



## Scope and Sequence Curriculum Outline

**Career Program:** Precision Machine Technology II

**DOE Code:** 5784

**Career Cluster:** Transportation

**Recommended Grade Levels:** 12

**Prerequisites:** Precision Machine Technology I

**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 Machine Technology II is a more in-depth study of skills learned in Precision Machine Technology I, with a stronger focus in CNC setup, programming, and operation. Projects concentrate on precision set-up and inspection work as well as machine shop calculations. Students develop skills in advanced machining and measuring parts involving tighter tolerances and more complex geometry. Students completing this program generally continue their education at the postsecondary level in 2 and 4-year degree programs or begin their careers in machining companies. Students also enter apprenticeship programs for specific machining-related trades.

**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 II Program Syllabus; WCC High School Pathway Plan; WCC Program Description Guide

### Curriculum Content Summary:

- Project Planning and Management
- Job Execution
- 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 apply and adapt skills for project and job planning to ensure quality parts creation</p>	<p><b>PMII-1.1</b> Employ job process planning</p> <p><b>PMII-1.2</b> Apply basic problem solving to projects</p> <p><b>PMII-1.3</b> Follow 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<p><b>DOMAIN</b> Job Execution</p> <p><b>Core Standard 2</b> Students apply hand and machine tool processes to create machined parts per industry specifications</p>	<p><b>PMII-2.1</b> Perform advanced benchwork</p> <p><b>PMII-2.2</b> Demonstrate precision layout procedures</p> <p><b>PMII-2.3</b> Perform advanced turning operations</p> <p><b>PMII-2.4</b> Perform advanced milling operations</p> <p><b>PMII-2.5</b> Demonstrate proper grinding wheel safety</p> <p><b>PMII-2.6</b> Perform precision surface grinding operations</p> <p><b>PMII-2.7</b> Perform drill press setup operations</p> <p><b>PMII-2.8</b> Utilize CNC programming and machine tools to perform complex machining tasks</p> <p><b>PMII-2.9</b> Perform advanced benchwork</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> <li>• Develop CNC mill and lathe programs.</li> <li>• Set-up CNC mill and lathe</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>15 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<p><b>DOMAIN</b> Quality Process Control and Inspection</p> <p><b>Core Standard 3</b> Students assess quality control and inspection processes to ensure compliance with industry and national standards</p>	<p><b>PMII-3.1</b> Perform proper piece part inspection and documentation</p> <p><b>PMII-3.2</b> Critique process control and improvement procedures</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>• 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<p><b>DOMAIN</b> General Maintenance</p> <p><b>Core Standard 4</b> Students integrate preventive maintenance schedules and tasks into daily class activities to ensure safe and accurate equipment usage</p>	<p><b>PMII-4.1</b> Demonstrate general housekeeping and maintenance procedures</p> <p><b>PMII-4.2</b> Perform preventive maintenance tasks</p> <p><b>PMII-4.3</b> Perform tooling maintenance tasks</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>• 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<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>PMII-5.1</b> Assess machine operations and material handling safety procedures</p> <p><b>PMII-5.2</b> Distinguish hazardous materials handling and disposal procedures for specific materials</p> <p><b>PMII-5.3</b> Implement appropriate 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>• 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<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>PMII-6.1</b> Interpret written technical instructions</p> <p><b>PMII-6.2</b> Create technical specifications documents</p> <p><b>PMII-6.3</b> Utilize appropriate industry language in all communications</p> <p><b>PMII-6.4</b> Utilize 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>• 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<p><b>DOMAIN</b> Mathematics</p> <p><b>Core Standard 7</b> Students select appropriate mathematical functions needed to perform various machining processes</p>	<p><b>PMII-7.1</b> Perform advanced arithmetic operations</p> <p><b>PMII-7.2</b> Solve product specification problems using geometric functions as appropriate</p> <p><b>PMII-7.3</b> Apply algebraic operations as appropriate in product design and creation</p> <p><b>PMII-7.4</b> Use applied trigonometry</p> <p><b>PMII-7.5</b> Research and apply 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>• 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>



Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<p><b>DOMAIN</b> Engineering Drawings and Sketches</p> <p><b>Core Standard 8</b> Students create products within specified dimensions</p>	<p><b>PMII-8.1</b> Interpret orthographic prints</p> <p><b>PMII-8.2</b> Work with/from standard GD&amp;T orthographic prints</p> <p><b>PMII-8.3</b> 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>• 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<p><b>DOMAIN</b> Measurement</p> <p><b>Core Standard 9</b> Students perform proper measurement procedures using appropriate instruments to ensure finished products meet given specifications</p>	<p><b>PMII-9.1</b> Select and use precision measuring instruments</p> <p><b>PMII-9.2</b> Use precision surface plate instruments</p> <p><b>PMII-9.3</b> Convert units of measurements and dimensions to other units</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>• 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<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>PMII-10.1</b> Utilize cutting theory</p> <p><b>PMII-10.2</b> Select and implement proper tooling processes</p> <p><b>PMII-10.3</b> Evaluate and select proper materials based on properties</p> <p><b>PMII-10.4</b> Examine the capabilities of machine tools</p> <p><b>PMII-10.5</b> Select proper cutting fluids and coolants for product creation</p>	<ul style="list-style-type: none"> <li>• Describe the composition of metals</li> <li>• Describe the difference between base elements verses alloys</li> <li>• Describe the heat treating process</li> <li>• Evaluate tolerances and machine features to select appropriate machine too</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>4 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>

Content	Indiana DOE Standards	Knowledge & Skills	Example Activities	Time Frame	Evaluation / Certification
<p><b>DOMAIN</b> Personal/Professional Development and Employment Relations</p> <p><b>Core Standard 11</b> Students establish personal and professional development plans to prepare for careers</p>	<p><b>PMI-11.1</b> Maintain 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> Strengthen 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> Strengthen skills and attitudes needed for lifelong learning</p> <p><b>PMI-11.6</b> Continually practice effective money management strategies</p> <p><b>PMI-11.7</b> Strengthen career planning skills</p> <p><b>PMI-11.8</b> Continually complete job applications</p> <p><b>PMI-11.9</b> Keep current resumes and cover letters</p> <p><b>PMII-11.10</b> Continually develop effective interviewing skills</p> <p><b>PMII-11.11</b> Build ongoing teamwork and interpersonal relations</p> <p><b>PMII-11.12</b> Maintain organizational structures and work relations</p> <p><b>PMII-11.13</b> Maintain proper employment relations</p> <p><b>PMII-11.14</b> Continually apply acceptable work place ethics and behavior</p> <p><b>PMII-11.15</b> Maintain group participation and teamwork</p> <p><b>PMII-11.16</b> Utilize 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 resumes</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>• Co-Op job</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>