



## Scope and Sequence Curriculum Outline

**Career Program:** Precision Machine Technology I

**DOE Code:** 5782

**Career Cluster:** Transportation

**Recommended Grade Levels:** 11, 12

**Prerequisites:** None

**High School Credits:** 3 per semester (6 total per school year)

**Additional Information:** Counts as a Directed Elective or Elective for the General, Core 40, Academic Honors and Technical Honors diplomas

**Program Description:** Precision Machining I is designed to provide students with a basic understanding of the precision machining processes used in industry, manufacturing, maintenance, and repair. The program provides instruction and laboratory experience in industrial safety, terminology, tools and machine tools, measurement, and layout. Students will become familiar with print reading and with the setup and operation of power saws, drill presses, lathes, milling machines, grinders. Students will also be exposed to an introduction to CNC (computer controlled) machines.

**Alignment:** Indiana Department of Education Academic Standards Course Framework; *Tooling U* (SME) competency-based framework and online system; NIMS (National Institute for Metalworking Skills) certification standards; Vincennes University (dual credit agreement)

**Companion Documents:** WCC Precision Machine Technology I Program Syllabus; WCC High School Pathway Plan; WCC Program Description Guide

### Curriculum Content Summary:

- Project Planning and Management
- Tools and Processes
- Quality Process Control and Inspection
- General Maintenance
- Industrial Safety and Environmental Protection
- Written and Oral Communications
- Mathematics
- Engineering Drawings and Sketches
- Measurement
- Metalworking Theory
- Personal/Professional Development and Employment Relations

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<p><b>DOMAIN</b> Project Planning and Management</p> <p><b>Core Standard I</b> Students develop skills for project and job planning to ensure quality parts creation</p>	<p><b>PMI-1.1</b> Demonstrate job process planning</p> <p><b>PMI-1.2</b> Examine basic problem solving</p> <p><b>PMI-1.3</b> Assess basic decision making rules</p>	<ul style="list-style-type: none"> <li>• Define machine tools and their operations</li> <li>• Understand machine tool order of operations</li> <li>• Interpret part blue prints and sketches to manufacture parts</li> <li>• Understand tolerances and proper measuring tools</li> <li>• Utilize and maintain precision measuring tools</li> <li>• Utilize mathematic formulas for cutting speeds and feeds</li> <li>• Locate and utilize information form the "Machinist Handbook"</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling "U" online instruction</li> <li>• Part inspections utilizing precision measuring tools</li> <li>• Create part process plans</li> <li>• Bench layout using the surface plate and height gauges</li> <li>• Pick proper tooling</li> </ul>	<p>2 weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling "U" certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> Tools and Processes</p> <p><b>Core Standard 2</b> Students apply and adapt basic hand and machine tool processes to create machined parts per industry specifications</p>	<p><b>PMI-2.1</b> Perform basic bench work</p> <p><b>PMI-2.2</b> Demonstrate basic layout procedures</p> <p><b>PMI-2.3</b> Perform turning operations</p> <p><b>PMI-2.5</b> Perform basic milling operations</p> <p><b>PMI-2.6</b> Demonstrate proper grinding wheel safety</p> <p><b>PMI-2.7</b> Perform surface grinding operations</p> <p><b>PMI-2.8</b> Perform basic drill press operations</p> <p><b>PMI-2.9</b> Develop basic CNC programming/ operations</p>	<ul style="list-style-type: none"> <li>• Identify different hand tools and their uses</li> <li>• Define precision layout tools</li> <li>• Describe and setup milling operations</li> <li>• Describe and setup lathe operations</li> <li>• Describe and setup surface grinding operations</li> <li>• Describe and setup drill press operations</li> <li>• Understand the advantages and disadvantages of CNC</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Layout parts with surface plate, height gauges and squares</li> <li>• Set up mills, lathes and surface grinders</li> <li>• Face mill, side mill</li> <li>• Mill slots, bore diameters and tap parts</li> <li>• Mill parts square and parallel</li> <li>• Turn, face, groove, thread, bore on the engine lathe</li> <li>• Chuck parts with 3 jaw, 4 jaw</li> <li>• Turn between centers</li> <li>• Pick when it is appropriate to use CNC equipment verses conventional machine tools</li> </ul>	<p>14weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> Quality Process Control and Inspection</p> <p><b>Core Standard 3</b> Students analyze processes and finished products to ensure compliance with job specifications</p>	<p><b>PMI-3.1</b> Evaluate proper piece part inspection procedures</p> <p><b>PMI-3.2</b> Recognize and explain control and improvement processes</p>	<ul style="list-style-type: none"> <li>• Understand concepts of geometric tolerance</li> <li>• Correlate blueprint dimensions to actual part dimensions</li> <li>• Pick proper measuring tools based on part tolerance</li> <li>• Arrange the order of operations to achieve a quality part</li> <li>• Troubleshoot surface finish problems</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Measure outside diameters and lengths with micrometers, dial calipers, height gauges, dial indicators, etc.</li> <li>• Adjust speed and feeds of cutting tools to maintain required surface finishes</li> <li>• Measure inside diameters with small hole gauges, telescope gauges and dial bore gauges</li> <li>• Measure screw threads with screw pitch gauges, thread pitch micrometers and thread wires</li> </ul>	<p>2 weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> General Maintenance</p> <p><b>Core Standard 4</b> Students Integrate preventive maintenance schedules and tasks to ensure safe and accurate equipment upkeep</p>	<p><b>PMI-4.1</b> Demonstrate general housekeeping and maintenance tasks</p> <p><b>PMI-4.2</b> Identify routine preventive maintenance tasks</p> <p><b>PMI-4.3</b> Recognize tooling maintenance procedures</p>	<ul style="list-style-type: none"> <li>• Maintain machine tools</li> <li>• Clean machine tools</li> <li>• Sharpen tools</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Clean machine tools daily after use</li> <li>• Lubricate machines as required in machine maintenance manuals</li> <li>• Replace and or sharpen cutting tools</li> <li>• Replace inserts in cutting tools</li> </ul>	<p>1 week</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> Industrial Safety and Environmental Protection</p> <p><b>Core Standard 5</b> Students apply concepts of industrial safety and recycling to meet industry and governmental environmental protection regulations and standards</p>	<p><b>PMI-5.1</b> Evaluate machine operations and material handling safety procedures</p> <p><b>PMI-5.2</b> Assess hazardous materials handling and disposal processes</p> <p><b>PMI-5.3</b> Implement recycling of materials and environmental protection measures</p>	<ul style="list-style-type: none"> <li>• Identify machine specific safety hazards</li> <li>• Understand and utilize SDS sheets</li> <li>• Maintain coolant systems</li> <li>• Maintain equipment guarding</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Wear appropriate safety equipment for the current task</li> <li>• Check coolant concentration and add water or coolant to desired levels</li> <li>• Clean and replace coolant, while properly disposing of old coolant</li> <li>• Inventor chemicals and store them in the proper locations</li> </ul>	<p>2 weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> Written and Oral Communications</p> <p><b>Core Standard 6</b> Students communicate using appropriate subject terminology and definitions both in writing and speaking to ensure the accurate reflection of ideas</p>	<p><b>PMI-6.1</b> Demonstrate technical reading skills</p> <p><b>PMI-6.2</b> Develop writing skills for a technical field</p> <p><b>PMI-6.3</b> Utilize proper speaking in an industrial environment</p> <p><b>PMI-6.4</b> Exercise effective listening skills</p>	<ul style="list-style-type: none"> <li>• Locate formulas and data</li> <li>• Develop process sheets</li> <li>• Communicate machining problems to peers and instructor</li> <li>• Understand instruction by lectures</li> <li>• Identify tools by their proper name</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Calculate formulas for feeds and speeds using data from the machinist’s handbook</li> <li>• Read machine manuals and schematics to repair machines</li> <li>• Write set up sheets for CNC programs</li> <li>• Write process sheets prior to machining</li> <li>• Follow directions from process and set up sheets</li> </ul>	<p>1 week</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> Mathematics</p> <p><b>Core Standard 7</b> Students select appropriate mathematical functions to perform various machining processes</p>	<p><b>PMI-7.1</b> Implement basic geometry applications in product design</p> <p><b>PMI-7.2</b> Select appropriate algebraic operations in product design and creation process</p> <p><b>PMI-7.3</b> Perform trigonometry functions as appropriate</p> <p><b>PMI-7.4</b> Study applied statistics</p>	<ul style="list-style-type: none"> <li>• Understand Geometric Dimensioning and Tolerance. (G.D.&amp;T)</li> <li>• Calculate algebraic formulas</li> <li>• Calculate Trigonometry formulas</li> <li>• Calculate thread dimensions</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Inspect using parts utilizing G.D.&amp;T standards</li> <li>• Calculate speeds and feeds</li> <li>• Calculate sine bar stack ups</li> <li>• Calculate radii to angle tangent points in programing</li> <li>• Calculate thread major, pitch and minor diameters</li> <li>• Calculate theoretical surface finish based on federate and cutter diameter</li> </ul>	<p>2 Weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>



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<p><b>DOMAIN</b> Engineering Drawings and Sketches</p> <p><b>Core Standard 8</b> Students draw sketches and interpret engineering drawings to determine product dimensions and specifications</p>	<p><b>PMI-8.1</b> Examine and comprehend standard orthographic prints</p> <p><b>PMI-8.2</b> Examine and comprehend standard GD&amp;T orthographic prints</p> <p><b>PMI-8.3</b> Identify and utilize GD&amp;T datum, symbology and tolerances</p>	<ul style="list-style-type: none"> <li>• Obtain information from prints to manufacture or repair parts</li> <li>• Create blue print dimensions</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Machine projects utilizing the information obtained from blueprints</li> <li>• Inspect parts from the information found on blueprints</li> </ul>	<p>2 weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> Measurement</p> <p><b>Core Standard 9</b> Students validate the proper use of precision measuring and layout instruments and inspection processes to ensure the quality of the finished product</p>	<p><b>PMI-9.1</b> Differentiate between basic measuring instruments</p> <p><b>PMI-9.2</b> Compare various precision measuring instruments</p> <p><b>PMI-9.3</b> Recognize basic surface plate instruments</p> <p><b>PMI-9.4</b> Convert metric measurements and dimensions to inches</p>	<ul style="list-style-type: none"> <li>• Identify measuring tools and their use</li> <li>• Pick the proper measuring tools for the applicable tolerance</li> <li>• Identify and use basic surface plate instruments</li> <li>• Using the correct formula to convert millimeters to inches and inches to millimeters</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Pick the proper tools to measure diameters, lengths, threads, parallelism and perpendicularity</li> <li>• Use the surface plate and with height gages to inspect parts</li> <li>• Use the surface plate and accessories to perform precision layout on work pieces</li> <li>• Convert metric blue print to inch measuring</li> </ul>	<p>3 weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> Metalworking Theory</p> <p><b>Core Standard 10</b> Students examine material properties and tooling processes to create finished products</p>	<p><b>PMI-10.1</b> Explain cutting theory concepts</p> <p><b>PMI-10.2</b> Identify appropriate tooling processes per product specifications</p> <p><b>PMI-10.3</b> Evaluate the properties of various metals</p> <p><b>PMI-10.4</b> Select appropriate machine tools for job completion</p> <p><b>PMI-10.5</b> Examine the role of cutting fluids and coolants in the machining process</p>	<ul style="list-style-type: none"> <li>• Understand composition of metals</li> <li>• Understand difference between base elements verses alloys</li> <li>• Understand the heat treating process</li> <li>• Evaluate tolerances and machine features to select appropriate machine tool</li> <li>• Understand coolant types and their uses in different machining operations and materials</li> </ul>	<ul style="list-style-type: none"> <li>• Tooling “U” online instruction</li> <li>• Set up mills, lathes and surface grinders</li> <li>• Face mill, side mill</li> <li>• Mill slots, bore diameters and tap parts</li> <li>• Mill parts square and parallel</li> <li>• Turn, face, groove, thread, bore on the engine lathe</li> <li>• Chuck parts with 3 jaw, 4 jaw</li> <li>• Turn between centers</li> <li>• Pick when it is appropriate to use CNC equipment verses conventional machine tools</li> </ul>	<p>5 Weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Tooling “U” certificates</li> <li>• NIMS certification</li> <li>• Dual credit</li> <li>• Weekly participation</li> </ul>

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<p><b>DOMAIN</b> Personal/Professional Development and Employment Relations</p> <p><b>Core Standard 11</b> Students establish a personal and professional development plan for their career</p>	<p><b>PMI-11.1</b> Create a continuing education plan that identifies the need for further education and training options</p> <p><b>PMI-11.2</b> Prepare for exams leading to certifications recognized by business and industry</p> <p><b>PMI-11.3</b> Develop skills needed to enter the workforce</p> <p><b>PMI-11.4</b> Evaluate resources that keep workers current in the career field</p> <p><b>PMI-11.5</b> Demonstrate skills and attitudes needed for lifelong learning</p> <p><b>PMI-11.6</b> Apply effective money management strategies</p> <p><b>PMI-11.7</b> Adopt career planning skills</p> <p><b>PMI-11.8</b> Create/complete job applications</p> <p><b>PMI-11.9</b> Construct successful resumes and cover letters</p> <p><b>PMI-11.10</b> Demonstrate effective interviewing skills</p> <p><b>PMI-11.11</b> Build teamwork and interpersonal relations</p> <p><b>PMI-11.12</b> Construct organizational structures and work relations</p> <p><b>PMI-11.13</b> Develop employment relations</p> <p><b>PMI-11.14</b> Comprehend and practice acceptable work place ethics and behavior</p> <p><b>PMI-11.15</b> Accept group participation and teamwork</p> <p><b>PMI-11.16</b> Evolve personal group leadership skills</p>	<ul style="list-style-type: none"> <li>• Present information for post-secondary training</li> <li>• Present information for apprenticeships</li> <li>• Identify certification programs</li> <li>• Obtain college credit</li> <li>• Present trade publications</li> <li>• Student mock interviews</li> <li>• Researching the internet</li> <li>• Create resume</li> <li>• Work in groups</li> <li>• Develop work ethics</li> </ul>	<ul style="list-style-type: none"> <li>• Business field trips</li> <li>• College presentations</li> <li>• College field trips</li> <li>• School open house with employer visits</li> <li>• Create resumes with a cover letter</li> <li>• Employer presentations with salary advancement</li> <li>• Employer college assistance</li> <li>• Student ambassadors</li> <li>• NTHS</li> </ul>	<p>2 weeks</p> <p>Reinforced throughout the year</p>	<ul style="list-style-type: none"> <li>• Work Ethic Certification</li> <li>• Essential Skills Evaluation</li> <li>• Technical Skills Evaluation</li> </ul>