Standards for Technological Literacy (STL).

Maryland Technology Education Standards Grades 6 – 12

Standard One: The Nature of Technology - Students will develop an understanding of the nature of technology. The nature of technology encompasses

1. **The characteristics and scope of technology.** This includes but is not limited to how products and systems are developed to solve problems, how demand is created for a product by marketing and advertising, and how goal-directed research can result in invention and innovation.
2. **The core concepts of technology**. This includes but is not limited to systems, resources, requirements, optimization, trade-offs, processes, and controls. **3. The connections between technology and other fields of study**. This includes understanding how technological systems interact with each other, how technology can be repurposed, how other fields of study can impact technological products, and how technological ideas are protected. **Essential Skills and Knowledge**

Students who demonstrate understanding can:

Grades 6 -8

▪Differentiate between technological inventions and innovations.
▪Identify the need for technological invention and innovation.
▪Describe how marketing and advertising is used to create demand for technological products (STL, 3I).

Core Concepts of Technology

▪Describe the components of a technological system.
▪Design a model that demonstrates how subsystems and system elements interact within systems.
▪Select or design a technological system to perform a task based on specific requirements.
▪Assemble and operate simple technological systems.
▪Analyze the performance of a feedback control system.
▪Troubleshoot a malfunctioning system (STL, 10F).

▪Analyze factors that drive technological invention and innovation.
▪Describe factors that may limit the development or use of technology (e.g. resources, societal concerns).
▪Assess the effects of technology on supply and demand.

Core Concepts of Technology

▪Analyze the functionality and interaction of various technological systems.
▪Analyze how technology can be repurposed for applications beyond their intended use.
▪Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interaction between systems (HS-ETS 1-4).
▪Employ constraint-based modeling to describe a biological system.
▪Assemble and operate simple and complex systems.
▪Diagnose a system that is malfunctioning and use tools, materials, and knowledge to repair it (STL, 12M).

Characteristics and Scope of Technology Characteristics and Scope of Technology Characteristics and Scope of Technology

▪Assess factors that shape the design of and demand for various technologies.

▪Demonstrate how research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.

Core Concepts of Technology

▪Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interaction between systems (HS-ETS 1-4).

▪Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.

▪Create representation of a system in another form or a higher level of abstraction.

▪Design and create a complex system. ▪Test and evaluate the operation of a system based on its specified purpose.

▪Design instructions for system maintenance. ▪Repurpose a technological device for an application beyond its intended use.

Maryland Technology Education Standards Grades 6 – 12

Standard One: The Nature of Technology - Students will develop an understanding of the nature of technology. The nature of technology encompasses

1. The characteristics and scope of technology. This includes but is not limited to how products and systems are developed to solve problems, how demand is created for a product by marketing and advertising, and how goal-directed research can result in invention and innovation.

2. The core concepts of technology. This includes but is not limited to systems, resources, requirements, optimization, trade-offs, processes, and controls. **3. The connections between technology and other fields of study**. This includes understanding how technological systems interact with each other, how technology can be repurposed, how other fields of study can impact technological products, and how technological ideas are protected. **Essential Skills and Knowledge**

Students who demonstrate understanding can:

Grades 6 -8

▪Use tools, materials, and machines safely to adjust and repair systems (STL, 12I).

▪Provide examples of optimization and trade-offs products, processes, and systems.

Connections Between Technology and Other Fields of Study

▪Analyze how knowledge gained from other fields impacted the development of (STL, 3F).

▪Describe how patents protect intellectual property (STL, 3I).

Grades 9-12

▪Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.

▪Create a model of a feedback control system.

▪Demonstrate how trade-offs can impact a design product.

Connections Between Technology and Other Fields of Study

▪Correlate technological advances to progress in other fields of study such as science and mathematics (STL, 3J).

▪Analyze the purpose and functionality of subject matter (SMEs) on a team.

▪Assess ways to protect intellectual property (e.g. patent, trademark, copyright).

▪Differentiate between open source and proprietary technology.

Advanced Technology

▪Differentiate between quality control and quality assurance.

▪Apply the quality control process to a designed for product.

Connections Between Technology and Other Fields of Study

▪Collaborate with subject matter experts to develop solutions to problems. technological products and systems of study has

▪Analyze and apply the process for protecting intellectual property.

▪Assess the limitations of open source technology.

Grades 10 -12

Maryland Technology Education Standards Grades 6 – 12

Standard Two: Impacts of Technology - Students will evaluate the impact of technology. The impact of technology incorporates

1. **The cultural, social, economic, political, and environmental effects of technology.** This includes but is not limited to ethical considerations, trade-offs between the positive and negative effects of technology, impact of transferring technology from one society to another, and the impact of technological advances on the environment.
2. **The role of society in the development and use of technology**. This includes but is not limited to factors that contribute to the design and demand for various technologies.

Essential Skills and Knowledge Students who demonstrate understanding can:

Grades 6 – 8 **Grades 9-12** **Advanced Technology**

Grades 10 -12

- Discriminate between responsible and irresponsible use of technology.
- Analyze the cultural, social, economic, political and environmental effects of technology.
- Describe legal and ethical concerns resulting from the development and use of technology (STL, F).
- Explain that decisions about the use of technology involve trade-offs between positive and negative effects (STL, 4I).
- Assess the impact of technology transfer from one society to another (STL, 4K).
- Evaluate the advantages and disadvantages of technology.
- Evaluate the desirable and undesirable consequences of technological advancements.
- Apply assessment techniques, such as trend analysis and experimentation, to make decisions about the future development of technology (STL, 13L).
- Analyze legal and ethical considerations in the development and application of technology.
- Analyze the relationship between technological and natural systems.
- Design a forecasting technique to evaluate the results of altering natural systems (STL, 13M).
- Create and design a product to mitigate the undesirable consequences of an existing technology.

Effects of Technology Effects of Technology Effects of Technology

- Conduct research on technological issues that currently affect a society.
- Assess the unintended consequences of technology on a society.
- Assess the impact of technological advances on the environment.
- Predict future consequences of technological solutions on a society.
- Weigh available information about the benefits, risks, costs, and trade-offs of technology in a systematic way.

Maryland Technology Education Standards Grades 6 – 12

Standard Two: Impacts of Technology - Students will evaluate the impact of technology. The impact of technology incorporates

1. **The cultural, social, economic, political, and environmental effects of technology.** This includes but is not limited to ethical considerations, trade-offs between the positive and negative effects of technology, impact of transferring technology from one society to another, and the impact of technological advances on the environment.
2. **The role of society in the development and use of technology**. This includes but is not limited to factors that contribute to the design and demand for various technologies.

Essential Skills and Knowledge Students who demonstrate understanding can:

Grades 6 – 8	Grades 9-12	Advanced Technology Grades 10 -12
Role of Society in the Development and Use of Technology ▪ Describe how new technologies have result of combing existing technology. Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values. ▪ Assess the impact that technological and innovation has on the needs and wants of a society (STL, 4E). how technological advances have impacted the nature of work.	Role of Society in the Development and Use of Technology ▪ Distinguish factors that affect the scaling of ▪Analyze the impact that technology transfer ▪ Compare and contrast the development, availability, and application of technology in developed and underdeveloped countries. connections between technological advances and evolution of civilization different archaeological periods bronze age, iron age) (STL,	Role of Society in the Development and Use of Technology ▪Explain the ethical considerations that inform the evolved as a development, selection, and use of technologies. technologies. ▪ between societies has on the economy, culture, invention and government of each society. ▪Assess the impact that technological invention and ▪ Explain innovation has on economic competitiveness and shifts in employment opportunities (job creation ▪ Draw and destruction). ▪Assess how technology stimulates changes in through society, influence cultural patterns, political (e.g. stone age, movements, and local and global economies. 4H).

Maryland Technology Education Standards Grades 6 – 12

Standard Three: Engineering Design and Development - Students will demonstrate knowledge of and apply the engineering design process to develop solutions to problems. Engineering design and development includes but is not limited to **research and development**, **invention and innovation**, **problem solving**, and **using and maintaining technological products and systems**.

Essential Skills and Knowledge Students who demonstrate understanding can:

Grades 6 - 8	**Grades 9-12**	**Advanced Technology**
Grades 10 -12		
develop concise problem statement. team brainstorming rules and techniques. Researching and Generating Ideas – prior solutions to the problem. Constraints – students will be able to asse time, materials, capital, energy, etc. solutions. Selecting an Approach – students will be ○ Developing a Design Proposal – students the specifics of the project. ○ Making a Model or a Prototype – students information. function, proportion) to eva uate existing process (STL, 9I) mathematical models at various intervals of the ▪ Assess how design requirements such as with each other (STL, 8K). ▪ Apply the engineering design process to deduce design features in a novel product. a journal, notebook, or portfolio. researched information. of unwanted side effects. ▪ Engage in cost-benefit analysis. ▪Explain how the design process is an iterative, approach to problem solving that	▪ Apply the design process to develop solutions to real-world problems.	▪ Conduct market research to make informed systematic decisions about product development.

includes collaboratively:

- problem – students will be able to employ technical reading and writing skills to
  - Brainstorming – students will be able to apply
  - students will be able to conduct research to assess Criteria and Specifying criteria (guidelines) and prioritize constraintsss the the problem. This includes people,
  - Exploring Possibilities – students will conduct explore possibilities for potential development.
  - to employ a decision matrix to select the best able problem.
  - will be able to create a plan of action that details
  - will be able to develop conceptual, mathematical, and/or a prototype that performs the final solution and can be used for testing/evaluating. This includes the creation of two and three dimensional scale drawings.

- Document the design process and solutions in a journal, notebook, or portfolio.
- Assess the reliability and validity of researched
- Apply design principles (e.g. flexibility, balance, designs, to collect data, andlto guide the design
- Evaluate design.solutions using software and other tools to develop conceptual, physical, and design process in order to ensure compliance with design requirements (STL, 11P). criteria, constraints, and efficiency can compete values.
- Identify the capital and other resources needed to develop solutions to problems.

Apply assessment techniques (e.g. trend analysis) to determine if a solution should be and development.

- Engage in failure analysis and optimization.
- Assess the validity of a research results.

- Develop or refine products based on the results of market research.
- develop solutions to real-world problems.
- Engage in the reverse engineering process to
- Document the design process and solutions in
  - Identifying
  - Evaluate the reliability and validity of
  - Employ risk analysis to minimize the likelihood (limitations) of
  - Use assessment techniques to ascertain if a research and solution should be pursed to design and for quality control.
  - Compare trade-offs between competing approach to solve the
- Implement current industry standard systems
- Analyze how the engineering code of ethics pursued to design impact product design.
- Engage in ethical engineering practices. or physical models

Maryland Technology Education Standards Grades 6 – 12

Standard Three: Engineering Design and Development - Students will demonstrate knowledge of and apply the engineering design process to develop solutions to problems. Engineering design and development includes but is not limited to **research and development**, **invention and innovation**, **problem solving**, and **using and maintaining technological products and systems**.

Essential Skills and Knowledge Students who demonstrate understanding can:

Grades 6 - 8

- Testing and Evaluating Design Using prepare devices and establish specifications to assess their design
- Refining a Design – student will employ data-
- Creating or Making the Product – students will be able to produce the design product
- Communicate Processes and Results – students will be able to communicate throughout the design process demonstrating application of the essential skills and knowledge presented in Maryland's College and Career Ready Disciplinary Literacy Standards.

- Apply the design process to develop solutions to real-world problems.
- Document the design process and solutions in a journal, notebook, or portfolio.
- Assess the reliability and validity of researched information.
- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of a problem (MS-ETS1-2).
- Discriminate between ethical and unethical engineering practices.

Grades 9-12

- Apply the research and development problem-Specifications – students will be able to use solving approach to systems for the marketplace.
- Engage in ethical engineering practices. driven decision making to improve their product.

Advanced Technology

Grades 10 -12

product.

Maryland Technology Education Standards Grades 6 – 12

Standard Four: Core Technologies and The Designed World - Students will demonstrate knowledge of the core technologies that underpin the designed world and major enterprises that produce the goods and services of the designed world. Core technologies include but are not limited to biotechnology, electrical, electronics, fluid, material, mechanical, optical, structural, and thermal technologies. Major enterprises include medical, agriculture, biotechnology, energy and power, information and communication, transportation, and manufacturing and construction technologies.

Essential Skills and Knowledge Students

who demonstrate understanding can:

Grades 6 - 8 **Grades 9-12** **Advanced Technology**

Grades 10 -12

- Analyze the function of select core technologies in the designed world.

Medical Technologies

- Explore the function and application of several medical technologies.
- Correlate advances in medical technologies to improvements in the length and quality of life for multicellular organisms.
- Describe ethical considerations involved in the development and application of medical technologies.

Agricultural Technologies

- Explore the function and application of a variety of technological processes, equipment, and systems used in agriculture (e.g. agroforestry, irrigation, global positioning systems).
- Design, develop, use, manage, maintain, and assess a closed system that supports living organisms (e.g. terrarium, hydroponics station).
- Evaluate the positive and negative effects of technological solutions to agricultural problems.

- Apply knowledge of core technologies in the development of solutions to problems.

Medical Technologies

- Employ trends, research, and forecasting techniques to analyze emerging health and medical technologies.
- Investigate the benefits and consequences of advances in medicine made through the use of technology.
- Analyze ethical issues and global concerns surrounding the development, access, application, and effects of health and medical technologies.
- Assess how advances in medical technology have improved the health of multicellular organisms (e.g. reducing the instances of serious diseases in humans).

Agricultural Technologies

- Analyze how advancement in technology has improved the yield and quality of food.
- Assess the products and systems used to produce, process, and distribute food, fiber, fuel, chemical, and other products (STL, 16K).
- Assess the need for regulations governing technologies used in agriculture.

- Apply knowledge of core technologies in the development of solutions to problems.

Medical Technologies

- Assess the social, cultural, political, and environmental forces impacting the design, development, application, and access to a variety of medical technologies.
- Analyze factors that need to be established to make emerging medical technologies viable in the marketplace.
- Describe the application of bioinformatics in health and wellness.
- Apply bioinformatics to analyze and interpret biological data.
- Analyze and evaluate health data collection tools (e.g. patient monitoring equipment, medical wearable devices).
- Analyze technological advances that allow for identification of disease pathogens.
- Design and build a medical device that meets a specific medical need.

Agricultural Technologies

- Assess the impact that technologies such as automation, sensors, mobile computing, and telematics have on agriculture.

Maryland Technology Education Standards Grades 6 – 12

Standard Four: Core Technologies and The Designed World - Students will demonstrate knowledge of the core technologies that underpin the designed world and major enterprises that produce the goods and services of the designed world. Core technologies include but are not limited to biotechnology, electrical, electronics, fluid, material, mechanical, optical, structural, and thermal technologies. Major enterprises include medical, agriculture, biotechnology, energy and power, information and communication, transportation, and manufacturing and construction technologies.

Essential Skills and Knowledge Students who demonstrate understanding can:

Grades 6 - 8	**Grades 9-12**	**Advanced Technology**
Grades 10 -12		
▪ technological products and systems (STL, ▪ Explore ways to conserve energy. ▪ Assess advantages and disadvantages of engineering). ▪ Assess the application and impacts of biorobotics. *Energy and Power Technologies* thermal, electrical, nuclear). ▪ Analyze energy inputs, processes and outputs. *Biotechnology* how genetic engineering can alter the *Energy and Power Technologies* and consumption of energy.		
▪ Describe techniques used to provide long-storage of food and reduce the health risk caused by tainted food (STL, 15J).	▪ Examine the social side effects and trade-offs of using various technologies in the production of food.	▪ Assess governmental regulations on term agricultural practices. ▪ Explore sustainable farming practices. ▪ Analyze the advantages and disadvantages of innovation farming techniques (e.g. ▪ Explore vertical farms, hydroponics, rooftop farming). ▪ Design and build a model of agricultural ▪ Analyze technology that meets a specific need.
Biotechnology applications of biotechnology. Examine positive and negative impacts of biotechnology. ethical, societal, and legal issues that arise from biotechnology applications.	*Biotechnology* ▪ Analyze the application of biotechnology processes and products in medicine, agriculture, food processing, and the environment. ▪ Assess the ethical, social, and legal issues	

Energy and Power Technologies

how power systems are used to drive and provide propulsion to other

- Design, construct, and test a device that either minimizes or maximizes energy
  - Analyze the production, conversion, different forms of renewable and nonrenewable energy.

bioinformatics, bioprocess engineering, and

regarding the use of biotechnology (e.g. genetic

biotechnology on other fields of study such as

function of cellular processes for a specific

biotechnology and other fields of study.

transmission, and application of different forms of energy (e.g. mechanical, radiant, chemical,

- Assess energy efficiency at generation, and point of use.

- Conduct research on emerging trends in biotechnology.
- Apply biotechnology techniques to assess

purpose.

- Assess the connection between transfer (MS-PS3-3).

- Examine renewable and conventional energy production technologies.
- Analyze the global production, distribution, distribution,
- Compare and contrast means to transfer and store energy.
- Create models and design experiments to improve energy efficiency.

- Analyze biotechnology.

16H).

Maryland Technology Education Standards Grades 6 – 12

Standard Four: Core Technologies and The Designed World - Students will demonstrate knowledge of the core technologies that underpin the designed world and major enterprises that produce the goods and services of the designed world. Core technologies include but are not limited to biotechnology, electrical, electronics, fluid, material, mechanical, optical, structural, and thermal technologies. Major enterprises include medical, agriculture, biotechnology, energy and power, information and communication, transportation, and manufacturing and construction technologies.

Essential Skills and Knowledge Students who demonstrate understanding can:

Grades 6 - 8	**Grades 9-12**	**Advanced Technology**
Grades 10 -12		
types of communication systems. ▪		
Design and develop a simple ▪		
Analyze the interdependence of a transportation system (structural, associated with sending and receiving information (STL, 17I). system (STL, 17O). ▪		
Design, use, and assess various types of techniques, and devices.		
Information and Communication Technologies application and functionality of the parts of a communication system encoder, transmitter, receiver, decoder, and destination) (STL, 17H).	▪ Create computational models to calculate the change in the energy of one component in a system when the change in the energy of the other component(s) an energy flows in and out of the system are known (HS-PS3-1).	▪ Create models that demonstrate energy and power flow in electromechnical systems and optoelectronic devices. (source, *Information and Communication Technologies*
▪ Explore different steps in the process (encode message, transmitted or switched through a channel, message is received and decoded by the receiver).	▪ Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy (HS-PS3-3).	▪ Analyze the interconnectivity of communication telecommunication, computer, and encoded message is audiovisual systems required to access, store, transmit, and manipulate information.
and send messages using various communications system.	*Information and Communication Technologies* ▪ Analyze the inputs, processes, and outputs ▪ Investigate components of a communication	▪ Assess a variety of communication methods, ▪ Design ▪ Analyze factors that impact the design, development, use, and access to information and communication technologies.
Transportation Technologies functionality of various methods of transportation for land, water,	▪ Assess approaches to reduce noise and promote clear communication. ▪ Analyze the function and application of	▪ Design and assemble a communication ▪ Investigate the

air, and space.

processes necessary for an entire transportation system to operate efficiently

holding, storing, loading)

that influence messages (e.g.

transportation systems.

- Design and develop models of subsystems in suspension, guidance, control, and support).

system to fulfill a specific need.

-

Assess the local, national, and global economic impact of information and communication technologies.

different forms of communication technologies - Assess (e.g. internet, wireless networks).

- Demonstrate the transfer of information (e.g. receiving,

through different communication systems. (STL, 18I).

- Analyze factors

timing, sequencings, processing).

information and communication systems (e.g. propulsion, graphic, optical, radio, tactical).

Maryland Technology Education Standards Grades 6 – 12

Standard Four: Core Technologies and The Designed World - Students will demonstrate knowledge of the core technologies that underpin the designed world and major enterprises that produce the goods and services of the designed world. Core technologies include but are not limited to biotechnology, electrical, electronics, fluid, material, mechanical, optical, structural, and thermal technologies. Major enterprises include medical, agriculture, biotechnology, energy and power, information and communication, transportation, and manufacturing and construction technologies.

Essential Skills and Knowledge Students

who demonstrate understanding can:

Grades 6 - 8	**Grades 9-12**	**Advanced Technology**

Grades 10 -12

system.

manufacturing systems to operate properly

▪

Examine the mechanical and chemical processes of manufacturing.

application, marketing, acquisition, and disposal of manufactured products.

▪

Assess the impact that technology (e.g.

process.

their longevity.

methodologies.

▪

Investigate and propose solutions to issues

government regulations.

Manufacturing Technologies

development, producing, and servicing).

combin ng, and conditioning).

▪

Create machine code to manufacture a

(STL, 19M).

▪

product.

manufacturing process.

transportation.

or direction of power.

technologies in society.

capacities, and times and durations of

quality in manufacturing systems.

▪

Evaluate advances in design and

Design a product using a computer

- Design and develop a model of a new energy efficient vehicle to be use on land, in the sea, in the air, or in space.

how governmental regulations influence the design and operation of transportation system.

Manufacturing Technologies

- Identify the components of a manufacturing
- Identify resources required for (e.g. raw materials, finances, people, tools, machines, time).
- Analyze the development, production, computer-aided design, automation, robots, lines) has on the manufacturing
- Assess the impact that the manufacturing process has on people and the environment.
- Classify manufactured goods according to
- Assess a variety of manufacturing

Transportation Technologies

- Assess the role of transportation in manufacturing, construction, communication, health, safety, recreation, entertainment, and agriculture.
- Analyze intermodal travel of people and goods.

associated with transportation such as cost, safety, environmental impact, energy, and

- Analyze manufacturing processes (designing,
- Describe mechanical processes that change the

form of materials (separating, forming,

- Classify imanufacturing systems as being

customized production, batch production, or production.

- Design and develop an interchangeable part.

product.

- Classify materials as natural, synthetic, or mixed

Analyze the life cycle of a manufactured

- Explore the life cycle costing of products in a

Transportation Technologies

- Analyze how systems (e.g. structural, suspension) in vehicles, aircrafts and other means of transportation impact passenger and cargo safety.
- Utilize a variety of systems for controlling distance and direction of a vehicle, hovercraft, or other means of
- Develop a model of an intelligent transportation system.
- Design systems to modify the speed, torque,

Manufacturing Technologies

- Assess of the role of manufacturing
- Assess the advantages and disadvantages of a variety of manufacturing systems. continuous
- Analyze manufacturing systems in terms of material flow and storage, information flow, assembly events.
- Analyze strategies to control quantity and

manufacturing technologies.

- controlled manufacturing process.

- Describe means of transportation impact passenger

Maryland Technology Education Standards Grades 6 – 12

Standard Four: Core Technologies and The Designed World - Students will demonstrate knowledge of the core technologies that underpin the designed world and major enterprises that produce the goods and services of the designed world. Core technologies include but are not limited to biotechnology, electrical, electronics, fluid, material, mechanical, optical, structural, and thermal technologies. Major enterprises include medical, agriculture, biotechnology, energy and power, information and communication, transportation, and manufacturing and construction technologies.

Essential Skills and Knowledge Students who demonstrate understanding can:

Grades 6 - 8

▪

Examine d

Analyze the

laws, and regulation have in the

structures.

▪

Design and create models of structures.

structures.

society or government to function (e.g.

rail lines, sewers).

development and maintenance of comprise buildings.

▪ Design, use, and assess building material.

▪

Design or model buildings th

Analyze and apply the process and

Construction Technologies

▪ Analyze the type of and purpose for a structures.

▪ Analyze factors used in the selection of designs for structures (e.g. laws, codes, style, cost, climate, function) (STL, 20F).

ifferent subsystems within

▪ subsystems. maintenance of structures and role that community planning,

Grades 9-12

▪ Analyze the various materials and systems that

▪ Analyze factors used to guide the process of designing and making structures.

▪ Examine the need for maintenance, alteration, or renovation to improve structures or to alter their intended use (STL, 20M).

▪ Analyze the steps in the construction process (preparing the site; setting foundations; building the framework; enclosing the structure**;** installing utilities**;** finishing the interior and exterior**;** completing the site).

▪ Examine the need for and application of terotechnology in manufacturing.

▪ Apply marketing techniques to build awareness of a manufactured product.

Construction Technologies

▪ Design and create models of a variety of

▪ Analyze the physical infrastructures that allow a infrastructures of roads, airports, dams, canals,

Advanced Technology

Grades 10 -12

Construction Technologies

▪ Analyze how architectural designs can variety of promote human health, well-being and social interaction.

▪ Design and construct an architectural model that serves a specified purpose. buildings.

optimum value engineering.at utilize

▪ requirements for LEED certification. ▪ Assess the

Maryland Technology Education Standards Grades 6 – 12

Standards and statements have been adapted from the Computer Science Teacher Association (CSTA) *Computer Science Standards.*

Standard Five: Computational Thinking and Computer Science Applications - Students will be able to apply computational thinking skills and computer science applications as tools to develop solutions to engineering problems.

Essential Skills and Knowledge Students who demonstrate understanding can:

Grades 6 -8	**Grades 9-12**	**Advanced Technology**
Grades 10 -12		
solving to des gn solutions to problems.		
▪		
Implement problem solutions using a programming language.		
▪		
Use productivity technology tools for publishing activities.		
software.		
Design, use, and evaluate computational		
▪Automate solutions through algorithmic thinking.		
▪Apply strategies for identifying and solving and analyze data, share information, and/or publish findings.		
modeling and s mulation.		
developing solutions to problems.		
publish, and present information.		
▪Use advanced technology tools to create digital multimedia).		
▪ Select and use appropriate tools and resources to accomplish a variety of tasks and solve problems.	▪Decompose a complex problem or system into parts.	▪Demonstrate proficiency in using a variety of technology programming languages to develop solutions to problems or accomplish tasks.
▪ Use the basic steps in algorithmic problem	▪Use a programming language to develop solutions to problems and/or accomplish tasks.	▪Analyze data and identify patterns through
▪ Use modelingiand simulation to represent and understand natural phenomena.	▪abstractions that model the state and behavior of real-world problems and physical systems.	▪Analyze and/ori design algorithms necessary for ▪Select and apply the appropriate software to facilitate collaboration and project management.
collaborative writing, communication, presentation, and/or	routine hardware and software problems. ▪Use a variety of productivity technology tools to	▪Select and apply productivity technology tools to individual and collect and analyze data, and to record, share,
▪ Apply responsible legal and ethical behaviors	collaborate with others, manage projects, collect	artifacts (e.g. web design, animation, video,

in the use of technology systems and computational thinking and computer programing can be used as tools for problem solving.

▪Apply responsible legal and ethical behaviors in the use of technology systems and software.

▪Apply responsible legal and ethical behaviors in the use of technology systems and software.

▪ Analyze how

Glossary

1. **Abstraction** – the process of representing essential features without including the background details or explanations. In computer science and software engineering, abstraction is used to reduce complexity and allow efficient design and implementation of complex software systems.
2. **Algorithm** – A self-contained step-by-step set of operations to be performed.
3. **Automation:** A machine or system that operates with minimal human control: using automated machines as control for production.
4. **Bioengineering** - Engineering applied to biological and medical systems, such as biomechanics, biomaterials, and biosensors. Bioengineering also includes biomedical engineering as in the development of aids or replacements for defective or missing body organs.
5. **Bioinformatics** – an interdisciplinary field that develops methods and software tools for understanding biological data.
6. **Biotechnology** – The technology of using, adapting, and altering organisms and biological processes for a desired outcome.
7. **CAD** (computer-aided design or computer-aided drafting) - 1. (Design) The use of a computer to assist in the process of designing a part, circuit, building, etc. 2. (Drafting) The use of a computer to assist in the process of creating, storing, retrieving, modifying, plotting, and communicating a technical drawing.
8. **Capital** - One of the basic resources used in a technological system. Capital (money) is the accumulated finances and goods devoted to the production of other goods.
9. **Closed-loop system** - A system that uses feedback from the output to control the input. 10. **Code** – programing instructions.

11. **Communication system** - A system that forms a link between a sender and a receiver making possible the exchange of information.
12. **Computational Thinking** – a process that generalizes a solutions to open ended problems.
13. **Constraint** - A limit to the design process. Constraints may be such things as appearance, funding, space, materials, and human capabilities.
14. **Construction** - The systematic act or process of building, erecting, or constructing buildings, roads, or other structures. 15. **Control system** - An assemblage of control apparatus

coordinated to execute a planned set of actions.

16. **Core technologies** – The building blocks of technology systems including mechanical, structural, electrical, electron, fluid, thermal, optical, material, and bio technologies.
17. **Custom production** - A type of production in which products are designed and built to meet the specific needs and wants of an individual.
18. **Data processing system** - A system of computer hard- ware and software to carry out a specified computational task.
19. **Design** - An iterative decision-making process that produces plans by which resources are converted into products or systems that meet human needs and wants or solve problems.
20. **Design brief** - A written plan that identifies a problem to be solved, its criteria, and its constraints. The design brief is used to encourage thinking of all aspects of a problem before attempting a solution.
21. **Design principle** - Design rules regarding rhythm, balance, proportion, variety, emphasis, and harmony, used to evaluate existing designs and guide the design process.
22. **Design process** – A systematic problem-solving strategy, with criteria and constraints, used to develop many possible solutions to solve a problem or satisfy human needs and wants and to winnow (narrow) down the possible solutions to one final choice.
23. **Design proposal** - A written plan of action for a solution to a proposed problem.
24. **Electrical technology** – The technology of producing, storing, controlling, transmitting and getting work from electrical energy - one of the nine core technologies.

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25. **Electronic technology –** The technology of using small amounts of electricity for controlling: detecting; and information collecting, storage, retrieving, processing, and communicating - one of the nine core technologies.
26. **Engineering** - The profession of or work performed by an engineer. Engineering involves the knowledge of the mathematical and natural sciences (biological and physical) gained by study, experience, and practice that are applied with judgment and creativity to develop ways to utilize the materials and forces of nature for the benefit of mankind.
27. **Engineering design** - The systematic and creative application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.
28. **Failure Analysis –** process of collecting and analyzing data to determine the cause of failure.
29. **Fluid technology –** The technology of using fluid, either gaseous (pneumatics) or liquid (hydraulics) to apply force or to transport materials - one of the nine core technologies.
30. **Forecast** - A statement about future trends, usually as a probability, made by examining and analyzing available information. A forecast is also a prediction about how something will develop usually as a result of study and analysis of available pertinent data.
31. **Information system** - A system of elements that receive and transfer information. This system may use different types of carriers, such as satellites, fiber optics, cables, and telephone lines, in which switching and storage devices are often important parts.
32. **Innovation** - An improvement of an existing technological product, system, or method of doing something.
33. **Invention** - A new product, system, or process that has never existed before, created by study and experimentation.
34. **Manufacturing system** - A system or group of systems used in the manufacturing process to make products for an end user. 35. **Marketing** - The act or process of offering goods or services for sale.
36. **Materials technology –** The technology of producing, altering, and combining materials - one of the nine core technologies.
37. **Mechanical technology –** The technology of putting together mechanical parts to produce, control and transmit motion -one of the nine core technologies.
38. **Medical technology** - Of or relating to the study of medicine through the use of and advances of technology, such as medical instruments and apparatus, imaging systems in medicine, and mammography. Related terms: bio- medical engineering and medical innovations.
39. **Model -** A visual, mathematical, or three-dimensional representation in detail of an object or design, often smaller than the original. A model is often used to test ideas, make changes to a design, and to learn more about what would happen to a similar, real object.
40. **Open-loop system** - A control system that has no means for comparing the output with input for control purposes. Control of open-loop systems often requires human intervention.
41. **Optical technology** - The technology of producing light, controlling light, using light for information collection, processing, storage, retrieval and communication and using light to do work.
42. **Optimization** - An act, process, or methodology used to make a design or system as effective or functional as possible within the given criteria and constraints.
43. **Portfolio –** A systematic and organized collection of a student's work that includes results of research, successful and less successful ideas, notes on procedures, and data collected.
44. **Problem solving** - The process of understanding a problem, devising a plan, carrying out the plan, and evaluating the plan in order to solve a problem or meet a need or want.
45. **Production system** -A technological system that involves producing products and systems by manufacturing (on the assembly line) and construction (on the job).
46. **Programming language –** A constructed language designed to communicate instructions to a machine. Programming languages can be used to create programs to control the behavior of a machine or to express algorithms.
47. **Prototype** - A full-scale working model used to test a design concept by making actual observations and necessary adjustments.

48. **Quality assurance-** The use of quality control techniques associated with a process.
49. **Quality control** - A system by which a desired standard of quality in a product or process is maintained. Quality control usually requires feeding back information about measured defects to further improvements of the process.
50. **Quantitative:** Relating to, or expressible in terms of quantity, typically displayed in a line graph.
51. **Research and development (R&D)** - The practical application of scientific and engineering knowledge for discovering new knowledge about products, processes, and services, and then applying that knowledge to create new and improved products, processes, and services that fill market needs.
52. **Reverse Engineering** - taking apart an object to see how it works in order to duplicate or enhance the object. 53. **Risk** - The chance or probability of loss, harm, failure, or danger.
54. **Scale** - A proportion between two sets of dimensions used in developing accurate, larger or smaller prototypes or models of design ideas.
55. **Structural system** - A system comprised of the framework or basic structure of a vehicle.
56. **Structural technology –** The technology of putting parts and materials together to create supports, containers, shelters, connectors, and functional shapes - one of the nine core technologies.
57. **Subject Matter Expert** - A professional who has acquired knowledge and skills through study and practice over the years, in a particular field or subject, to the extent that his or her opinion may be helpful in fact finding, problem solving, or understanding of a situation.
58. **Subsystem** - A division of a system that, in itself, has the characteristics of a system.
59. **System** - A group of interacting, interrelated, or interdependent elements or parts that function together as a whole to accomplish a goal.
60. **Systems-oriented thinking** - A technique for looking at a problem in its entirety, looking at the whole, as distinct from each of its parts or components. Systems-oriented thinking takes into account all of the variables and relates social and technological characteristics.
61. **Technology** - 1. Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities. 2. The innovation, change, or modification of the natural environment to satisfy perceived human needs and wants.
62. **Technology education** - A study of technology, which provides an opportunity for students to learn about the processes and knowledge related to technology that are needed to solve problems and extend human capabilities.
63. **Technological transfer** - The process by which products, systems, knowledge, or skills, developed under federal research and development funding, is translated into commercial products to fulfill public and private needs.
64. **Telemedicine** - The investigation, monitoring, and management of patients and the education of patients and staff using systems which allow ready access to expert advice and patient information, no matter where the patient or the relevant information is located. The three main dimensions of telemedicine are health service, telecommunications, and medical computer technology.
65. **Terotechnology –** the maintenance of assets in optimal manner. It is the combination of management, financial, engineering, and other practices applied to physical assets such as plant, machinery, equipment, buildings and structures in pursuit of economic life cycle costs.
66. **Thermal technology** - The technology of producing, sorting, controlling, transmitting and getting work from heat energy. 67. **Thermodynamics-** The study of thermal energy as it moves from one substance to another.
68. **Trade-off** - An exchange of one thing in return for another; especially relinquishment of one benefit or advantage for another regarded as more desirable.
69. **Transportation system** - The process by which passengers or goods are moved or delivered from one place to another.
70. **Trend analysis** - A comparative study of the component parts of a product or system and the tendency of a product or system to develop in a general direction over time.

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