

CNC Fabrication Course Outline

Prerequisite- Introduction to CAD course and Engineering and Fabrication course

Needed Equipment- Haas CNC Machine or Mastercam CNC Machine

In this course, students learn the fundamentals of using CNC technology developing skills with a CNC lathe and CNC milling machine. As a *FIRST* program, students have access to certifications through our sponsors (Haas CNC Certification, Mastercam Certification, Driveworks Certification). The content in this course can be used as a pathway for students to gain the necessary skills for certification which can help them in the workforce while also gaining essential skills to fulfill their role on their *FIRST* Robotics or *FIRST* Tech Challenge Team.

If instructors do not have access to machines in their facility, they are encouraged to find a college or a testing facility for certification that could provide the certification with their students.

Lesson	Learning Objectives	Time
Understanding Program Geometry's Sketches, and how CAD Transfers to Machining	<ul style="list-style-type: none"> a) Sketch a basic part in a CAD/CAM program. This could be a tool such as Driveworks, Onshape or the Mastercam program. b) Understand how a CAD program is transferred into toolpaths or machine code. c) Understand how the CAD/CAM program can go from a rough stock to a finished product utilizing different cutting techniques. 	10 hours
Basic Understanding of CNC Machine Tools and Use	<ul style="list-style-type: none"> a) Cover the history of machine tools, basic machine construction, and basic cutting tools. b) Introduce the machining process, from raw stock to finished part, explain the roles of the operator, the machine, and the programs in the process. c) Includes a basic explanation of G & M codes, X/Y/Z movement, spindle rotation, and speeds. d) Explain the difference between lathe and mill coordinates. 	3 hours
Machine Safety	<ul style="list-style-type: none"> a) A full review of the machine's safety features they will be using. This includes details such as emergency stops, door interlocks, feed hold, single block, properly clamping parts, housekeeping for the work area and reset. 	3 hours
Basic Machine Start-Up	<ul style="list-style-type: none"> a) Students will utilize a list of items to check machine Power Up, including coolant level, machine cleanliness prior to operation, tooling, and work holding. They will also learn the items they should do when they power down a machine. 	3 hours
Correctly Loading and Unloading Parts	<ul style="list-style-type: none"> a) Students will learn the basics of Workholding and part clamping. They learn proper use of part stops, various types of work holding, and using proper clamping force to ensure the workpiece is correctly clamped into the Workholding. 	3 hours
Run a Simple Program	<ul style="list-style-type: none"> a) Students will learn the basic elements of a program and explain the lines of code including program safe start-up, distance to go, single block mode and rapid vs feed motion. Discusses the danger of chip-build-up on all working surfaces of the machine. 	3 hours

Controls and Functions	a) Students will review the entire keypad and control screen layout. Highlight specific keys as an introduction for the new operator, such as: Cycle Start, Feed hold, Reset, E-Stop, Coolant On/Off and the Help Screen.	3 hours
Reading of Blueprints and Shop Routers	a) Students will learn the various aspects of a drawing including the title block, revision block, tolerance location, and general note's location. Explains dimensioning on drawings, callouts, and section view.	3 hours
Ability to Use Measuring Tools	a) Students will learn the details of various inspection tools and their use these include scales, calipers, and micrometers.	3 hours
Basic Math	a) Students will apply basic shop math skills including addition/subtraction, decimal equivalencies, converting fractions to decimals, and converting metric measurements to inch.	3 hours
Mill Cutting Tools and Common Work Materials	a) Overview of the common cutting tools used in a CNC machine and the common materials you will encounter in the job.	3 hours
Machine Maintenance	a) Review of the basic maintenance for a CNC machine, including clearing of chips from the machine enclosure, maintaining the coolant tank and coolant system, checking the lubrication system, and caring and cleaning all filters.	3 hours
Hands-On Test	a) Students will prepare for an in-person examination at a testing facility. They will be asked to demonstrate the concepts presented in the course.	5 hours