Maryland CTE Programs of Study

Engineering I (2025)

General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successfully completing this course. 1

1 General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successfully completing this course. 1

Introduction. 2

A Career and Technical Education (CTE) 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 Cluster emphasizes developing a skilled workforce in manufacturing and engineering fields. This cluster prepares students for careers that involve designing, creating, and maintaining systems and processes in manufacturing, utilizing modern technologies and engineering principles. 2.B

C The Engineering program of study emphasizes careers and educational pathways related to the design, development, and optimization of engineering solutions and processes. This includes disciplines such as mechanical, electrical, civil, and industrial engineering. The Engineering program of study covers essential topics such as the engineering design process (emphasized across all projects), computational thinking, the relationship between engineering and society, materials science, manufacturing techniques, and systems analysis. Students will engage in projects that involve the iterative use of the engineering design process, computational problem-solving and critical thinking to address real-world challenges in engineering, preparing them for careers in various industries and equipping them with the skills needed to innovate and improve engineering solutions. Students will examine the societal impact of engineering decisions, understand the role of ethics in effective decision- making, and develop essential professional skills such as communication and technical writing. 2.C

D Engineering I introduces students to core engineering principles, focusing on the engineering design process as a central framework, computer-aided design (CAD) with Autodesk Inventor, materials science, and basic manufacturing. Through hands-on projects and real-world problem-solving, students gain CAD proficiency, explore engineering careers, apply computational thinking strategies, and build employability skills. The course integrates academic concepts into practical

Skip to main content

applications, preparing students for industry certifications like the Autodesk Certified User in Inventor. 2.D

E **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.E

F **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.F

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, maintenance of a clean and safe work environment, and pride in work. 3.A.1
2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn. 3.A.2
3. Employ effective reading, writing, and technical documentation skills. 3.A.3
4. Solve problems using critical thinking techniques and structured troubleshooting methodologies. 3.A.4
5. Demonstrate leadership skills and collaborate effectively as a team member. 3.A.5
6. Implement safety procedures, including proper handling of equipment and following engineering guidelines. 3.A.6
7. Exhibit an understanding of legal and ethical responsibilities in the engineering field, following intellectual property laws and best practices for engineering and design. 3.A.7
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting. 3.A.8
9. Engage in computational thinking by breaking down complex engineering problems, designing algorithms, and using logical reasoning to develop effective solutions. 3.A.9

B **The student identifies various career pathways in the engineering field. 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 engineering design. 3.B.1
2. Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations. 3.B.2
3. Demonstrate effective interview skills for roles in engineering and technology. 3.B.3

Skip to main content

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. 3.C.1
2. Use digital tools, including computers, mobile devices, collaboration platforms, and cloud services, to access, manage, and create information. 3.C.2
3. Demonstrate proficiency in using emerging and industry-standard technologies, including data visualization tools, CAD software, robotics and other hardware, and programming applications. 3.C.3
4. Understand ethical and legal considerations for technology use, including the principles of data protection, copyright, and responsible technology use. 3.C.4
5. Apply computational thinking skills, such as decomposition, pattern recognition, abstraction, and algorithmic thinking, to engineering-related challenges and digital problem-solving. 3.C.5

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

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards, such as the creation of engineering design briefs, portfolios, summaries, and/or reflections. 3.D.1
2. Apply mathematical concepts such as scale-drawing, isometric and geometric drawings, spatial recognition, and standard algebraic techniques. 3.D.2
3. Use scientific and mathematical principles and methods, including sustainability and scalability practices, to evaluate and develop engineering solutions to authentic problems. 3.D.3
4. Solve authentic engineering problems involving community stakeholders and create scalable and sustainable solutions 3.D.4
5. Analyze how engineering decisions impact society, considering ethical, environmental, and economic implications in the design and implementation of technology. 3.D.5

E **The student demonstrates the necessary skills to understand and operate engineering systems. The student is expected to:** 3.E

1. Identify and apply all phases of the Engineering Design Process (EDP)—including problem definition, research, brainstorming, prototyping, testing, and iteration—to develop effective solutions to engineering problems. 3.E.1
2. Identify and describe the functions of key engineering system components, including inputs, processes, and outputs. 3.E.2
3. Perform basic installation, configuration, and troubleshooting of engineering solutions in line with industry standards, including setting up design software, testing equipment, and machine tools. 3.E.3

Skip to main content

4 Demonstrate the ability to install and configure relevant software and firmware, focusing on updates, calibration, and compatibility testing for engineering systems. 3.E.4

5 Reflect on the effectiveness of design solutions using criteria and constraints, and revise designs using iterative improvements informed by testing data and stakeholder feedback. 3.E.5

F The student demonstrates the necessary skills to design, configure, and manage engineering systems and environments. The student is expected to: 3.F

1 Understand basic engineering principles such as force, motion, and energy, and apply this knowledge to system design and troubleshooting. 3.F.1

2 Configure and troubleshoot mechanical, electrical, and software systems used in engineering applications, adhering to safety standards and operational protocols. 3.F.2

3 Apply fundamental principles of engineering system security, including safety protocols, equipment safeguards, and ensuring system reliability through design. 3.F.3

4 Demonstrate the ability to set up and secure engineering environments, including laboratory setups, ensuring equipment safety, and applying industry best practices for efficient system performance. 3.F.4

5 Apply computational thinking to model, simulate, and evaluate engineering system behavior and performance using digital tools. 3.F.5

G The student demonstrates the necessary skills to implement fundamental engineering practices for protecting systems and data. The student is expected to: 3.G

1 Describe common risks and vulnerabilities in engineering solutions, including equipment failure, material degradation, and design flaws, and apply mitigation strategies. 3.G.1

2 Implement basic security measures for engineering solutions, such as physical safeguards for equipment, secure design protocols, and redundancy planning. 3.G.2

3 Demonstrate knowledge of access controls and system permissions for engineering software, design files, and collaborative platforms used in engineering projects. 3.G.3

4 Conduct basic risk assessments and apply strategies to prevent failures and ensure operational continuity in engineering solutions, using hazard analysis and fault tolerance methods. 3.G.4

H The student demonstrates the necessary skills to manage and troubleshoot engineering system issues in a professional environment. The student is expected to: 3.H

1 Identify and troubleshoot common engineering system issues (mechanical, electrical, software) using systematic diagnostic methods, including tests, simulations, and real-time observations. 3.H.1

Skip to main content

2 Document technical issues, troubleshooting steps, and solutions in professional reports, adhering to industry documentation practices such as technical drawings, schematic updates, and logbooks. 3.H.2

3 Demonstrate using technical support tools, such as diagnostic equipment (multimeters, oscilloscopes) and simulation software, to resolve engineering system issues. 3.H.3

4 Apply professional communication skills in troubleshooting and customer support scenarios, practicing clear reporting, teamwork, and problem-solving in an engineering context. 3.H.4

5 Incorporate iterative testing and evaluation as part of the engineering design process to refine and improve solutions to identified system issues. 3.H.5

I The student integrates core academic skills into engineering practice. The student is expected to: 3.I

1 Demonstrate clear communication techniques, both written and verbal, consistent with industry standards, including technical reports, presentations, and collaboration in team settings. 3.I.1

2 Apply mathematical concepts such as statistics, algebra, trigonometry, and calculus in system analysis, design, and troubleshooting. 3.I.2

3 Use scientific principles, such as thermodynamics, fluid dynamics, energy transfer, and materials science, to design, test, and optimize engineering solutions and components. 3.I.3

4 Evaluate the societal, environmental, and economic impacts of engineering innovations and decisions, using case studies and current events to analyze the broader consequences of engineering work. 3.I.4

5 Use engineering ethics to assess real-world design scenarios, emphasizing responsible decision-making in line with public welfare and sustainability. 3.I.5