Maryland CTE Programs of Study

Machining Technology III (2025)

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Introduction. 2

A **Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.** 2.A

B **The Advanced Manufacturing Career Cluster focuses on preparing students for entry-level, technical, and professional careers in various engineering and manufacturing fields.** 2.B

C **The Machining Technology Career and Technical Education (CTE) Program of Study prepares students for a beginning career in manufacturing and machine technologies and aligns to the National Institute of Metalworking Skills (NIMS) Machining Level I Credentials. Students will progress through a program that includes hands-on education in precision machining while developing competency in process control, manual operations, process adjustment, part inspection as well as demonstrate usage of machine safety.** 2.C

D **Machining Technology III prepares students for two NIMS Machining Level I credentials, selected by schools from options such as Manual Milling, Turning, Grinding, and Drilling. Building on prior courses, students develop skills in process planning, machine setup, and operation. They collaborate on projects, apply quality assurance practices, follow safety protocols, and interpret orthographic prints and job process sheets. When available, ToolingU is used to supplement instruction. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.** 2.D

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E **Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.** 2.E

Knowledge and Skills. 3

A **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:** 3.A

1 Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, and the maintenance of a clean and safe work environment. 3.A.1

2 Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn, especially in collaborative environments and technical problem-solving scenarios. 3.A.2

3 Employ effective reading, writing, and technical documentation skills in the context of process planning, setup sheets, and job instructions for machining operations. 3.A.3

4 Solve advanced machining-related problems using critical thinking techniques and structured troubleshooting methodologies, particularly during the setup, operation, and finishing of machining tasks. 3.A.4

5 Demonstrate leadership skills and collaborate effectively as a team member, offering ideas and feedback to improve machining processes and resolve technical issues. 3.A.5

6 Implement safety procedures in all aspects of machining, including the proper handling of machinery, tools, materials, and waste disposal, while adhering to industry safety guidelines. 3.A.6

7 Exhibit an understanding of legal and ethical responsibilities in the machining industry, following relevant laws, standards, and best practices in the production environment. 3.A.7

8 Demonstrate time-management skills and the ability to prioritize tasks in a busy technical setting, especially during multiple-machine operations and complex projects. 3.A.8

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B **The student identifies various career pathways in the machining and manufacturing fields. The student is expected to:** 3.B

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in machining operations and manufacturing. 3.B.1
2. Create a professional resume and portfolio that reflects skills in machining operations, process planning, machine setup, and successful project outcomes, including certifications such as NIMS Machining Level I. 3.B.2
3. Demonstrate effective interview skills for advanced roles in machining, manufacturing, and production planning, including discussing knowledge of industry-specific credentials and competencies. 3.B.3

C **The student develops technology and digital literacy skills. The student is expected to:** 3.C

1. Use technology as a tool for research, organization, communication, and problem-solving in machining operations, including digital tools for job planning and documentation. 3.C.1
2. Use digital tools, including computers, mobile devices, and collaboration platforms, to access, manage, and create information related to machining processes and project management. 3.C.2
3. Demonstrate proficiency in using industry-standard software tools, including Computer- Aided Design (CAD), Computer-Aided Manufacturing (CAM), and online learning management systems like ToolingU for continued learning and certification preparation. 3.C.3
4. Understand ethical and legal considerations for technology use, including principles of data protection, intellectual property, and responsible technology use in manufacturing environments. 3.C.4

D **The student integrates core academic skills into machining practices. The student is expected to:** 3.D

1. Demonstrate clear communication techniques, both written and verbal, consistent with industry standards, when preparing process plans, job instructions, and reports for machining tasks. 3.D.1
2. Apply mathematical concepts such as trigonometry, geometry, and advanced measurement techniques in process planning, machine setup, and quality control during machining operations. 3.D.2
3. Use scientific principles such as material properties, cutting tool dynamics, and thermal effects to understand and optimize machining processes like milling, turning, grinding, and drilling. 3.D.3

E **The student demonstrates the necessary skills to operate and set up advanced machining equipment. The student is expected to:** 3.E

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1. Identify and describe the functions of advanced machining equipment, including CNC and manual lathes, mills, surface grinders, and drilling machines. 3.E.1

2 Perform advanced machine setup for turning, milling, drilling, and grinding operations, ensuring accuracy in alignment, tool selection, and material preparation. 3.E.2

3 Demonstrate the ability to operate machines safely and efficiently, following standard operating procedures, and adjusting machine parameters as needed for specific operations. 3.E.3

4 Perform routine maintenance, tool changes, and adjustments on machines to ensure optimal performance and precision in machining operations. 3.E.4

F The student demonstrates the necessary skills in process planning and job setup for machining operations. The student is expected to: 3.F

1 Develop process plans for machining operations that outline step-by-step instructions, including material selection, tooling requirements, and machining methods for turning, milling, drilling, or grinding. 3.F.1

2 Read and interpret orthographic prints, job process sheets, and technical specifications to determine the correct approach to machining tasks and ensure dimensional accuracy. 3.F.2

3 Implement setup procedures for a variety of machining operations, adjusting for specific requirements such as part tolerances, cutting speeds, and tooling configurations. 3.F.3

4 Demonstrate proficiency in organizing and preparing materials, tools, and machines for specific jobs based on detailed plans and specifications. 3.F.4

G The student demonstrates the necessary skills to perform quality assurance in machining operations. The student is expected to: 3.G

1 Understand and apply basic quality control principles, including statistical process control (SPC), to monitor and adjust machining processes for consistent quality and precision. 3.G.1

2 Use precision measurement instruments, such as micrometers, calipers, height gauges, and CMMs, to inspect finished parts and ensure compliance with engineering specifications. 3.G.2

3 Perform inspection and testing of both single and multiple part production, identifying and correcting issues related to part defects, dimensional inaccuracy, and tooling wear. 3.G.3

4 Follow established procedures for documenting quality control results, process changes, and any corrective actions taken during machining operations. 3.G.4

H The student demonstrates the necessary skills for material handling and disposal in machining operations.. The student is expected to: 3.H

1 Identify and handle a variety of materials used in machining operations, including metals, alloys, and composites, ensuring that material properties are considered during planning and setup. 3.H.1

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2 Implement appropriate material handling techniques to ensure safety and efficiency, including the use of lifting equipment, storage methods, and transportation protocols. 3.H.2

3 Safely dispose of waste materials, including scrap, coolant, and hazardous materials, in accordance with environmental and safety regulations. 3.H.3

I The student demonstrates proficiency in preparing for the NIMS Machining Level I certifications in specific machining operations. The student is expected to: 3.I

1 Develop the skills and knowledge required to obtain NIMS Machining Level I certification in the selected areas, such as Manual Milling, Turning Operations Between Centers, Turning and Chucking, Grinding, or Drilling Operations. 3.I.1

2 Demonstrate competency in executing specific machining tasks with precision and following industry standards, preparing for certification testing. 3.I.2

3 Participate in simulations, practice tests, and hands-on activities to reinforce understanding of machining operations, safety procedures, and quality control for certification readiness. 3.I.3