

# Machine Tooling Technics

Program Number: 32-420-5

Two-Year Technical Diploma

Manufacturing Program Cluster

Center for Construction, Manufacturing, Apprenticeship & Transportation

Program offered at Madison Campuses

For information call: (608) 243-4169 or (800) 322-6282 Ext. 4169

## About the Program

Emphasis in Machine Tool is on training graduates for employment in tool and die making, mold making, Computer Numerical Control (CNC) Programming or as quality control inspectors or precision and repair machinists. Students utilize CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) and state-of-the-art machining centers, turning centers and Electrical Discharge Machines (EDM). This knowledge is blended with basic hands-on skills learned throughout the two-year program. Students gain the knowledge and skills necessary to design, build and inspect a machined part, injection mold or stamping die. This is the program for students seeking interesting and challenging work in a clean, high tech work environment, job stability and a career that rewards growth and experience.

## Application Process

To apply to the program, students must submit a complete application. A completed application consists of 1.) Application; 2.) Application fee; and 3.) High school transcripts – or - GED/HSED test scores – or – college transcript showing an Associate, Bachelor, or higher degree from an institution other than Madison College.

## Unique Requirements for Admission

There are no unique requirements for admission to this program.

## Unique Requirements for Graduation

Students must meet two 2.0 GPA requirements to graduate. 1.) GPA for entire program must be 2.0 or above; 2.) GPA of combined occupational courses (420) must be 2.0 or above.

## Program Courses

*Note: Due to space constraints, pre-requisite information has not been included in with the course descriptions. Please check our website for course pre-requisite and co-requisite information for each course.*

### 32-419-300 Hydraulics and Mechanics 2 credits

This course covers fundamentals of fluid and mechanical power components and their principle function, terminology and use. The basic power train systems are studied and include hydraulic components, gears, belt and chain drives, shafting, bearings, lubrication systems and speed and limit controls found on common industrial equipment.

### 32-420-304 Intermediate Metrology Applications 1 credit

Course studies precision inspection methods while utilizing optical and electronic precision measuring instruments such as the profilometer, optical comparator, microscope, laser alignment machines, the Coordinate Measuring Machine and state-of-the-art computerized vision system.

### 32-420-322 Machine Tool 1 4 credits

Introduces the basic concepts and skills using engine lathes, milling machines, power saws, Drill presses and bench applications. Emphasizes safety and proper operation of tools and machines, speeds, feeds, cutting tools, tool geometry, tool grinding and work-holding devices. Stresses dimensional accuracy, finish and quality as well as team-building and work ethics.

### 32-420-323 Machine Tool 2 4 credits

Expands on basic concepts and skills using engine lathes, milling machines, power saws, drill presses, bench applications, CNC setup and operation. Emphasizes safety and proper operation of tools and machines, speeds feeds, cutting tools, tool geometry, tool grinding and work-holding devices. Stresses dimensional accuracy, finish and quality with team-building and work ethics.

### 32-420-324 Machine Tool 3 4 credits

Expands the concepts and skills using engine lathes, milling machines, power saws, drill presses, bench applications, and advanced CNC setup and operation. Emphasizes safety and proper operation of tools and machines, speeds feeds, cutting tools, tool geometry, tool grinding and work-holding devices. Stresses dimensional accuracy, finish and quality with team-building and work ethics.

## Curriculum

The courses listed below outline the requirements for graduation for students entering this program in the 2011-2012 academic year. Requirements for graduation may vary depending on the semester in which a student is admitted to their program. Current/continuing students should consult their degree progress report available through their student center account for specific graduation requirements. Program requirements are subject to change.

FIRST YEAR		Credits	Hrs/week Lec-Lab
<b>First Semester</b>			
32-420-322	Machine Tool 1* .....	4	4-12
32-420-323	Machine Tool 2* .....	4	4-12
32-420-345	Drawing Interpretation 1 .....	2	4-0
32-420-346	Intro to CNC – G-code Programming .....	2	3-1
32-420-351	Elements of Basic Metrology .....	2	2-2
31-801-356	Communications 1 .....	1	2-0
31-804-381	Machine Tool Mathematics 1 .....	2	4-0
<b>Semester Total</b>		<b>17</b>	

### Second Semester

32-420-304	Intermediate Metrology Applications .....	1	1-1
32-420-324	Machine Tool 3* .....	4	4-12
32-420-325	Machine Tool 4* .....	4	4-12
32-420-337	Manufacturing w/Solid Modeling- 2D .....	2	4-0
32-420-348	Applied CNC- Conversational & Setup .....	2	1-3
32-420-388	Tool and Fixture Design .....	1	2-0
32-420-390	Fundamentals of Metallurgy .....	2	4-0
31-804-382	Machine Tool Mathematics 2 .....	1	2-0
<b>Semester Total</b>		<b>17</b>	

## SECOND YEAR

### First Semester

32-420-326	Machine Tool 5 (Die Making)* .....	4	4-12
32-420-327	Machine Tool 6* .....	5	5-13
32-420-336	Manufacturing w/Solid Modeling – 3D .....	2	4-0
32-420-389	Applied CNC-Intermediate Operations .....	2	1-3
32-420-394	Tool Making Theory 1 (Die Making) .....	2	4-0
31-806-363	Science 1 .....	2	2-2
<b>Semester Total</b>		<b>17</b>	

### Second Semester

32-419-300	Hydraulics and Mechanics .....	2	2-2
32-420-328	Machine Tool 7 (Mold Making)* .....	4	4-12
32-420-329	Machine Tool 8* .....	5	5-13
32-420-370	Manufacturing w/Solid Modeling - Advanced .....	1	2-0
32-420-391	Applied CNC- Advanced Operations .....	1	0-2
32-420-393	Job Orientation .....	1	1-0
32-420-395	Tool Making Theory 2 (Mold Making) .....	2	4-0
32-442-313	Related Welding .....	1	1-1
<b>Semester Total</b>		<b>17</b>	

\*Meets for 9 weeks.

*Note: Students are placed in English or mathematics courses based on their scores on the COMPASS or ASSET test or on completion of the appropriate prerequisite/s.*

Program Courses (continued)

**32-420-325 Machine Tool 4 4 credits**

Expands on basic concepts and skills using engine lathes, milling machines, power saws, drill presses, bench applications, CNC setup and operation. Emphasizes safety and proper operation of tools and machines, speeds feeds, cutting tools, tool geometry, tool grinding and work-holding devices. Stresses dimensional accuracy, finish and quality with team-building and work ethics.

**32-420-326 Machine Tool 5 4 credits**

Skills and knowledge necessary for advanced setups and procedures on milling machines, grinders, and lathes. Introduces both tool and cutter grinding and the selection and use of carbide tooling. Special emphasis is given to Electrical Discharge Machine and electrode development. CNC machining applications to complete course projects is enhanced. Safety, precision measurement and craftsmanship are stressed.

**32-420-327 Machine Tool 6 5 credits**

Provides the student with the skills and knowledge necessary for advanced setups and procedures on milling machines, grinders, and lathes. Students are also introduced both tool and cutter grinding and the selection and use of carbide tooling. Special emphasis is given to Electrical Discharge Machine and electrode development. CNC machining applications to complete course projects is also enhanced. Building a stamp die. Safety, precision measurement and craftsmanship are stressed.

**32-420-328 Machine Tool 7 4 credits**

Set-up and operate a CNC EDM machine, CNC machining center, and select and use superabrasives for grinding and machining. Advanced machining setups, procedures, and operations will be covered to enable students to accomplish the machining projects. Safety, precision measurement, and craftsmanship are stressed.

**32-420-329 Machining Tool 8 5 credits**

Set-up and operate a CNC EDM machining center, and select and use superabrasives for grinding and machining. Includes advanced machining setups, procedures, and operations to accomplish the machining of a small MUD plastic injection mold or special machining project. Safety, precision measurement, and craftsmanship are stressed.

**32-420-336 Manufacturing w/ Solid Modeling - 3D 2 credits**

This course builds on the concepts learned in Manufacturing w Solid Modeling--2D. Learners will utilize Solid Modeling software and CAM software to create true 3D models with surfacing concepts. Students will gain competency in file management by saving, converting, and working with different file types. Learners will create geometry in each application and convert files between CAD and CAM. Students will apply various tool paths theories to the designs they have created. Such theories include Surfacing, High Speed Machining, Hard Milling/Turning, 2 and 4 Axis Wire, Live lathe tooling and 4 Axis milling Pre-req-Manufacturing w/Solid Modeling--2D, Intro to CNC—G-code Programming, Applied CNC—Conversational & Setup. Co- reqs-Applied CNC—Intermediate Operations

**32-420-337 Manufacturing w/Solid Modeling--2D 2 credits**

This course offers instruction on individual computer workstations in a computer lab. This computer-aided drafting (CAD) instruction uses Solid Modeling software that is capable of creating 3D models and manufacturing drawings. In this course you will spend half of the time creating 3D models using 2 and 2.5D features while exploring the concepts of working in 3D space. Once the solid models are created students will import the solid models into CAM (Computer-aided manufacturing) software and utilize machining concepts to produce manufactured part using 2.5D programming methods such as pocketing, contouring & drilling for milling machines as well as turning, facing, grooving and threading for turning centers.

**32-420-345 Drawing Interpretation 1 2 credits**

Basic principles of engineering drawings and manufacturing procedures. Through interpretation and sketching, students learn to visualize the part, section or assembly. Uses drawings pertinent to the trade with examples.

**32-420-346 Intro to CNC – G-code Programming 2 credits**

Hands-on and lecture course exposing students to CNC (Computer Numerical Control). Emphasizes CNC vertical milling machines and CNC turning centers.- Covers history, basic CNC understanding and beginning programming including G-codes, M-codes. Students will utilize simulation software that will verify manually written code.

**32-420-348 Applied CNC – Conversational & Setup 2 credits**

This introductory Applications class familiarizes students with the basic setup procedures of CNC milling machines and CNC turning centers. They will set up rough stock and execute existing programs to produce finished parts. Once students learn these concepts they utilize the conversational programming software on the various CNC machines to program and produce parts.

**32-420-351 Elements of Basic Metrology 2 credits**

This course introduces the principles of basic dimensional measurement, layout techniques for machines, use of direct and indirect measuring tools as well as the use of length standards relative to calibration of measuring instruments and the basic operation of the Coordinate Measuring Machine.

**32-420-370 Manufacturing w/Solid Modeling--Advanced 1 credit**

The advanced course requires students to draw complex wire-frame models utilizing CAD software. These Models will then be imported into CAM software to use advanced programming methods to produce high quality parts. Mill Programming will include 2D, 2.5D, 3D, 4-Axis and an introduction to 5 Axis and 3+2 techniques. Lathe programming will include advanced turning and live tooling.

**32-420-388 Tool and Fixture Design 1 credit**

Introduces tool design and gauging. Emphasizes jigs, fixture design, clamping, locating devices and tooling and production methods. Presents preset and qualified tooling for NC/CNC as they relate to conventional practice.

**32-420-389 Applied CNC-Intermediate Operations 2 credits**

This applications class builds on CNC concepts learned in previous classes. Emphasis is on CNC Turning Center, CNC Milling machine, and CNC Wire set up and operation. Students will produce parts that they have modeled and programmed in Manufacturing w/Solid Modeling 1 and 2 as well as instructor provided programs.

**32-420-390 Fundamentals of Metallurgy 2 credits**

Introduces metallurgy, emphasizing applications, selection, identification methods and alloy influences. Studies metal properties using testing, micro-structure interpretation and heat-treatment processes. Covers tool steels, weld heat effects, failure analysis and machinability variations in cast iron, alloy steels and non-ferrous materials in detail.

**32-420-391 Applied CNC – Advanced Operations 1 credit**

Our most advanced CNC applications course devoted to machining complex toolpaths, including mold cavities and graphite electrodes. Stresses hands-on instruction and operation of CNC turning centers, vertical milling machines, and machining centers.

**32-420-393 Job Orientation 1 credit**

Covers specific occupational information including personal data sheets, job interviews, resumes and recommendations. Guest speakers lecture on employment, management and industry trends.

**32-420-394 Tool Making Theory 1 2 credits**

Lecture course supporting Machine Tool 3 lab activities. Major emphasis on the nomenclature, theory, construction features, design, and the technology of stamping and forming dies. Student also will spend time designing and planning a special die, mold or advanced CNC project.

**32-420-395 Tool Making Theory 2 2 credits**

Lecture course supporting Machine Tool 4 lab activities. Major emphasis on nomenclature, theory, construction features, design and the technology of mold dies. The seven molding processes will be discussed. Students also will spend time designing and planning a special mold, tool, or CNC project.

**32-442-313 Related Welding 1 credit**

Students learn basic welding processes, equipment operations, and safety procedures. Emphasizes welding procedures and practices commonly used in the machine tool industry.

**Career Potential:**

- Tool and Die Apprentice
- Mold Making Apprentice
- Millwright Apprentice
- Precision Machinist
- CNC Machinist
- CNC Programmer
- Machine Repair Specialist

With additional education and/or work experience, graduates may find employment as:

- Journey-level Tool and Die Maker
- Journey-level Mold Maker
- Journey-level Millwright
- Shop Owner
- Shop Manager
- Industrial Engineer
- Manufacturing Engineer
- Industrial Sales Engineer
- Die and/or Mold Designer
- Educator

*More detailed and updated information on this program may be available at: [madisoncollege.org](http://madisoncollege.org). The college reserves the right to make changes in the regulations and courses announced in this publication without notice.*

*Madison Area Technical College provides equal opportunity in education and employment.*

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