup
 - h. Setup sine plate
 - i. Grind all 7 sides of the project part to tolerance