

# Machine Technology Curriculum Guide 2021-2022

## **Program Description**

MCTI's Machine Technology Program is run like a small machine/fabrication shop. Students are taught to run various equipment including manual lathes, milling machines, welding equipment, and grinders. Students use hand tools to layout, finish, fit, and assemble parts. Students may also learn setup and operation of CNC turning and machining centers. Advanced students learn to use CAD/CAM software to generate G-code for CNC machining.

**Program Admissions Requirements** - Students who most closely match the **U.S. Department of Labor occupational profile** for a Machinist are accepted for enrollment.

**Aptitude/Abilities** - Average learning ability, spatial and form perception, motor, and fine finger dexterity. Demonstrated ability of mechanical reasoning, computer literacy, and the ability to problem solve and compute dimensions.

**CASAS Scaled Score** - Reading 216-225 & Math 226-235

**Environment** - Loud, hazardous machines

**Physical Demands** – Medium

**Temperament** - Perform precision work and a variety of tasks

**Entry-Level Pay** - Starting pay may range from the current minimum wage to a higher amount depending on the location of the job.

**Certificate of Completion Programs** (SOC code):

- Machine Operator (51-4034)
- Production Welder (51-4122)
- Fabrication Welder (51-4122)
- CNC Operator (51-4011)

**Pre-requisites to enter Machine Technology Program:**

EC130 Technical Math for MT

MT105A Blueprint Reading

**The Machine Technology Program has two distinct tracks:**

Welding Track: Production Welder (1 term) and Fabrication Welder certificate (2 terms).

CNC Track: Machine Operator (2 terms) and CNC Operator certificate (3 terms).

### **Required Courses for Certification**

*To advance from term to term, students must demonstrate academic progress (satisfactory grade point average of 2.0) and good employability skills.*

#### **Before entering the Machine Technology trade (Pre-Requisites)**

<b>Course Number</b>	<b>Course Name</b>	<b>Credits</b>
EC 130	Technical Math for MT	2
MT 105A	Blueprint Reading	0

#### **Welding Track** – Production Welder certificate (first term)

<b>Course Number</b>	<b>Course Name</b>	<b>Credits</b>
EC 115	Algebra - MT	2
MT 109	Intro. Welding Processes	2
MT211B	Production Welding	8

#### Fabrication Welder certificate (second term)

<b>Course Number</b>	<b>Course Name</b>	<b>Credits</b>
EC 239A	Geometry/Trigonometry	2
MT 309	Weldment Print Reading	3
MT 311	Welding Fabrication	9

#### **CNC Track** Machine Operator certificate (first term)

<b>Course Number</b>	<b>Course Name</b>	<b>Credits</b>
EC 115	Algebra - MT	2
MT 107	Machine Tool I	2
MT 108C	Machine Shop Practices I	8

#### No certificate (second term)

<b>Course Number</b>	<b>Course Name</b>	<b>Credits</b>
MT 207A	CNC Fundamentals	3
MT 208A	CNC Operations I	7
MT 220	Intro. CNC Programming	2

#### CNC Operator certificate (third term)

<b>Course Number</b>	<b>Course Name</b>	<b>Credits</b>
EC 239A	Geometry/Trigonometry	2
MT 315	CAD/CAM	3
MT 320A	CNC Operations II	7

Advanced Courses (Instructor Approval Needed)

Course Number	Course Name	Credits
MT 680	Independent Study	2-12
MT 690	Work Internship	6-12

Instructors, program managers, and/or the referring counselor may recommend employability skills and elective classes based on the student's needs, interest, and abilities. Additional terms or courses are initiated by the instructor and approved by the Manager of Career and Technical Education programs. Job Seeking Skills is required for all students expecting to graduate from MCTI.

### **Course Descriptions**

**EC 130: Technical Math for Machine Technology and Drafting** - This course is for students seeking a job in machine technology or drafting. Students work with problems like those found in machine trade handbooks and engineered drawings. Students solve realistic industry-related problems and use actual industrial applications that progress from simple to relatively complex. **Topics Covered:** application of basic arithmetic operations of fractions and decimals, calculator, blueprint dimensions as working dimensions, formulas.

**MT 105A: Blueprint Reading** - This course is designed for students that have little or no blueprint reading knowledge. This course prepares the students to read blueprints and understand blueprint nomenclature to be able to produce a product from a print.

**Topics Covered:** Orthographic projection, line types, title blocks, dimensioning, precision measurement, hole callouts, thread callouts, arcs, sectioning, angles, and machining details.

**EC 115: Algebra** - Students learn basic algebra that is needed for training in any technical/ vocational field or testing including GED, college entrance, civil service, and military entrance. **Topics Covered:** signed numbers and order of operations, powers, roots, and scientific notation, algebraic expressions and formulas, one-step equations, multi-step equations, special equations, graphing equations, polynomials.

**MT 109: Introduction to Welding Processes** - This course is designed to introduce students to basic shop safety, terminology, and equipment as it relates to the various welding processes. Students will learn benchwork, layout, band machining, grinding, basic electricity, as related to the welding processes, standard joint configurations, and the different equipment and materials used for the Gas Metal Arc Welding (GMAW), Gas Tungsten Arc Welding (GTAW), and Plasma Arc Cutting (PAC) processes.

**MT 109: Introduction to Welding Processes - Continued**

**Topics Covered:** Welding Safety, Band Machining, Grinding, Cutting, Basic Electricity, joint configurations, and the various welding processes such as: GMAW, GTAW, and PAC

**MT 211B Production Welding** - This course is designed to introduce students to various welding processes and materials commonly joined using the MIG, TIG, and plasma cutting processes. Students use various materials including mild steel, stainless steel, and aluminum to hone their welding skills to function in a production environment.

**Topics Covered:** MIG and TIG welding processes on various materials. Plasma cutting.

**EC 239A: Geometry/Trigonometry** - This course is designed for students who need beginning Geometry and Trigonometry skills to prepare for training in the Machine Shop or Cabinetmaking vocational fields. The course focuses on instruction in the fundamentals of Geometry and Trigonometry as they apply to those areas.

**Topics Covered:** Geometry: Principles of angles, triangles, and circles; Finding perimeters and areas for various geometric figures; Using geometry in shop applications. Trigonometry: The basic trigonometric functions, Calculations of missing angles & sides of right triangles, Using trig in shop applications.

**MT 309 Weldment Print Reading** - This course is designed for students who have a working knowledge/skill level in blueprint reading. This course builds on their knowledge/skill to prepare the students to identify and interpret welding symbols and terminology found on weldment blueprints. **Topics Covered:** Welding symbols, terminology

**MT 311 Fabrication Welding** - This course is designed for the students who can already make proficient welds in multiple materials utilizing various welding processes. The course prepares the student for entry-level employment in the welding/fabricating field and develops their ability to assemble complex weldments. Safety and personal reliability (class attendance and participation) are stressed. **Topics Covered:** Blueprint Reading, Cut Lists, Production and Fabrication Techniques.

**MT 107: Machine Tool 1** - This course is designed for students with little or no machining experience. Students will learn different types of hand tools, measuring tools, and machine tools used within the career field. Safety and personal reliability (class attendance and participation) will be stressed. **Topics Covered:** Safety, Layout, Hand tools, Materials, Grinding, Fasteners, Drilling, Tapping, Turning, Milling, Jigs and Fixtures, Band Machining, and Cutting Fluids.

**MT 108C: Machine Shop Practices 1** - This course is designed for students with little or no machining experience and prepares them for entry-level employment in the manufacturing career field. The student learns to use, in a lab environment, the different

types of hand tools, measuring tools, and machine tools commonly used in the manufacturing field. **Topics Covered:** Hand tools, Measuring Devices, Engine Lathe, Band Saws (horizontal and vertical), Vertical milling Machine, Pedestal Grinder, and Surface Grinder.

**MT 207A: CNC Fundamentals** - This course introduces students to CNC terminology, operation, and programming. This course is designed for students with little to no experience with CNC equipment and operation. Students are required to have a prior understanding of basic machining equipment and terminology. Safety and personal reliability (class attendance and participation) will be stressed. **Topics Covered:** Cartesian Coordinate system, CNC terminology, CNC operation, and CNC programming including G-codes and M-codes.

**MT 208A: CNC Operations I** - This lab is designed for students with a no knowledge of CNC machining or turning centers. Students will learn Haas CNC machine setup and operation. Students will utilize Haas CNC equipment to manufacture projects from code written by themselves. Students will be exposed to the complete processes from print to part. Safety and personal reliability (class attendance and participation) will be stressed. **Topics Covered:** CNC operation, Tool Offsets, Calculating Feeds and Speeds, and Basic Program Editing.

**MT 220: Introduction to CNC Programming** - This course is designed for students with no previous CNC programming. This course familiarizes the student with the fundamentals of G-code and M-code programming. The programming focuses on the Haas controller and specific canned cycles associated with Haas Machining and Turning centers. Students will be required to manually program drawings and test their programs using the simulator functions of the Haas machines.

**Topics Covered:** G-codes and M-codes, programming sequence, X,Y,Z coordinate system

**MT 315: CAD/CAM** - This course is designed for students with little or no knowledge of CNC programming with CAM software or CNC operations, but have knowledge of machine shop operations including manual lathe and mill. The course focuses on basic applications of CNC operation, computer assisted programming using CAM software, and advanced canned program cycles. Programming focus will be on the Haas milling and turning controllers. **Topics Covered:** CNC programming, CNC operations, Canned Cycles, CAM software functionality.

**MT 320A: CNC Operations II** - This course is a continuation of MT208A. It continues to build on the principals learned in the previous CNC courses. The course focuses on the considerations of part production setup, advanced controller operations, setup of tooling offsets, machine maintenance, and manual program editing. CAM program

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development is also explored. **Topics Covered:** CNC operation, Setting tool offsets, Production setups, and machine maintenance.