Massachusetts CTE

Engineering Technology (2025)

Health & Safety Standards

1 **Safety and Health in an Engineering Technology Environment: Students will demonstrate the skills required to maintain a safe and healthy working environment in engineering technology settings, including the management of tools and equipment, proper use of personal protective equipment (PPE), and adherence to workspace ergonomics.** 1

- a Identify, describe, and demonstrate the effective use of Safety Data Sheets (SDS) to meet documentation requirements. 1.A
- b Locate emergency equipment, first aid kit, and emergency action and response plan, including labels and signage that follow OSHA Hazard Communication Program (HAZCOM). 1.B
- c Demonstrate safe dress and use of relevant safety gear, personal protective equipment (PPE), and jobsite ergonomics, e.g., safety equipment, gloves, proper footwear, knee pads, earplugs, eye protection and breathing apparatus. 1.C
- d Demonstrate safe body mechanics, including appropriate lifting techniques and ergonomics aimed at minimizing injury. 1.D
- e Describe procedures used to manage emergency situations, defensive measures, and accidents, including identification, reporting, response, evacuation plans, and follow-up procedures. 1.E
- f Identify and list contact information for appropriate health and safety agencies and resources. 1.F
- g Demonstrate safety practices and procedures to be followed when working with and around electricity, e.g., ground fault circuit interrupter (GFCI) and frayed wiring. 1.G
- h Identify, describe, and apply Environmental Protection Agency (EPA) and other environmental protection regulations that apply to specific tasks and jobs in the specific occupational area. 1.H
- i Demonstrate safe handling, storing, disposing of, and recycling hazardous, flammable, and combustible materials, according to EPA, OSHA, and product specifications. 1.I
- j Demonstrate the safe use, storage, and maintenance of equipment in the lab, shop, and classroom, e.g., the OSHA Lockout/Tagout Program (LOTO). 1.J

Skip to main content

k Demonstrate appropriate workspace cleaning, sanitation, disinfection, and sterilization procedures required in specific occupational areas, e.g., Workplace Housekeeping OSHA Regulations. 1.K

l Comply with appropriate fire protection regulations, local permit regulations, and state/federal regulations. 1.L

m Discuss ways to identify, prevent, and report school and workplace violence, discrimination, harassment, and bullying. 1.M

n Identify and describe potential consequences for non-compliance with appropriate health and safety regulations. 1.N

Technical & Integrated Academic Standards

2 **Role of Engineering Technology Professionals in Society: Students will be able to analyze the role of engineering technology professionals, evaluate the societal and environmental impacts of technological advancements, and explain how current engineering practices shape various disciplines.** 2

a Apply knowledge of Massachusetts General Laws and regulations to assess their impact on the professional engineering industry, including compliance requirements and licensing standards related to building design and engineering applications. 2.A

b Analyze how engineering innovations contribute to improving quality of life, such as advancements in healthcare technology, transportation infrastructure, and smart city developments. 2.B

c Evaluate the environmental impact of engineering practices by analyzing efforts to reduce carbon footprints, manage waste, and promote renewable energy sources, and examine how engineers integrate green technologies and sustainable practices into their designs, including eco-friendly building materials and energy-efficient systems. 2.C

3 **Fundamentals of Engineering: Students will be able to apply the engineering design process to solve problems by identifying needs, researching solutions, brainstorming ideas, developing, and testing prototypes, and refining designs.** 3

a Identify complex problems by assessing customer needs and reviewing related information to develop, evaluate options, and implement solutions. 3.A

b Conduct market research, gather customer feedback, and utilize various sources (such as patents and industry contacts) to inform the design process and develop justifications for engineering solutions. 3.B

c Generate innovative designs by collaborating in teams and utilizing brainstorming techniques. 3.C

d Identify and refine the most effective solution based on problem analysis. 3.D

e Maintain an engineering journal for projects to document design solutions. 3.E

f Apply CAD and drawing standards to create technical documentation using industry-recognized 2D and 3D design tools. 3.F

Skip to main content

g Utilize engineering notations and prefixes, e.g., tera, giga, mega, kilo, milli, micro, nano, and pico. 3.G

h Create preliminary hand or digital sketches and 3D models using CAD software to represent proposed solutions. 3.H

i Apply basic parametric modeling features, including sketches, constraints, dimensions, and extrusions, in CAD software to create functional parts. 3.I

j Establish evaluation criteria and identify any limitations or constraints for the project. 3.J

k Export digital models into fabrication-ready formats, e.g., STL, DXF, for 3D printing or CNC machining. 3.K

l Fabricate a prototype using hand tools, manual machine tools, CNC devices, joining processes, measuring, and cutting techniques. 3.L

m Demonstrate problem-solving, diagnostics, and troubleshooting skills by pinpointing specific issues within the system or design. 3.M

n Develop a testing protocol, test and evaluate the prototype, assess performance, and function, and refine and improve the design based upon results. 3.N

o Produce final drawing documentation, develop, and present a comprehensive presentation using various media formats (such as animation, presentation software, and web pages), and pursue patenting, marketing, and selling the idea. 3.O

p Use spreadsheet software, e.g., Excel, to analyze design data, create graphs, perform calculations, and document prototype test results; integrate these findings into a comprehensive technical design report. 3.P

q Reflect on the design process and outcomes and iterate on the design, as needed, for continuous improvement. 3.Q

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4 **Engineering Project Management and Quality Assurance: Students will apply project management skills in engineering technology by managing schedules, executing projects to achieve goals, and ensuring quality.** 4

a Define requirements and create (or follow) specifications for a project or product. 4.A

b Identify internal and external customer needs, resources needed (supplies, personnel, equipment) and create/provide needed standard operational procedures (SOPs). 4.B

c Establish milestones, develop a timeline, and identify critical path components to implement an effective project schedule. 4.C

d Develop methods and plans of production, determining the method (molding, machining, etc.) to create a product, defining an efficient order of fabrication operations, and identifying parts and materials. 4.D

e Identify potential risks and challenges, develop strategies for mitigation, and determine how a system should operate. 4.E

f Assess how changes in conditions, operations, and the environment will impact its outcomes. 4.F

Skip to main content

g Develop and maintain digital and physical project documentation throughout the design, implementation, and testing phases to ensure compliance with engineering standards and customer requirements. 4.G

h Make custom parts (those not readily available that meet specifications). 4.H

i Assemble a product using appropriate techniques and tools to ensure functionality and quality. 4.I

j Monitor manufacturing and design processes using process control data to identify variations and maintain quality assurance. 4.J

k Explain inventory control practices and their impact on production. 4.K

l Assess products to verify they meet customer specifications and regulatory requirements. 4.L

m Explain quality control techniques, TQM concepts, and apply continuous improvement strategies to enhance quality and operational efficiency. 4.M

n Design a packaging solution for a product, integrating industrial design elements, such as branding, usability, ergonomics, sustainability, maintainability, and aesthetics. 4.N

o Apply project planning software or digital tools, e.g., Gantt charts, Kanban boards, or CAD-integrated planning tools, to schedule tasks, track progress, and manage engineering project workflows. 4.O

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5 **Electrical Engineering Fundamentals and Analog Circuits: Students will apply foundational electrical engineering principles to analyze, design, and test analog electrical circuits using industry-standard tools.** 5

a Describe the structure and function of an atom, including subatomic particles, and explain their roles in electrical properties. 5.A

b Classify materials as insulators, conductors, or semiconductors based on electrical properties. 5.B

c Calculate resistance values and explain their impact on circuit performance. 5.C

d Identify basic circuit components (source, load, control, conductors) and explain their functions within a circuit. 5.D

e Differentiate between direct current (DC) and alternating current (AC) through examples and measurements. 5.E

f Select and safely use test devices such as oscilloscopes and multimeters for electrical measurements. 5.F

g Calibrate oscilloscopes and multimeters and demonstrate accurate measurement of voltage, current, resistance, and capacitance. 5.G

h Interpret resistor color codes and identify resistor values. 5.H

i Measure voltage, current, and resistance in series and parallel circuits using a multimeter. 5.I

Measure and interpret capacitance values using appropriate instruments. 5.J

Skip to main content

k Draw and label waveforms (square, sawtooth, sine) and interpret their characteristics. 5.K

l Determine time, fall time, frequency, and amplitude of waveforms using an oscilloscope. 5.L

m Read and interpret schematic diagrams to analyze circuit designs. 5.M

n Apply Ohm's law and Kirchhoff's law to calculate voltage, current, and resistance in electrical circuits. 5.N

o Distinguish and analyze series, parallel, and series-parallel circuit configurations. 5.O

p Identify capacitor types, values, and polarity requirements for circuit design. 5.P

q Explain switch types and demonstrate their applications in electrical circuits. 5.Q

r Demonstrate the operation of diodes and transistors in circuits. 5.R

s Compare and explain the function of display devices including LEDs, seven-segment displays, and LCDs. 5.S

t Analyze electrical circuit designs for renewable energy sources such as solar panels and wind turbines. 5.T

u Implement and document preventative and corrective maintenance procedures on electrical equipment to ensure operational functionality. 5.U

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6 **Digital Electronics, Logic Design, and Emerging Technologies: Students will design, simulate, and implement digital logic circuits and explore emerging technologies using industry-standard tools and software.** 6

a Retrieve, interpret, and analyze information from datasheets and reference catalogs to select appropriate logic families and integrated circuits (ICs). 6.A

b Perform number system conversions between binary, decimal, and hexadecimal accurately. 6.B

c Draw and interpret schematic diagrams of digital logic gates including AND, OR, NOT, NAND, NOR, XOR, and X-NOR. 6.C

d Develop Boolean expressions and construct truth tables to verify the operation of digital circuits 6.D

e Simplify logic expressions using DeMorgan's theorem and other Boolean algebra techniques. 6.E

f Explain the duality principle in logic functions and apply it in circuit design. 6.F

g Analyze and solve digital logic problems by designing corresponding logic circuits. 6.G

h Design, simulate, and implement digital circuits using reprogrammable logic devices (PLDs) and associated software tools. 6.H

i Create and configure logic files for PLDs, defining digital logic functions accurately. 6.I

Skip to main content

Construct, test, and troubleshoot simple latches and flip-flops built from discrete gates. 6.J

k Interpret timing diagrams and truth tables for J-K flip-flops and apply these to circuit design. 6.K

l Explain timing requirements of ICs and demonstrate timing considerations in circuit design. 6.L

m Identify and describe IoT technologies, including sensor types, communication protocols, and data integration in electrical systems. 6.M

n Explain cybersecurity threats and implement basic protective measures to safeguard electrical systems in connected environments. 6.N

o Troubleshoot, diagnose, and resolve faults in electrical systems using corrective maintenance techniques and document findings. 6.O

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7 **Mechanical Engineering Principles, Materials, and Prototyping: Students will analyze mechanical engineering concepts, evaluate materials, and apply prototyping and manufacturing methods to design functional mechanical systems.** 7

a Identify and compare industry-wide prototyping methods, evaluating their applications, advantages, and limitations for mechanical design. 7.A

b Classify engineering plastics and metals based on properties, additives, and processing techniques, and analyze their influence on material performance. 7.B

c Calibrate and use measurement devices (mass, length, angles, time) to collect data and solve engineering problems. 7.C

d Interpret detail and assembly drawings, technical processes, and instructions to accurately assemble mechanical systems. 7.D

e Apply kinematic equations and interpret graphs to calculate displacement, velocity, acceleration, and predict object motion. 7.E

f Analyze relative motion between objects in different reference frames and solve related problems. 7.F

g Evaluate mechanical assemblies for motion and interference issues to optimize design function. 7.G

h Calculate properties of mass (volume, density, moment of inertia) and apply these to solve engineering problems. 7.H

i Categorize engineering materials (organics, metals, polymers, ceramics, composites) by micro and macro structure and predict their behavior. 7.I

j Apply material property-changing treatments (heat, chemical, additives) and assess their effects on material performance. 7.J

k Describe and assess casting and molding processes, explaining their impact on material properties and product quality. 7.K

l Trace material production from raw material to finished product and analyze environmental impacts, including recycling and disposal. 7.L

m Analyze how material properties affect mechanical design reliability, e.g., Mean Time Between Failure. 7.M

Skip to main content

n Differentiate and select appropriate production processes involving material removal (turning, milling, grinding, plating). 7.N

o Identify and apply forming processes (bending, forging, cutting) relevant to product design. 7.O

p Create clear hand sketches using orthographic and perspective views with appropriate labels, geometric shapes, and line types. 7.P

q Apply scale, dimensioning, and tolerance standards (including GD&T) to produce accurate production drawings. 7.Q

r Analyze design choices for manufacturability, safety, liability, and cost-effectiveness. 7.R

s Analyze and test simple machines (gears, pulleys, levers, wheels and axles, wedges, screws) and calculate mechanical advantage. 7.S

t Analyze fluid systems considering flow, pressure, density, temperature, elevation, and friction effects. 7.T

u Analyze heat flow systems (conduction, convection, radiation) and perform heat loss calculations. 7.U

v Analyze beam deflection, stress, strain, tension, compression, moment, and torsion using finite element analysis (FEA) techniques. 7.V

w Construct free body diagrams, resolve forces into vector components, and calculate static forces, stress, strain, and acceleration. 7.W

x Identify and select appropriate material joining processes (gluing, welding) for mechanical assemblies. 7.X

y Execute mechanical designs using prototyping methods including rapid prototyping, producing physical models from digital databases. 7.Y

z Set up and operate a basic manufacturing assembly process, producing a finished product meeting specifications. 7.Z

aa Perform preventative maintenance on mechanical systems, document procedures, and monitor equipment to meet industry and OSHA standards. 7.AA

bb Troubleshoot mechanical systems, perform corrective maintenance, and document repair actions. 7.BB

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8 **Mechanical CAD Modeling, Simulation, and Digital Design Integration: Students will develop expertise in CAD modeling, simulation, and collaboration tools to design, analyze, and document mechanical systems digitally.** 8

a Create and modify 3D parametric models using CAD software (Fusion 360, Inventor, SolidWorks) applying feature-based, history-driven modeling techniques. 8.A

b Use direct modeling methods to rapidly edit and refine CAD models while maintaining design intent. 8.B

c Combine and integrate mechanical CAD models with BIM software (Revit), ensuring cross-platform compatibility for interdisciplinary coordination. 8.C

Skip to main content

d Perform simulation analyses (stress, motion, thermal) using CAD-integrated tools to validate designs and optimize performance prior to prototyping. 8.D

e Apply version control and cloud collaboration features in CAD software to manage design revisions and support team workflows. 8.E

f Generate detailed technical drawings and 3D assemblies, applying GD&T and dimensioning standards to prepare accurate manufacturing documentation. 8.F

g Export and import CAD models between different software platforms, maintaining data integrity and facilitating multi-disciplinary design. 8.G

h Document and present design solutions using CAD software output, including animations, exploded views, and presentation materials. 8.H

i Apply parametric design principles to automate design modifications and enhance productivity. 8.I

j Develop and test digital prototypes in simulation environments to predict mechanical behavior under realistic conditions. 8.J

k Prepare digital CAD models for additive or subtractive manufacturing by exporting to appropriate file formats, e.g., STL, STEP, applying slicing software, configuring print or machining parameters, e.g., layer height, infill, support, tool paths, and generating G-code for fabrication. 8.K

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9 **Automated Systems Engineering Demonstration, Design, and Implementation: Students will demonstrate automated systems engineering techniques by designing, building, and maintaining an advanced automated system, incorporating principles of control systems, programming, and integration of sensors and actuators.** 9

a Evaluate the impact of robots on manufacturing processes and societal factors, considering their benefits, challenges, and overall influence. 9.A

b Describe various types of automated systems and robots, including their classifications and specifications for work envelopes. 9.B

c Design automated systems with sustainability in mind, focusing on energy efficiency, resource optimization, and reducing environmental impact. 9.C

d Identify and sketch the components of a robot, including servo, stepper, and DC motors, and describe their uses in robotic systems. 9.D

e Select, size, and implement interface device(s) to control a motor(s). 9.E

f Describe the components of robot controllers and explain the need for end of arm tooling and how different end effectors are specific to processes, affecting the robot's operation. 9.F

g Describe the applications of programmable logic controllers (PLCs) in computer-integrated manufacturing (CIM) systems, including their differences from computers with interfaces. 9.G

h Identify individual components used in CIM systems. 9.H

i Differentiate between open- and closed-loop control. 9.I

Design and create a program to evaluate data and make decisions using external digital and analog sensors. 9.J

Skip to main content

k Formulate a flow chart to correctly apply basic programming concepts. 9.K

l Describe the function of sensors in electronic circuitry, e.g., temp., optical, etc. 9.L

m Explain the principles of control techniques and computer simulations. 9.M

n Compare and contrast the benefits and drawbacks of the three categories of CIM manufacturing systems. 9.N

o Describe the working relationship between the CNC mill and the robot. 9.O

p Analyze and select CIM system components for a specific industrial application. 9.P

q Design an end effector by specifying its function based on the intended application. 9.Q

r Design and program a working model of a robot or automated system to perform multiple tasks and solve materials handling problems. 9.R

s Design an automated feed system with sensors. 9.S

t Design an interface that inspects, evaluates, and manages program parameters during the operation of the program. 9.T

u Design and create an end effector tailored to the specific requirements of the robotic or automated system. 9.U

v Build a working model of a robot or automated system, including the construction and integration of drive systems used in its operation. 9.V

w Operate a CIM system utilizing appropriate safety precautions. 9.W

x Demonstrate how individual components work together to form a complete CIM system. 9.X

y Assemble and test individual component designs by integrating them into a complete model FMS. 9.Y

z Run, test, evaluate, and redesign system operation. 9.Z

aa Build an automated feed system with sensors. 9.AA

bb Utilize advanced sensors and actuators, such as vision systems and adaptive grippers, to improve precision and functionality in automated systems. 9.BB

cc Explore how AI and machine learning algorithms can be incorporated into automated systems to enhance decision-making, predictive maintenance, and adaptive control. 9.CC

dd Examine the integration of IoT technologies into automated systems for real-time data collection, remote monitoring, and enhanced system communication. 9.DD

ee Implement cybersecurity measures to protect automated systems and data from unauthorized access and cyber threats. 9.EE

ff Examine the impact of Industry 4.0 principles, including smart factories and digital twins, on the design and optimization of automated systems to achieve increased efficiency and flexibility. 9.FF

gg Compare the programming requirements for collaborative robots (cobots) to ensure they operate safely and effectively alongside human operators in a shared workspace. 9.GG

Skip to main content

hh Explain the benefits of using digital twins and simulation tools to model, test, and optimize automated systems before their physical implementation. 9.HH

ii Ensure that automated systems, including robots, operate correctly through regular preventative and corrective maintenance. 9.II

jj Develop and apply strategies to prevent system failures and maintain detailed logs of maintenance activities. 9.JJ

kk Troubleshoot and resolve issues in automated systems as they arise to restore optimal functionality. 9.KK

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10 Civil Engineering, Architecture Demonstration, Design, and Implementation: Students will apply civil engineering and architecture principles and techniques, utilizing design tools and materials, to construct functional, structurally sound, and sustainable scale models. 10

a Compare and contrast various architectural styles. 10.A

b Describe the components of, and coordination required of, an entire construction document set, including mechanical, electrical, plumbing, civil, structural, and architectural drawings. 10.B

c Use an architectural or engineering scale to measure drawings. 10.C

d Identify various structural systems, such as steel frame, concrete frame, and different foundation types. 10.D

e Explain surveying strategies and the use of surveying equipment, including the principles of measurement, data collection methods, and the application of tools, such as total stations, levels, and GPS systems, to accurately assess and map land and construction sites. 10.E

f Explain how sustainable design practices contribute to energy efficiency, reduce waste, and enhance the overall quality of life by creating healthier and more resilient built environments. 10.F

g Evaluate regenerative design principles that extend beyond sustainability to enhance ecosystems and communities. 10.G

h Use structural analysis software, e.g., MD Solids or similar tools, to model and analyze forces, moments, and stability in building and infrastructure components such as beams, trusses, and columns. 10.H

i Calculate stress and strain in structural elements, e.g., beams, columns, and supports, using material properties and design loads; interpret and plot stress-strain diagrams relevant to construction materials such as steel, concrete, and timber. 10.I

j Calculate the moment of inertia for structural members with common cross-sectional shapes to evaluate their resistance to bending and ensure proper stability in architectural and civil designs. 10.J

k Analyze stress, strain, and deflection in beams used in building and bridge design, considering load types, support conditions, and cross-sectional geometry. 10.K

Skip to main content

l Create a site survey using appropriate survey equipment and tools. 10.L

m Conduct soil testing and analyze the results. 10.M

n Analyze a site to determine drainage requirements and design site grading, including cut and fill volume calculations. 10.N

o Create a commercial site design, including parking, roads, and landscaping. 10.O

p Apply building codes, regulations, and standards to a construction project. 10.P

q Calculate dead, live, and environmental (snow, wind) loads on a structure. 10.Q

r Trace gravity loads through a structure from their point of application to the building's foundation. 10.R

s Determine the tributary area of a particular structural element. 10.S

t Design a simply supported structural beam for a building or bridge, performing calculations for shear forces, bending moments, and deflection to meet safety and code requirements. 10.T

u Conduct heat loss calculations to assess thermal efficiency and determine the necessary insulation or heating requirements for a space. 10.U

v Apply sustainable design to a project. 10.V

w Create a cost estimate for a construction project. 10.W

x Create a 3D computer model of both residential and commercial buildings. 10.X

y Use BIM software, e.g., Revit, to develop coordinated 3D building models, supporting visualization, clash detection, and project planning. 10.Y

z Set up BIM model sheets with title blocks, section cuts, elevations, and schedules suitable for construction documentation. 10.Z

aa Export 3D models from BIM or CAD software in standard formats, e.g., IFC, DWG, STL, for interoperability with other design, fabrication, or simulation platforms. 10.AA

bb Build a scale model of a building with a particular architectural style. 10.BB

cc Build, test, and redesign a scale model of an engineering structure, e.g., building, bridge, etc. 10.CC

dd Create an as-built drawing set, including plans, sections, and details. 10.DD

ee Research and recommend preventative maintenance measures for civil structures, e.g., bridges, to customers or project managers, and document the process. 10.EE

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11 **Advanced Engineering - Integrated Area Research, Design, and Implementation: Students will conduct comprehensive research on advanced engineering fields, develop and present a business plan for a design within a selected field, and apply integrated design principles to create and build a working model of a system.** 11

a Select and define an emerging or specialized engineering field for in-depth research. 11.A

Skip to main content

b Demonstrate integrated area research by identifying and explaining major engineering disciplines such as Manufacturing, Aerospace, Environmental, Nuclear, Mining, Sustainable Technologies, Geological, Agricultural, Marine, or Ocean Engineering. 11.B

c Outline how to research and integrate information from different engineering fields to inform interdisciplinary design. 11.C

d Apply research methods to develop viable engineering solutions within the selected area. 11.D

e Develop and present a detailed business plan that outlines the design, market potential, and implementation strategy for a solution in the selected engineering area. 11.E

f Utilize project management and business software tools to organize, track, and present components of the business plan. 11.F

g Develop a working design of a system used in the selected engineering area. 11.G

h Demonstrate advanced parametric and direct modeling techniques using CAD software (Fusion 360, Inventor, SolidWorks) to develop system components aligned with integrated design principles. 11.H

i Simulate and analyze the working design under realistic conditions using CAD-integrated simulation tools to validate functionality and sustainability goals. 11.I

j Integrate multi-disciplinary CAD data and manage model interoperability across different engineering domains to support collaborative design and prototyping. 11.J

k Identify how a component or subsystem of the system design relates to core engineering learning areas, e.g., electrical, mechanical, digital, or civil. 11.K

l Apply lifecycle analysis and sustainability assessment tools during the design and maintenance planning phase. 11.L

m Incorporate principles of sustainability and environmental responsibility in the design, operation, and maintenance of the system to ensure long-term functionality. 11.M

n Build a model or prototype of the engineered system based on the working design and business plan. 11.N

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12 **Advanced Elective Engineering Area Design Template: Students will independently select an elective engineering area (EEA), conduct comprehensive research, and create a detailed, functional project to demonstrate their understanding and problem-solving abilities within that domain. Note: This section provides a framework to help an Engineering Technology student pursue a personally interesting, self-selected domain of engineering for study.** 12

a Identify an elective engineering area (EEA) of interest and present initial research and rationale for further study within this domain. 12.A

b Demonstrate knowledge of essential scientific discoveries and mathematics required for success in the EEA. 12.B

Skip to main content

c Describe the engineering history, evolution, and state of the art of technology (devices and processes) within the EEA. 12.C

d Identify and demonstrate knowledge of design tools, techniques, materials, and skills utilized in both the implementation and maintenance of a system within the EEA. 12.D

e Review and document initial findings on the EEA to assess the feasibility of continuing with engineering design, implementation, and maintenance within this domain. 12.E

f Explain and apply principles and techniques of the elective EEA, demonstrating a working knowledge of design tools and materials in accordance with industry and OSHA standards. 12.F

g Analyze or reverse engineer a design of a system, subsystem, or component, typical of your EEA. 12.G

h Create or recreate an initial EEA design, e.g., schematics, drawing, flowcharts, pseudocode, etc. using elementary design tools typical to the chosen engineering domain. 12.H

i Specify materials and components for your EEA design and determine a maintenance strategy to ensure its functionality and longevity. 12.I

j Create or recreate a working design using computer-aided design (CAD) tools typical of your EEA industry, following the engineering design process through all stages of development. 12.J

k Simulate and validate the design under operational conditions using CAD-integrated tools to test stress, motion, thermal behavior, or manufacturing constraints. 12.K

l Export CAD models to industry-standard formats, e.g., STL, IGES, STEP, for 3D printing, simulation platforms, or CNC fabrication workflows. 12.L

m Build a model or working prototype of your EEA design, or alternatively, create a model of an emulated commercial EEA design. 12.M

n Specify and document processes to ensure efficient commercial manufacturing of your EEA design or an existing one. 12.N

o Maintain and repair elective engineering area designs, including identifying required skills, tools, and processes, and practice maintenance while keeping a repair log. 12.O

p Prepare a professional-level technical report or presentation that documents the full design process, challenges, testing, and proposed next steps. 12.P

Employability Standards

13 **Employability Skills: Students will demonstrate the roles of professional communication, critical thinking, problem-solving, professionalism, teamwork, and collaboration within the engineering technology industry.** 13

Skip to main content

a Demonstrate the ability to effectively communicate complex engineering concepts, design solutions, and technical data in both written and oral forms to stakeholders, including clients, regulatory bodies, and interdisciplinary team members. 13.A

b Utilize technical documentation, e.g., specifications, manuals, reports, and project management tools to ensure clear and accurate communication. 13.B

c Analyze complex problems and technical data to develop innovative solutions and make informed decisions, applying creative thinking to generate new ideas and approaches. 13.C

d Demonstrate the importance of teamwork and effective communication in collaborative projects, understanding how these skills contribute to successful integration of individual designs into a cohesive and functional model, such as a Flexible Manufacturing System. 13.D

e Demonstrate adaptability by responding to evolving project requirements, new technologies, and industry shifts, e.g., automation, AI, Industry 4.0, and by integrating emerging technologies into the design process. 13.E

f Exhibit professionalism by adhering to industry ethics, safety standards, e.g., OSHA, environmental responsibility, and regulations influencing design choices, while understanding intellectual property and project confidentiality in the design, implementation, and maintenance of engineering systems. 13.F

Entrepreneurship Standards

14 Entrepreneurship: Students will be able to identify and describe entrepreneurship opportunities within the engineering field and assess the value proposition of starting and managing a business in engineering. 14

a Describe a major engineering category or sub-discipline, including core tasks, working conditions, salary expectations, education and training requirements, and the skills and abilities needed. 14.A

b Conduct market research and feasibility analysis to evaluate market needs and the viability of an engineering business idea, enabling informed decision-making for entrepreneurial ventures. 14.B

c Evaluate the licensing, regulatory, and tax implications of self-employment and business ownership as an engineering professional compared to W-2 employment. 14.C

d Implement strategies for building professional networks and pursue ongoing development opportunities to support business growth and career advancement in the engineering field. 14.D

Digital Literacy Standards

15 Digital Literacy: Students will demonstrate proficiency in both common and specialized engineering software, showcasing digital literacy skills essential for excelling as competitive professionals in the engineering industry. 15

a Utilize modern digital tools and cloud-based platforms, e.g., Autodesk BIM 360, Google Drive, Microsoft Teams, to facilitate real-time collaboration, data sharing, and the integration of design aspects, ensuring seamless communication among project stakeholders and improving team efficiency across multi-disciplinary engineering projects. 15.A

b Locate and utilize online resources that support effective practices, while adhering to principles of safe and ethical digital content creation and consumption. 15.B

Skip to main content

c Develop and implement strategies for leveraging digital tools and technologies to optimize business operations within the engineering sector, focusing on process automation, effective project management, and data-driven decision-making to enhance efficiency, innovation, and competitiveness. 15.C

d Implement cybersecurity measures within digital engineering tools and platforms, ensuring the protection of sensitive project data, intellectual property, and system integrity in compliance with industry standards and regulations. 15.D