

Advanced Engineering CAD

1A1

1.0.1 Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts* and relationships between technologies and other fields.

**The core concepts of technology include systems, resources, requirements, optimization and tradeoffs, processes and controls.*

Technology Diffusion Synthesize information, evaluate and make decisions about technologies.

1A1 List and describe factors that may influence the development of technology.

1A2

1.0.2 Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts* and relationships between technologies and other fields.

**The core concepts of technology include systems, resources, requirements, optimization and tradeoffs, processes and controls.*

Goal-directed Research Synthesize information, evaluate and make decisions about technologies.

1A2 Describe goal-directed research, define invention and innovation, and explain the relationship among them.

1A3

1.0.3 Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts* and relationships between technologies and other fields.

**The core concepts of technology include systems, resources, requirements, optimization and tradeoffs, processes and controls.*

Commercialization of Technology Synthesize information, evaluate and make decisions about technologies.

1A3 Make informed choices among technology systems, resources and services.

1B1

1.0.4 Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts* and relationships between technologies and other fields.

**The core concepts of technology include systems, resources, requirements, optimization and tradeoffs, processes and controls.*

Optimization and Trade-offs Apply technological knowledge in decision-making.

1B1 Cite examples showing how the failure of system components contributes to the instability of a technological system (e.g., if the fuel pump in an automobile malfunctions, the entire system will not work properly; or if a computer hard drive fails, the computer system will not work properly).

1C1

1.0.5 Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts¹ and relationships between technologies and other fields.

**The core concepts of technology include systems, resources, requirements, optimization and tradeoffs, processes and controls.*

Technology Transfer Examine the synergy between and among technologies and other fields of study when solving technological problems.

1C1 Describe how technology transfer occurs when an innovation in one setting is applied in a different setting.

1C2

1.0.6 Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts* and relationships between technologies and other fields.

**The core concepts of technology include systems, resources, requirements, optimization and tradeoffs, processes and controls.*

Innovation and Invention Examine the synergy between and among technologies and other fields of study when solving technological problems.

1C2 Describe how technologies are, or can be, combined (e.g., a computer-controlled surgical laser scalpel represents the combination of physical, information and bio-related technology).

1C3

1.0.7 Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts* and relationships between technologies and other fields.

**The core concepts of technology include systems, resources, requirements, optimization and tradeoffs, processes and controls.*

Innovation and Invention Examine the synergy between and among technologies and other fields of study when solving technological problems.

1C3 Define examples of how technological progress is integral to the advancement of science, mathematics and other fields of study.

1C3

1.0.8 Nature of Technology

Students develop an understanding of technology, its characteristics, scope, core concepts* and relationships between technologies and other fields.

**The core concepts of technology include systems, resources, requirements, optimization and tradeoffs, processes and controls.*

Innovation and Invention Examine the synergy between and among technologies and other fields of study when solving technological problems.

1C3 Predict changes in society as a result of continued technological progress and defend the rationale.

2A1

1.0.9 Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Technology and Citizenship Interpret and practice responsible citizenship relative to technology.

2A1 Explain how making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.

2B1

1.0.10 Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Technology and the Environment Demonstrate the relationship among people, technology and the environment.

2B1 Understand that humans can devise technologies to conserve water, soil and energy through such techniques as reusing, reducing and recycling.

2C1

1.0.11 Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Technology and History Interpret and evaluate the influence of technology throughout history, and predict its impact on the future.

2C1 Describe how some technological development has been evolutionary, the result of a series of refinements to basic inventions or innovations over time.

2C2

1.0.12 Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Technology and History Interpret and evaluate the influence of technology throughout history, and predict its impact on the future.

2C2 Select a technology or tool and predict how it will change in the future.

2D1

1.0.13 Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Technology and Ethics Analyze ethical and legal technology issues and formulate solutions and strategies that foster responsible technology usage.

2D1 Practice responsible usage of technologies (e.g., download legally, install licensed software, adhere to copyright restrictions).

2D4

1.0.14 Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Technology and Ethics Analyze ethical and legal technology issues and formulate solutions and strategies that foster responsible technology usage.

2D4 Practice responsible and ethical usage of technology.

2E2

1.0.15 Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible **and** ethical use of technology.

Technology Assessment Forecast the impact of technological products and systems.

2E2 Select a technology that has had national impact and describe its impact.

2E3

1.0.16 Technology and Society Interaction

Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Technology Assessment Forecast the impact of technological products and systems.

2E3 Compare and contrast the past, present and future developments of a technological system.

3A3

1.0.17 Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Problem-solving Integrate conceptual knowledge of technology systems in determining practical applications for learning and technical problem-solving.

3A3 Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use.

3A3

1.0.18 Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Problem-solving Integrate conceptual knowledge of technology systems in determining practical applications for learning and technical problem-solving.

3A3 Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use.

3B1

1.0.19 Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Knowledge Generation Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

3B1 Assimilate productivity and technological tools into all aspects of solving problems and managing personal information and communications.

3B1

1.0.20 Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Understanding Operations Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

3B1 Identify and use input and output devices to operate and interact with computers and multimedia technology resources (e.g., digital video camera, mobile cameras-a camera on a robot base, like a Mars rover, how to connect analog equipment to digital equipment).

3B2

1.0.21 Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Knowledge Generation Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

3B2 Use technology tools to model complex systems of information to improve the communication of and access to the information (e.g., modeling physics principles, graphic/geographic information system, weather modeling).

3B2

1.0.22 Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Productivity Tools Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

3B2 Demonstrate proficiency in all productivity tools (e.g., word processing, spreadsheet, database, desktop publishing).

3B2

1.0.23 Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Communication Tools Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

3B2 Use equipment related to computer and multimedia technology imaging (e.g., digitalization, optical character recognition, and scanning, computerized microscopes).

3B3

1.0.24 Technology for Productivity Applications

Students learn the operations of technology through the usage of technology and productivity tools.

Problem-solving Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

3B3 Identify/recognize state-of-the-art technology tools for solving problems and managing personal/professional information.

4A4

1.0.25 Technology and Communication Applications

Students use an array of technologies and apply design concepts to communicate with multiple audiences, acquire and disseminate information and enhance learning.

Evaluation Apply appropriate communication design principles in published and presented projects.

4A4 Assess the accuracy of the communication product.

4B1

1.0.26 Technology and Communication Applications

Students use an array of technologies and apply design concepts to communicate with multiple audiences, acquire and disseminate information and enhance learning.

Electronic Communications Create, publish and present information, utilizing formats appropriate to the content and audience.

4B1 Archive communication products in appropriate electronic forms (e.g., store electronic publications so that they may be accessed when needed).

4B2

1.0.27 Technology and Communication Applications

Students use an array of technologies and apply design concepts to communicate with multiple audiences, acquire and disseminate information and enhance learning.

Use of Communications Create, publish and present information, utilizing formats appropriate to the content and audience.

4B2 Use technology to publish information in electronic form (e.g., Web, multimedia, digital video, electronic portfolio).

6A1

1.0.28 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Design Process Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

6A1 Explain and apply the methods and tools of inventive problem-solving to develop and produce a product or system.

6A3

1.0.29 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Technical Contradictions Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

6A3 Identify the conceptual and technical principles that underpin design processes (e.g., analyze characteristics of technical systems that affect performance and identify principles that resolve design contradictions).

6A4

1.0.30 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Requirements Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

6A4 Identify the elements of quality in a product/system (e.g., tolerances, fit, finish, function, form (aesthetics), repeatability, durability, material).

6A5

1.0.31 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Optimization and Trade-offs Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

6A5 Explain that design problems are seldom presented in a clearly defined form (e.g., problems often involve competing constituencies, undiscovered constraints and unidentified regulations).

6A6

1.0.32 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Technical Problem-solving Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

6A6 Brainstorm solutions to problems using common brainstorming techniques (e.g., select a leader, select a recorder, generate ideas, discuss and add-on to ideas of others and recognize all ideas are welcome).

6A7

1.0.33 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Technical Communication Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

6A7 Demonstrate knowledge of pictorial and multi-view CAD drawings (e.g., orthographic projection, isometric, oblique, perspective using proper techniques).

6A8

1.0.34 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Technical Communication Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

6A8 Recognize that patent, trademark and copyright laws protect technological ideas and intellectual property.

6A9

1.0.35 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Understanding Technological Systems Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

6A9 Describe how the technological systems of manufacturing, construction, information and communication, energy and power, transportation, medical, and agricultural, and related biotechnologies can be used to solve practical problems.

6B1

1.0.36 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Design Process Recognize the role of teamwork in engineering design and of prototyping in the design process.

6B1 Explain how established design principles are used to evaluate existing designs, collect data and guide the design process (e.g., design principles include flexibility, unity, emphasis, balance, function and proportion).

6B2

1.0.37 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Design Process Recognize the role of teamwork in engineering design and of prototyping in the design process.

6B2 Explain how a prototype is a working model used to test a design concept by making actual observations and necessary adjustments.

6B3

1.0.38 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Design Process Recognize the role of teamwork in engineering design and of prototyping in the design process.

6B3 Create a model of a design solution to an engineering problem (e.g., virtual, physical, graphic or mathematical model).

6B4

1.0.39 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Requirements Recognize the role of teamwork in engineering design and of prototyping in the design process.

6B4 Identify the factors that must be taken into account in the process of engineering design (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors in engineering, such as ergonomics).

6B5

1.0.40 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Design Team Collaboration Recognize the role of teamwork in engineering design and of prototyping in the design process.

6B5 Describe how engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.

6B6

1.0.41 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Design Team Collaboration Recognize the role of teamwork in engineering design and of prototyping in the design process.

6B6 Describe the importance of teamwork, leadership, integrity, honesty, work habits and organizational skills of members during the design process.

6B7

1.0.42 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Technical Careers Recognize the role of teamwork in engineering design and of prototyping in the design process.

6B7 Explain the different engineering disciplines and how they relate to the major technological systems (e.g., mechanical-manufacturing, audiocommunication, civilconstruction).

6C2

1.0.43 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Redesign Understand and apply research, development and experimentation to problem-solving.

6C2 Research previous solutions to a technological problem and redesign an alternative solution.

6C3

1.0.44 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Reverse Engineering Understand and apply research, development and experimentation to problem-solving.

6C3 Describe and demonstrate the reverse engineering process in problem-solving.

6C4

1.0.45 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Technical Communication Understand and apply research, development and experimentation to problem-solving.

6C4 Use and maintain technical drawing/design tools in order to create a variety of drawings and illustrations (e.g., instruments, equipment, materials, computer-aided design software, hardware and systems).

6C5

1.0.46 Design

Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Technical Communication Understand and apply research, development and experimentation to problem-solving.

6C5 Use computers, calculators, instruments and devices to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate to group members (e.g., CAD computer-aided design, software, library resources, the Internet, word processing, CBL/calculator based labs, laser measuring tools and spreadsheet software).

7B2

1.0.47 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

System Management Classify, demonstrate, examine and appraise transportation technologies.

7B2 Describe the vital role transportation plays in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture (e.g., subsystems of aviation, rail transportation, water transportation, pedestrian walkways, roadways).

7B3

1.0.48 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Safety Classify, demonstrate, examine and appraise transportation technologies.

7B3 Identify and apply appropriate safety measures when working with transportation technologies.

7B4

1.0.49 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Use and Maintain Technological Systems Classify, demonstrate, examine and appraise transportation technologies.

7B4 Employ transportation technologies to resolve practical problems (e.g., getting students to athletic events).

7C2

1.0.50 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

System Management Classify, demonstrate, examine and appraise manufacturing technologies.

7C2 Describe the factors that influence the cost of producing technological products and systems in manufacturing technologies (e.g., materials, labor, energy, time, location).

7C2

1.0.51 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

System Management Classify, demonstrate, examine and appraise manufacturing technologies.

7C2 Produce a product using the manufacturing system (e.g., customized production, batch production and continuous production) appropriate to the context.

7C3

1.0.52 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Use and Maintain Technological Systems Classify, demonstrate, examine and appraise manufacturing technologies.

7C3 Identify and investigate modern production technology practices and equipment in manufacturing technologies (e.g., just-in-time, lean production, six-sigma, new automation processes, systems, materials, tools).

7C3

1.0.53 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Safety Classify, demonstrate, examine and appraise manufacturing technologies.

7C3 Identify and apply appropriate safety measures when working with manufacturing technologies.

7C5

1.0.54 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Use and Maintain Technological Systems Classify, demonstrate, examine and appraise manufacturing technologies.

7C5 Employ manufacturing technologies to resolve practical problems (e.g., produce a product).

7C6

1.0.55 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Technology Assessment Classify, demonstrate, examine and appraise manufacturing technologies.

7C6 Identify and investigate a variety of technological tools, equipment, machines, materials and technical processes used in manufacturing technologies to manufacture/fabricate products or systems.

7C7

1.0.56 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Emerging Technology Classify, demonstrate, examine and appraise manufacturing technologies.

7C7 Investigate emerging (state-of-the-art) and innovative applications of manufacturing technology.

7D3

1.0.57 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Safety Classify, demonstrate, examine and appraise construction technologies.

7D3 Identify and apply appropriate safety measures when working with construction technologies.

7D4

1.0.58 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Engineering Practice Classify, demonstrate, examine and appraise construction technologies.

7D4 Distinguish among the different forces acting upon structural components (e.g., tension, compression, shear and torsion).

7D5

1.0.59 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Use and Maintain Technological Systems Classify, demonstrate, examine and appraise construction technologies.

7D5 Identify and use a variety of technological tools, equipment, machines, materials and technical processes used in construction technologies to build/construct products or systems.

7D7

1.0.60 Designed World

Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Design Applications Classify, demonstrate, examine and appraise construction technologies.

7D7 Differentiate the factors that affect the design and building of structures (e.g., material availability, zoning laws, the need for riparian buffer, building codes and professional standards).