

***CTE Standards Unpacking***  
***Advanced Machine Tool Technology***

**Course:** Advanced Machine Tool Technology

**Course Description:** Advanced Machine Tool Technology students will be introduced to advanced machining processes in the areas of safety, applied math skills and machining operations. The desire is for the student to use basic learned techniques from machine tool technology to obtain higher levels of competency through creation of projects to emulate industry needs.

**Career Cluster:** Manufacturing

**Prerequisites:** Algebra 1/Machine Tool Technology

**Program of Study Application:** Advanced Machine Tool Technology is the second pathway course in the Manufacturing cluster, Machining pathway. Machine tool technology is a prerequisite to the Advanced Machining course.

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| <b>INDICATOR #AMT 1: Demonstrate knowledge of safety and essential academic concepts in machine tool.</b>  |   |  |
| <b>SUB-INDICATOR 1.1 (Webb Level: 2 Skill/Concept):</b> Prove knowledge of shop operations and tool safety procedures consistent with Occupational Safety and Health Administration (OSHA) standards.  |   |  |
| <b>SUB-INDICATOR 1.2 (Webb Level: 2 Skill/Concept):</b> Apply advanced concepts, including machine tool mathematics, blueprint reading, science, and communications to machine tool processes.   |   |  |
| <b>SUB-INDICATOR 1.3 (Webb Level: 2 Skill/Concept):</b> Demonstrate and apply computer numerical control (CNC) programming concepts  |   |  |
| <b>Knowledge (Factual):</b><br>-Proper knowledge of machine operations<br><br>-Occupational Safety and Health Administration (OSHA)<br><br>-Advance CNC programming codes<br><br>-Basic trigonometry and geometry formulas that apply to machine tooling | <b>Understand (Conceptual):</b><br>-Usage of personal protective equipment<br><br>-Hazards in the machining lab<br><br>-Mathematical formulas for machine tooling<br><br>-Machine functions and uses<br><br>-Advance CNC code | <b>Do (Application):</b><br>-Interpreting measuring equipment<br><br>-Utilization of specific machining measuring equipment<br><br>-Conversions of fractions to decimals<br><br>-Calculate machining formulas<br><br>-Identify and differentiate line types and tolerances of views of blueprints<br>-Programming with |

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|  |   | <p>Advance CNC codes</p> <p>-Applying principles of trigonometry, cartesian geometry, and/or polar geometry, distinguishing when and which principle apply to a given machining task</p> <p>-Usage of personal protective equipment and machine tools</p> |
| <p><b>Benchmarks:</b><br/> <i>Students will be assessed on their ability to:</i></p> <ul style="list-style-type: none"> <li>• Demonstrate safe tool selection and properly utilize personal protective equipment</li> <li>• Determine and utilize appropriate math applications for the production of machine parts and completion of a manufactured part</li> <li>• Read and interpret blueprints to complete manufactured products</li> </ul>  |   |   |
| <p><b><i>Academic Connections</i></b></p>  |   |   |
| <p><b>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</b></p> <p>n-Cn.4 (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.</p> <p>G-MG.1 Modeling with Geometry Use geometric shapes, their measures, and their properties to describe objects</p> <p>PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system</p> | <p><b>Sample Performance Task Aligned to the Academic Standard(s):</b></p> <p>-Students will create points and coordinates for machining that coincide with blueprints</p> <p>-Students will identify geometric structures within the blueprint</p> <p>-Students will utilize mathematical relationships to identify net force on a machine system.</p> |   |

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| <p><b>INDICATOR #AMT 2: Demonstrate ability through research, development, and implementation to create a project</b></p>   |  |   |
| <p><b>SUB-INDICATOR 2.1 (Webb Level: 3 Strategic Thinking):</b> Design, analyze and create various types of projects utilizing previous knowledge and skills to manufacture a single or assembled project.</p>  |  |   |
| <p><b>SUB-INDICATOR 2.2 (Webb Level: 3 Strategic Thinking):</b> Evaluate and solve issues related to lathe and milling setups and operations.</p>   |  |   |
| <p><b>Knowledge (Factual):</b></p> <ul style="list-style-type: none"> <li>-Design loop</li> <li>-Material specifications</li> <li>-Material tolerances</li> <li>-Equipment parameters</li> <li>-Geometric dimensioning and tolerancing symbols and nomenclature</li> <li>-Machine tool terminology</li> <li>-Blueprint reading</li> <li>-Lathe and milling setup</li> </ul> | <p><b>Understand (Conceptual):</b></p> <ul style="list-style-type: none"> <li>-Effect of design loop process on final product</li> <li>-Impact of material specifications and tolerance in the design loop</li> <li>-Blueprint</li> <li>-Proper mathematical formulas in the design of a manufacturing product</li> <li>-Proper machine setup principles.</li> </ul> | <p><b>Do (Application):</b></p> <ul style="list-style-type: none"> <li>-Create accurate bill of materials</li> <li>-Dimension part specified by a drawing</li> <li>-Select proper tools to complete the required operations</li> <li>-Select proper materials</li> <li>-Analyze prototype</li> <li>-Make modifications to prototype</li> <li>-Complete late and milling setup per specifications</li> <li>-Troubleshoot machine tool process</li> <li>-Research applicability of chosen product per design requirements</li> <li>-Assess and evaluate machine tool process</li> </ul> |
| <p><b>Benchmarks:</b></p>   |  |   |

*Students will be assessed on their ability to:*

- Demonstrate and practice teamwork, problem-solving and decision-making skills in manufacturing environment through the completions of an end product
- Completions of end product with modifications as needed

**Academic Connections**

| <b>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</b>   | <b>Sample Performance Task Aligned to the Academic Standard(s):</b>                           |
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| S-IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. | -Students will analyze products to determine if product is in industry standard tolerances.   |
| G-MG.1 Modeling with Geometry Use geometric shapes, their measures, and their properties to describe objects  | -Students will use geometric principals to assist in designing final product with design loop |

**INDICATOR #AMT 3: Demonstrate ethical practices and research career pathways**

**SUB-INDICATOR 3.1 (Webb Level: 3 Strategic Thinking):** Identify and demonstrate professional practices used in the machine shop

**SUB-INDICATOR 3.2 (Webb Level: 4 Extended Thinking):** Evaluate and describe career exploration activities to follow for a minimum of two different career pathways.

| <b>Knowledge (Factual):</b>                          | <b>Understand (Conceptual):</b>                 | <b>Do (Application):</b>   |
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| -Career opportunities and pathways in manufacturing. | -Education needed for specific career           | -Research potential career interests for at least two different pathways               |
| -Appropriate apprenticeships                         | -Importance of Industry certification           | -Interview potential employers or post secondary program specialists                   |
| -Appropriate personal hygiene                        | -Potential job outlook based on location        | -Create Personal Learning Plan: <a href="http://www.sdmylife.com">www.sdmylife.com</a> |
| -Business policies and procedures/practices          | -Effect of personal appearance in the workplace | -Complete soft skills Assessment   |
|  | -Importance of business policies and company    |  |

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|   | handbooks   | <a href="http://www.keytrain.com/softskills.asp">http://www.keytrain.com/softskills.asp</a><br><br>-Interview local Human Resource officer |
| <p><b>Benchmarks:</b><br/> <i>Students will be assessed on their ability to:</i></p> <ul style="list-style-type: none"> <li>• Create a list of career opportunities that are linked to career match maker section of <a href="http://www.sdmylife.com">www.sdmylife.com</a></li> <li>• Presentation on career choice</li> <li>• Role play appropriate and inappropriate actions in the workplace</li> <li>• Present findings from interviewer</li> </ul>  |   |  |
| <p><b><i>Academic Connections</i></b></p>   |   |  |
| <p><b>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</b></p> <p>RI.7 Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem</p> <p>W.4 – Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience</p> <p>SL.2. Integrate multiple sources of information presented in diverse formats and media</p> <p>SL.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</p> | <p><b>Sample Performance Task Aligned to the Academic Standard(s):</b></p> <p>-Read technical publications</p> <p>-List of occupations</p> <p>-Through the interview process student will form a presentation on career choices.</p> <p>-Role play for interviewing for a job</p> |  |



### **Additional Resources**

Lake Area Tech (<https://www.lakeareatech.edu/>)

Mitchell Tech (<https://www.mitchelltech.edu/>)

Western Dakota Tech ( <https://www.wdt.edu/>)

South Dakota Industry

sources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.