

# Millwright Technology Mississippi Curriculum Framework

Industrial Maintenance CIP 48.9999

2019



**Published by:**

Mississippi Community College Board  
Division of Workforce, Career, and Technical Education  
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The Office of Curriculum and Instruction (OCI) was founded in 2013 under the Division of Workforce, Career, and Technical Education at the Mississippi Community College Board (MCCB). The office is funded through a partnership with The Mississippi Department of Education (MDE), who serves as Mississippi's fiscal agent for state and federal Career and Technical Education (CTE) Funds. The OCI is tasked with developing statewide CTE curriculum, programming, and professional development designed to meet the local and statewide economic demand.

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## ADOPTION OF NATIONAL CERTIFICATION STANDARDS

The standards used to create this curriculum document can be found in the following documents on the Mississippi Community College Board website: <http://www.mccb.edu/OCI/currdownload.aspx>

- Precision Manufacturing and Machining Technology (CIP 48.0501)
- Industrial Technology Cluster (CIP 15.1501, CIP 47.0303, CIP47.0303, CIP 14.4201, CIP15.0499)
- Electrical Technology (CIP 46.0302)
- Industrial Electronics Engineering Technology (CIP 47.0105)

# INDUSTRY JOB PROJECTION DATA

The Millwright occupations require an on- the- job training. There is expected to be a 0.57% increase at the state level. Median annual income for this occupation is \$46,279.48 at the state level. A summary of occupational data from the State Workforce Investment Board Data Center is displayed below:

**Table 1: Education Level**

Program Occupations	Education Level
Elevator Installers and Repairers	Long-Term on-the-job training
Industrial Machinery Mechanics	Long-Term on-the-job training
Maintenance Workers, Machinery	Short-Term on-the-job training
Millwrights	Long-Term on-the-job training
Refractory Materials Repairers, Except Brick masons	Moderate-Term on-the-job training

**Table 2: Occupational Overview**

	Region	State	United States
2016 Occupational Jobs	5,566	5,566	489,890
2026 Occupational Jobs	5,598	5,598	496,473
Total Change	32	32	6,583
Total % Change	0.57%	0.57%	1.34%
2016 Median Hourly Earnings	\$22.25	\$22.25	\$24.96
2016 Median Annual Earnings	\$46,279	46,279	\$51,917.48
Annual Openings	3	3	658

**Table 3: Occupational Breakdown**

Description	2016 Jobs	2026 Jobs	Annual Openings	2010 Hourly Earnings	2010 Annual Earnings 2,080 Work Hours
Elevator Installers and Repairers	164	164	0	\$37.93	\$78,894.40
Industrial Machinery Mechanics	4,141	4,173	3	\$21.00	\$43,680.00
Maintenance Workers, Machinery	868	868	0	\$19.18	\$39,894.00
Millwrights	383	383	0	\$24.42	\$50,793.60
Refractory Materials Repairers, Except Brick masons	10	10	0	\$21.74	\$45,219.20
<b>TOTAL</b>	5,566	5,598	3	\$22.25	\$46,280.00

**Table 4: Occupational Change**

Description	Regional Change	Regional % Change	State % Change	National % Change
Elevator Installers and Repairers	0	0.00%	0.00%	2.64%
Industrial Machinery Mechanics	32	0.77%	0.77%	1.59%
Maintenance Workers, Machinery	0	0.00%	0.00%	0.30%

Millwrights	0	0.00%	0.00%	0.90%
Refractory Materials Repairers, Except Brick masons	0	0.00%	0.00%	-0.45

## ARTICULATION

At this time, there is no secondary Millwright Technology program to articulate into this postsecondary program.



# TECHNICAL SKILLS ASSESSMENT

Colleges should report the following for students who complete the program with a career certificate, technical certificate, or an Associate of Applied Science Degrees for technical skills attainment. To use the approved Alternate Assessment for the following programs of study, colleges should provide a Letter of Notification to the Director of Career Technical Education at the MS Community College Board. Please see the following link for further instructions: <http://www.mccb.edu/wkfEdu/CTDefault.aspx>.

CIP Code	Program of Study	
48.9999	Millwright Technology	
Level	Standard Assessment	Alternate Assessment
Accelerated Career Pathway	OSHA 10	
Level	Standard Assessment	Alternate Assessment
<b>Career</b>		
Manufacturing Trade	OSHA 10 NIMS Level I	
Workplace Leadership	Measurement, Materials, and Safety OSHA 30	
CNC Operator	NIMS Level I Measurement, Materials, and Safety	
Precision Manufacturing	Drill Press Skills I & Measurement Material & Safety Job Planning Bench work & Layout CNC Milling: Programming Setup Operations	
Level	Standard Assessment	Alternate Assessment
<b>Technical/AAS</b>		
Workplace Leadership	OSHA 30 NIMS LEVEL I Measurement, Materials, and Safety	
CNC Operator	NIMS Level I Measurement, Materials, and Safety	

## RESEARCH ABSTRACT

In the spring of 2019, the Office of Curriculum and Instruction (OCI) met with the different industry members who made up the advisory committees the Millwright program. An industry questionnaire was used to gather feedback concerning the trends and needs, both current and future, of their field. Program faculty, administrators, and industry members were consulted regarding industry workforce needs and trends. Industry advisory team members from the college involved with this program were asked to give input related to changes to be made to the curriculum framework. Specific comments related to soft skills are communication skills, critical thinking, and use of technology, team work and attendance. Occupation-specific skills include basic math skills, reading skills and understand of tools and equipment.

## REVISION HISTORY:

2019 Mississippi Community College Board

## PROGRAM DESCRIPTION

The uniform program structure for Millwright Technology is designed to serve as the core of instruction for approximately 75% of each major machine tool operation course. The remaining 25% of each course is to be added at the local level based upon needs of students and local employers.

The Modular Option for Millwright Technology is designed to provide flexibility in scheduling and timely certification testing through NIMS. This curriculum revision was developed by utilizing the national standards for machining skills as developed and approved by the National Institute for Metalworking Skills (NIMS). Industry standards are based on the *National Institute for Metalworking Skills*.

Millwright Technology two-year certificate – Industrial Maintenance option is an instructional program that prepares individuals to manufacture metal parts on machines such as lathes, grinders, drill presses, and milling machine equipment. Included is instruction in making computations related to work dimensions, testing, feeds, and speeds of machines; using precision measuring instruments such as layout tools, micrometers, and gauges; machining and heat-treating various metals; and laying out machine parts. The Industrial Maintenance option is designed to prepare students for entry-level employment as multi-skilled maintenance technicians. Industrial maintenance trade technicians are responsible for assembling, installing, and maintaining/repairing machinery used in the manufacturing or industrial environment. Students receive basic instruction in a wide variety of areas including safety, machinery maintenance and troubleshooting/service, blueprint reading, basic welding and cutting operations, basic machining operations, fundamentals of piping and hydro-testing, and fundamentals of industrial electricity

## SUGGESTED COURSE SEQUENCE

### Accelerated Career Pathway (Manufacturing Trades)

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
IMM 1934	Manufacturing Basic Skills	4	2	4	90			OSHA 10  *OPAC Certification Exam for Keyboarding
EET 1154	Equip. Maintenance	4	2	4	90			
	*Computer Elective	3						
	Instructor Approved Electives	4						
	<b>TOTAL</b>	<b>15</b>						

A stand-alone 15-hour Manufacturing Basic Skills certificate option is available for individuals seeking entry level employment in a manufacturing setting.

\*Must enroll in a BOT computer elective in order to sit for the OPAC certification exam.

### Career Certificate (Manufacturing Trades)

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
IMM 1934	Manufacturing Basic Skills	4	2	4	90			OSHA 10 NIMS Level I Measurement, Material and Safety
EET 1154	Equip. Maintenance	4	2	4	90			
MST 1313	Machine Tool Mathematics	3	2	2	60			
MST 1413	Blueprint Reading	3	2	2	60			
MST 1613	Precision Layout	3	2	2	60			
	Instructor Approved Electives	10						
	Computer Elective	3						
	<b>TOTAL</b>	<b>30</b>						

Accelerated Career Pathway (Precision Manufacturing)

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
MST 1413	Blueprint Reading	3	2	2	60			
MST 1613	Precision Layout	3	2	2	60			
	Technical Electives	9						
	<b>TOTAL</b>	<b>15</b>						

Career Certificate (Precision Manufacturing)

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
MST 1313	Machine Tool Mathematics	3	2	2	60			Drill Press Skills I & Measurement Material & Safety Job Planning Bench work & Layout CNC Milling: Programming Setup Operations
MST 1413	Blueprint Reading	3	2	2	60			
MST 1115	Power Machinery I	4	2	4	90			
MST 1124	Power Machinery II	4	2	4	90			
MST 1613	Precision Layout	3	2	2	60			
MST 2714	Computer Numerical Control Operations I	4	2	4	90			
MST 1423	Advanced Blueprint Reading	3	2	2	60			
	Technical Electives	6						
	<b>TOTAL</b>	<b>30</b>						

Career Certificate (Electrical Trade)

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
ELT 1113	Residential Wiring	3	2	2	60			OSHA 10
ELT 1123	Commercial Wiring	3	2	2	60			
ELT 1144	AC and DC Circuits for Electrical Technology	4	2	4	90			
ELT 1192	Fundamentals of Electricity	2	1	2	45			
ELT 1213	Electrical Power	3	2	2	60			
ELT 1263	Electrical Drawings and Schematics	3	2	2	60			
ELT 1413	Motor Control Systems	3	2	2	60			
ELT 2913	Special Projects I	3	0	6	90			
ELT 2933	Special Projects II	3	0	6	90			
	Instructor Approved Electives	3						
	<b>TOTAL</b>	<b>30</b>						

Technical (Manufacturing Trade) OR 15-Hour Certificate (Workplace Leadership)

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
ENT 1153	Basic Application. Of Industrial. Safety	3	3	0	45			OSHA 30 *NIMS Level Measurement, Materials and Safety
MST 2223 <b>OR</b> ENT 2263	Inventory Control <b>OR</b> Quality Control	3	3	0	45			
	Management Technical Elective	3						
	Computer Elective	3						
	Communication Tech. Elective	3						
	<b>TOTAL</b>	<b>15</b>						

A stand-alone 15-hour Workplace Leadership certificate option is available for business and industry employees seeking the knowledge and skills needed to advance into a leadership or supervisory position.

\*The NIMS credential option is only available to students seeking the 30- hour career certificate or 45- hour technical certificate within the manufacturing trade option.

15 Hour Certificate (CNC Operator Certificate)

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
MST 1413	Blue Print Reading	3	2	2	60			NIMS Level I Measurement Materials & Safety
MST 1613	Precision Layout	3	2	2	60			
MST 1313	Machine Tool Math	3	2	2	60			
MST 2714	CNC I	4	2	4	90			
ENT 2263 <b>OR</b> MST 2223	Quality Assurance <b>OR</b> Inventory Control	3	3	0	45			
	<b>TOTAL</b>	<b>16</b>						

A stand-alone 15-hour CNC operator certificate option is available for individuals seeking the knowledge and skills needed to seek employment as a CNC operator.



## General Education Core Courses

To receive the Associate of Applied Science degree, a student must complete all of the required coursework found in the Career Certificate option, Technical certificate option, and a minimum of 15 semester hours of General Education core. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester or provided primarily within the last semester. Each community college will specify the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science degree at their college. The Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) Section 9 Standard 3 of the *Principles of Accreditation: Foundations for Quality Enhancement*<sup>1</sup> describes the general education core.

### Section 9 Standard 3:

3. The institution requires the successful completion of a general education component at the undergraduate level that
  - a) is based on a coherent rationale.
  - b) is a substantial component of each undergraduate degree program. For degree completion in associate programs, the component constitutes a minimum of 15 semester hours of the equivalent; for baccalaureate programs, a minimum of 30 semester hours or the equivalent.
  - c) ensures breadth of knowledge. These credit hours include at least one course from each of the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics. These courses do not narrowly focus on those skills, techniques, and procedures specific to a particular occupation or profession.

<<<Add any additional general education standards as required for programmatic accreditation here and footnote below.>>>

## General Education Courses

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
	Humanities/Fine Arts	3						
	Social/Behavioral Sciences	3						
	Math/Science	3						
	Academic electives	6						
	<b>TOTAL</b>	<b>15</b>						

<sup>1</sup> Southern Association of Colleges and Schools Commission on Colleges. (2017). *The Principles of Accreditation: Foundations for Quality Enhancement*. Retrieved from <http://www.sacscoc.org/2017ProposedPrinc/Proposed%20Principles%20Adopted%20by%20BOT.pdf>

Electives

MST 1523	Hand Tools	3
MST 1713	Fundamentals of Management and Leadership	3
MST 2823	Industrial Soldering and Fasteners	3
MST 1723	Workplace Communications	3

**All other electives approved by instructor per local community college policy.**

# MILLWRIGHT TECHNOLOGY COURSES

The standards used to create this curriculum document can be found in the following documents on the Mississippi Community College Board website: <http://www.mccb.edu/OCI/currdownload.aspx>

- Precision Manufacturing and Machining Technology (CIP 48.0501)
- Industrial Technology Cluster (CIP 15.1501, CIP 47.0303, CIP47.0303, CIP 14.4201, CIP15.0499)
- Electrical Technology (CIP 46.0302)
- Industrial Electronics Engineering Technology (CIP 47.0105)

**Course Number and Name:** ENT 1153 Basic Application of Industrial Safety

**Description:** This course addresses OSHA standards as related to 29 CFR 1910 General Industry Standards.

**Hour Breakdown:**

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

**Prerequisite:** Instructor approved

**Student Learning Outcomes**

**Students will be able to:**

1. Demonstrate the ability to reference 29 CFR 1910 General Industry Standards.
2. State effective hazard recognition practices in accordance with 29 CFR 1910 General Industry Standards.
3. Demonstrate the ability to use the OSHA website to reference safety materials.
4. Translate complex OSHA standards verbiage into common speech for dissemination to employees.
5. Write an effective OSHA inspectable program.

**Course Number and Name:** MST 1523 Hand Tools

**Description:** This course provides instruction in safe and proper use of hand tools and mechanical components commonly used by industrial mechanics and technicians. Includes instruction in the selection, use and care of common hand tools.

**Hour Breakdown:**

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

**Prerequisite:** Instructor approved

**Student Learning Outcomes**

**Students will be able to:**

1. Discuss and apply proper safety procedures for hand tools and mechanical components.
2. Identify, select, apply, and maintain common hand tools used by industrial maintenance mechanics and technicians.
  - a. Identify, select, apply, and maintain wrenches, pliers, clamping tools, and screwdrivers.
  - b. Identify, select, apply, and maintain striking tools (hammers, punches, chisels, etc.)
  - c. Identify, select, apply, and maintain drill, cutting, and threading tools, including sharpening drill and cutting bits.
  - d. Identify, select, apply and maintain hoisting, pulling and pressing tools.

**Course Number and Name:** MST 1713 Fundamentals of Management and Leadership

**Description:** This course addresses organizational management and the role management plays in the success of a company. This course further explores leadership and theories associated with leadership.

**Hour Breakdown:**

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

**Prerequisite:** Instructor approved

**Student Learning Outcomes**

**Students will be able to:**

1. Describe the role of managers and management in an organization.
2. Discuss the foundation of planning and decision-making.
3. Assess basic organization, staffing, building your career and managing change.
4. Understanding individual group behavior, motivation and rewarding employees, leadership, trust, and communication.
5. Describe the foundation of control and operations management.
6. Foster culture and leadership
7. Demonstrate leadership ethics

**Course Number and Name:** MST 2823 Industrial Soldering and Fasteners

**Description:** This course is designed to provide an overview of the basic manual soldering equipment and techniques in addition to the proper safety precautions for soldering. This course will also cover material related to industrial fasteners, including the knowledge and tools needed to work with fasteners properly.

**Hour Breakdown:**

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

**Prerequisite:** Instructor approved

**Student Learning Outcomes**

**Students will be able to:**

1. Demonstrate the basic techniques of soldering and safety precautions as it relates to soldering.
2. Attain and apply common knowledge of soldering alloys, including but not limited to lead- free solders.
3. Upon successful completion of the course, students will have the opportunity to sit for the IPS JSTD-001 Soldering Certification exam.
4. Recognize common types of non-threaded and threaded fasteners and their application.
5. Understand and apply common terminology related to screw threads.

**Course Number and Name:** MST 1723 Workplace Communications

**Description:** This course addresses communication in everyday life written, verbal, and non-verbal.

**Hour Breakdown:**

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

**Prerequisite:** Instructor approved

**Student Learning Outcomes**

**Students will be able to:**

1. Identify the student's behavior style and how to recognize other behavior styles.
2. Use effective grammar, punctuation, vocabulary and editing skills.
3. Compose effective oral, written, and electronic communications in a business environment.
4. Organize and compose effective oral communications.
5. Identify how to effectively communicate with others in the workplace.



**Course Number and Name:** MST 2223 Inventory Control

**Description:** This course is designed to introduce the concepts of managing an inventory, including elements of shipping and receiving.

**Hour Breakdown:**

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

**Prerequisite:** Instructor approved

**Student Learning Outcomes**

**Students will be able to:**

1. Describe the elements used in the process of shipping and receiving inventory.
2. Discuss the purpose of inventory.
3. Describe the types of inventory identification.
4. Describe the types of inventory control and management.

## APPENDIX A: RECOMMENDED TOOLS AND EQUIPMENT

The recommended tools and equipment for the Millwright options can be found in the following documents on the Mississippi Community College Board website: <http://www.mccb.edu/OCI/currdownload.aspx>

- Precision Manufacturing and Machining Technology (CIP 48.0501)
- Industrial Technology Cluster (CIP 15.1501, CIP 47.0303, CIP 14.4201, CIP15.0499)
- Electrical Technology (CIP 46.0302)
- Industrial Electronics Engineering Technology (CIP 47.0105)

## APPENDIX B: CURRICULUM DEFINITIONS AND TERMS

- Course Name – A common name that will be used by all community colleges in reporting students
- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students
- Classification – Courses may be classified as the following:
  - Career Certificate Required Course – A required course for all students completing a career certificate.
  - Technical Certificate Required Course – A required course for all students completing a technical certificate.
  - Technical Elective – Elective courses that are available for colleges to offer to students.
- Description – A short narrative that includes the major purpose(s) of the course
- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course
- Corequisites – A listing of courses that may be taken while enrolled in the course
- Student Learning Outcomes – A listing of the student outcomes (major concepts and performances) that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
  - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
  - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
  - Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs
  - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas
- Sequencing of the course within a program is left to the discretion of the local college. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors. Programs that offer an Associate of Applied Science Degree must include all of the required Career Certificate courses, Technical Certificate courses **AND** a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college

specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college.

- In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:
  - Adding new student learning outcomes to complement the existing competencies and suggested objectives in the program framework
  - Revising or extending the student learning outcomes
  - Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)

## APPENDIX C: RECOMMENDED TEXTBOOK LIST

The recommended textbook list for the Millwright options can be found in the following documents on the Mississippi Community College Board website: <http://www.mccb.edu/OCI/currdownload.aspx>

- Precision Manufacturing and Machining Technology (CIP 48.0501)
- Carpentry Technology (CIP 46.0201)
- Industrial Technology Cluster (CIP 15.1501, CIP 47.0303, CIP47.0303, CIP 14.4201, CIP15.0499)  
Electrical Technology (CIP 46.0302)
- Industrial Electronics Engineering Technology (CIP 47.0105)

<b>Recommended Millwright Text Book List</b> <b>CIP: 48.9999- Millwright</b>		
<b>Book Title</b>	<b>Author (s)</b>	<b>ISBN</b>
OSHA General Industry Regulations 29 CFR 1910	Mancomm Inc	978-1599598796
Industrial Maintenance and Mechatronics	Shawn A. Ballee & Gary R. Shearer	978-1635634273
Leadership	Peter Northouse	978-1506362311
Communication in Everyday Life	Steve Duck & David T. McMahan	978-1506315164
Essentials of Inventory Management	Max Muller	978-0814416556
IPC J-STD-001	Association Connection Electronic Industries	978-1611933352

## APPENDIX D: MANUFACTURING TECHNOLOGY NIMS CERTIFICATION MAPPING

<b>Manufacturing Technology NIMS Certification Mapping 48.9999</b>	
	<b>NIMS Machining Level 1: Measurement, Materials, and Safety</b>
<b>MST 1313: Machine Tool Math</b>	<b>Applied Mathematics</b>
<ol style="list-style-type: none"> <li><b>1. Solve mathematical problems relating to machine tool activities</b> <ol style="list-style-type: none"> <li><b>a. Set up formulas, and solve reading problems</b></li> <li><b>b. Transpose components of algebraic formulas</b></li> </ol> </li> <li><b>2. Describe and apply trigonometric functions</b> <ol style="list-style-type: none"> <li><b>a. Describe the trigonometric functions, and state their relationship to the sides and angles of a triangle</b></li> <li><b>b. Use the trigonometric functions to solve for unknown sides and angles of a triangle</b></li> </ol> </li> <li><b>3. Identify properties of a circle, and solve mathematical problems relating to the properties, and calculate area and volume for geometric objects</b> <ol style="list-style-type: none"> <li><b>a. Identify the properties of a circle, and solve problems relating to these properties</b></li> </ol> </li> </ol>	<p>Arithmetic, Pythagorean Theorem, Right Angle Trigonometry, Use of Scientific Calculator</p>

<ul style="list-style-type: none"> <li>b. Calculate area and volume for various geometrically shaped objects</li> </ul>	
<b>MST 1613: Precision Layout</b>	<b>Filing</b>
<ul style="list-style-type: none"> <li>1. Identify precision layout instruments               <ul style="list-style-type: none"> <li>a. Describe the use of instruments used for precision layout</li> </ul> </li> </ul>	File Maintenance, File Selection, File Types, Filing Techniques
<b>MST 1523: Industrial Hand Tools</b>	
<ul style="list-style-type: none"> <li>1. Identify, select, apply, and maintain common hand tools used by industrial maintenance mechanics and technicians</li> <li>2. Identify, select, apply and maintain drilling, cutting, and threading tools, including sharpening drill and cutting bits</li> </ul>	
<b>MST 1613: Precision Layout</b>	<b>Fits</b>
<ul style="list-style-type: none"> <li>1. Perform precision layout safely               <ul style="list-style-type: none"> <li>a. Explain the steps in layout</li> <li>b. Perform a precision layout to specification and tolerances</li> </ul> </li> </ul>	ANSI Standard Fit Symbols, Classes of Fits
<b>MST 1412: Blueprint Reading</b>	
<ul style="list-style-type: none"> <li>1. Identify, describe, and apply dimensions and tolerances               <ul style="list-style-type: none"> <li>a. Identify, describe, and apply industrial methods for showing dimensions and tolerances</li> <li>b. Describe and apply the International Systems</li> </ul> </li> </ul>	

<p>of Units (SI) as used in plans</p> <p>c. Describe and apply the need for metric dimensioning</p> <p>d. Describe and apply specifications found on plans</p>	
<b>MST 2714: CNC I</b>	
<p>1. Identify, describe, and apply dimensions and tolerances</p> <p>a. Identify, describe, and apply industrial methods for showing dimensions and tolerances</p> <p>b. Describe and apply the International Systems of Units (SI) as used in plans</p> <p>c. Describe and apply the need for metric dimensioning</p> <p>d. Describe and apply specifications found on plans</p> <p>2. Identify, describe, and apply auxiliary vies, finishes, materials, section lines, and cutting plane lines.</p> <p>a. Identify, distinguish, and apply primary and secondary auxiliary views on a drawing</p> <p>b. Identify, describe and apply surface finishes shown on a plan</p> <p>c. Identify materials used as indicated by section</p>	



lines, and demonstrated correct selection d. Describe and apply the use of cutting plane line	
<b>MST 1613: Precision Layout</b>	<b>Geometrical Dimensioning and Tolerancing</b>
2. Perform precision layout safely a. Explain the steps in layout b. Perform a precision layout to specification and tolerances	Feature Control Frame, Geometric Control Symbols, Geometric Tolerancing Categories, Geometric Tolerancing Characteristics, Geometric Tolerancing Zone Shapes, Symbols Associated with Feature Control Frames
<b>ENT 2263: Quality Assurance</b>	<b>Inspection</b>
1. Effective use sampling techniques a. Describe the process of random sampling as applied to quality assurance b. Compare single and multiple sampling plans c. Describe the characteristics of the sampling plans	Gage Block Assembly, Sampling Procedure
<b>EET 1154: Equipment Maintenance, Troubleshooting, and Repair</b>	<b>Machine Maintenance</b>
1. Discuss and apply proper safety procedures regarding maintenance, troubleshooting, and repair of equipment 2. Perform preventative maintenance on equipment a. Develop a preventative maintenance program for a given piece of equipment	Coolants, Oils and Lubricants, Refractometer Readings

<ul style="list-style-type: none"> <li>b. Inspect and adjust belts, chains, and other moving parts</li> <li>c. Lubricate a machine following manufacturers recommendations</li> </ul> <p><b>3. Troubleshoot and repair equipment</b></p> <ul style="list-style-type: none"> <li>a. Identify symptoms that indicate a machine is not operating properly</li> <li>b. Determine the cause of the symptoms</li> <li>c. Inspect machinery for broke or worn parts, and determine if replacement is needed</li> <li>d. Prepare a report on time and costs involved in repairing equipment</li> <li>e. Perform lockout-tagout procedures for broken equipment</li> <li>f. Disassemble, inspect, repair, and reassemble equipment to specifications</li> <li>g. Perform preventative maintenance on an electric motor</li> <li>h. Check and service a battery, including recharging</li> </ul>	
<b>MST 1523: Industrial Hand Tools</b>	
<p><b>1. Identify the characteristics of, and select lubricants for, maintenance and of mechanical components</b></p>	

<b>EET 1154: Equipment Maintenance, Troubleshooting, and Repair</b>	<b>Machine Safety</b>
<b>1. Discuss and apply proper safety procedures regarding maintenance, troubleshooting, and repair of equipment</b>	Machine Guarding
<b>MST 1523: Industrial Hand Tools</b>	
<b>1. Discuss and apply proper safety procedures for hand tools and mechanical components (OSHA-10)</b>	
<b>ENT 1153: Basic Application of Industrial Safety</b>	
<b>1. Upon completion of this course the student will demonstrate the ability to reference 29 CFR 1910 General Industry Standards</b> <b>2. State effective hazard recognition practices in accordance with 29 CFR 1910 General Industry Standards</b> <b>3. Demonstrate the ability to use the OSHA website to reference safety materials</b> <b>4. Translate complex OSHA standard verbiage into common speech for dissemination to employees</b> <b>5. Write an effective OSHA inspectable program</b>	
<b>MST 2714: CNC I</b>	<b>Machining Applications</b>
<b>1. Describe CNC machining and uses, and applications of CNC Program</b> <b>2. List and describe commands for CNC machine codes</b>	Drilling, Pocket Milling, Reaming, Tapping

3. Describe and select tooling for CNC operations and use CNC mills, CNC lathes, and CNC machining centers to project specifications	
<b>MST 1523: Industrial Hand Tools</b>	
1. Identify, select, apply, and maintain drilling, cutting, and threading tools, including sharpening drill and cutting bits	
<b>MST 1412: Blueprint Reading</b>	<b>Materials</b>
3. Identify, describe, and apply dimensions and tolerances <ul style="list-style-type: none"> <li>a. Identify, describe, and apply industrial methods for showing dimensions and tolerances</li> <li>b. Describe and apply the International Systems of Units (SI) as used in plans</li> <li>c. Describe and apply the need for metric dimensioning</li> <li>d. Describe and apply specifications found on plans</li> </ul> 4. Identify, describe, and apply auxiliary vies, finishes, materials, section lines, and cutting plane lines. <ul style="list-style-type: none"> <li>a. Identify, distinguish, and apply primary and secondary auxiliary views on a drawing</li> </ul>	Standard Steel Classification, Standard Steel Numbering System (AISI/SAE)

<ul style="list-style-type: none"> <li>b. Identify, describe and apply surface finishes shown on a plan</li> <li>c. Identify materials used as indicated by section lines, and demonstrated correct selection</li> <li>d. Describe and apply the use of cutting plane line</li> </ul>	
<b>MST 1613: Precision Layout</b>	<b>Measurements</b>
<ul style="list-style-type: none"> <li>3. Identify precision layout instruments <ul style="list-style-type: none"> <li>a. Describe the use of instruments used for precision layout</li> <li>b. Explain upkeep and preventative maintenance</li> </ul> </li> </ul>	Reading Micrometers, Reading Steel Rule, Reading Vernier Scales
<b>IMM 1935: Manufacturing Basic Skills</b>	
<ul style="list-style-type: none"> <li>1. Each student will master the following course competencies: <ul style="list-style-type: none"> <li>a. Identify, select, apply, and maintain common precision instruments such as calipers and micrometers</li> <li>b. Identify, select, apply, and maintain quality tools within a manufacturing environment</li> </ul> </li> </ul>	
<b>MST 1412: Blueprint Reading</b>	<b>Print Reading</b>
<ul style="list-style-type: none"> <li>5. Identify, describe, and apply dimensions and tolerances <ul style="list-style-type: none"> <li>a. Identify, describe, and apply industrial methods for showing</li> </ul> </li> </ul>	Block Tolerances, Line Types and Conventions, Orthographic Projection, Surface Finish Requirements, Title Blocks and Revisions

<p>dimensions and tolerances</p> <p>b. Describe and apply the International Systems of Units (SI) as used in plans</p> <p>c. Describe and apply the need for metric dimensioning</p> <p>d. Describe and apply specifications found on plans</p> <p>6. Identify, describe, and apply auxiliary views, finishes, materials, section lines, and cutting plane lines.</p> <p>a. Identify, distinguish, and apply primary and secondary auxiliary views on a drawing</p> <p>b. Identify, describe and apply surface finishes shown on a plan</p> <p>c. Identify materials used as indicated by section lines, and demonstrated correct selection</p> <p>d. Describe and apply the use of cutting plane line</p>	
<b>IMM 1935: Manufacturing Basic Skills</b>	
<p>1. Each student will master the following course competencies</p> <p>a. Read and interpret blueprints</p>	
<b>MST 1613: Precision Layout</b>	<b>Shop Safety</b>
<p>1. Discuss and apply general machine shop safety</p>	<p>Blood Born Pathogen, Fire Prevention/Suppression, Hazardous Material Information</p>

<ul style="list-style-type: none"> <li><b>a. Identify, discuss, and test safety procedures</b></li> <li><b>b. Demonstrate Safety Procedures</b></li> </ul>	System (HMIS), Lock Out/Tag Out, Means of Egress (Evacuation), Personal Protective Equipment (PPE), Safety Data Sheets (SDS), Waste Removal
<b>EET 1154: Equipment Maintenance, Troubleshooting, and Repair</b>	
<ul style="list-style-type: none"> <li><b>1. Discuss and apply proper safety procedures regarding maintenance, troubleshooting, and repair of equipment</b></li> <li><b>2. Troubleshoot and repair equipment</b> <ul style="list-style-type: none"> <li><b>a. Identify symptoms that indicate a machine is not operating properly</b></li> <li><b>b. Determine the cause of the symptoms</b></li> <li><b>c. Inspect machinery for broke or worn parts, and determine if replacement is needed</b></li> <li><b>d. Prepare a report on time and costs involved in repairing equipment</b></li> <li><b>e. Perform lockout-tagout procedures for broken equipment</b></li> <li><b>f. Disassemble, inspect, repair, and reassemble equipment to specifications</b></li> <li><b>g. Perform preventative maintenance on an electric motor</b></li> </ul> </li> </ul>	

<b>h. Check and service a battery, including recharging</b>	
<b>MST 1523: Industrial Hand Tools</b>	
<b>1. Discuss and apply proper safety procedures for hand tools and mechanical components (OSHA-10)</b>	
<b>ENT 1153: Basic Application of Industrial Safety</b>	
<b>1. Upon completion of this course the student will demonstrate the ability to reference 29 CFR 1910 General Industry Standards</b> <b>2. State effective hazard recognition practices in accordance with 29 CFR 1910 General Industry Standards</b> <b>3. Demonstrate the ability to use the OSHA website to reference safety materials</b> <b>4. Translate complex OSHA standard verbiage into common speech for dissemination to employees</b> <b>5. Write an effective OSHA inspectable program</b>	