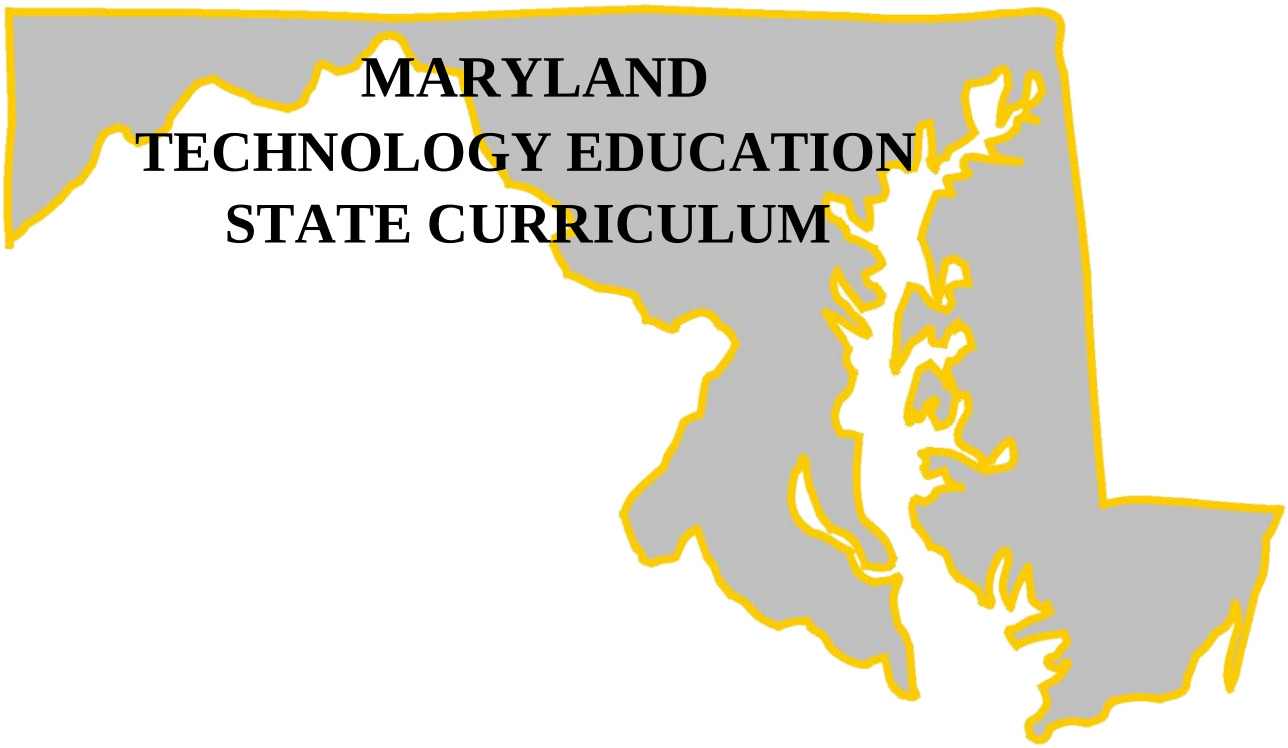

MARYLAND
TECHNOLOGY EDUCATION
STATE CURRICULUM

MARYLAND STATE DEPARTMENT OF EDUCATION
Achievement Matters Most

October 2005

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Robert L. Ehrlich, Jr.
Governor

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Rationale for Technology Education State Curriculum

Nationally, the task of developing content standards for Technology Education began in 1995 with the Technology for All Americans Project (TfFAAP). The National Science Foundation and the National Aeronautics and Space Administration funded this effort to develop a nationally viable rationale and structure for technology education. The International Technology Education Association (ITEA) led this effort, and in 1996 TfAAP published *Technology for All Americans: A Rationale and Structure for the Study of Technology*. This document provided the foundation for Technology Education State Curriculum and established the guidelines for what each person should know and be able to do in order to be technologically literate. ITEA continued to build upon this work to present a general content framework for Technology Education, and in 2000, Standards for Technological Literacy: Content for the Study of Technology was published and disseminated.

As the primary instructional program addressing technological literacy in Maryland, Technology Education must align with the work being done nationally. It is our responsibility to define in measurable terms what it means for Maryland youth to be technologically literate. ITEA defines technological literacy as "The ability to use, manage, understand, and assess technology."

As evidenced in the final report of the Visionary Panel for Better Schools, teachers must have access to a precise and challenging curriculum, one that is uniform in content and expectations and fully aligned with state standards. Additionally, teachers must have the technical assistance and support they need to translate curriculum into effective, individualized instruction. The development of state the State Curriculum for Technology Education is our first step in meeting this goal.

Organization of the Technology Education State Curriculum

Overarching Standards: These are broad statements on what students should know and be able to do. This document has five overarching standards.

> **Indicators:** Each of the overarching standards has several indicators, which are more specific statements on what students should know and be able to do.
>
> **Objectives:** Each indicator has several objectives. These are very specific statements that should assist local school systems in developing curriculum at appropriate grade levels.

Theme: Each grade level has a broad theme (i.e., *Exploring Technology, Invention and Innovation, Technological Systems, Foundations of Technology, Impacts of Technology, Technological Issues and Engineering Design*). These titles correspond to course guides that have been and are being developed by the Center to Advance the Teaching of Technology and Science (CATTS), which is the professional develop arm of the International Technology Education Association (ITEA). They are included to help further guide instruction at the various grade levels.

Grade Levels: Based on the overarching standards, indicators and objectives were written grade-by-grade at the middle school level (6^{th}, 7^{th} and 8^{th}) and at the nine through twelve-grade band.

Maryland High School Graduation Requirement in Technology Education: The italicized indicators and objectives in the nine through twelve-grade band specify the content students must achieve to earn the Maryland High School Graduation Requirement in Technology Education.

Alignment to Standards: There are references throughout where the document aligns to the ITEA Standards for Technological Literacy and Maryland's State Curriculum for Science, Mathematics, Reading/English Languish Arts and Social Studies.

Key to Abbreviations:

ITEA STL (International Technology Education Association Standard for Technological Literacy) **ITEA-CATTS** (Center to Advance the Teaching of Technology and Science)
STATE CURRICULUM (Maryland State Curriculum)

Technology Education Grade 6 State Curriculum

EXPLORING TECHNOLOGY

The Nature of Technology:
Students will develop an understanding of the nature of technology

Indicator Statement:
Develop an understanding of the nature, characteristics and scope of technology. (ITEA, STL 1)

Objective(s):

Explain that new products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (ITEA, STL 1-F)
Explain that technology is closely lined to creativity, which as resulted in innovation. (ITEA, STL 1-H)
Understand, acquire, and use new vocabulary related to technology. (STATE CURRICULUM Reading Processes/ Vocabulary)
Define the term "technology."
Describe how new technologies (products and systems) are developed to solve problems.
Recognize and explain that creativity is the basis for the development of products and systems.
Explain that technology is a powerful force that improves human productivity.
Recognize and explain that technology is a process for transforming raw materials into useful goods and services.

Indicator Statement:
Develop an understanding of the core concepts of technology. (ITEA, STL 2)

Objective(s):

Explain that technology systems include input, processes, output, and, at times, feedback. (ITEA, STL 2-M)
Explain that controls are mechanisms or particular steps that people perform using information about the system that causes systems to change. (ITEA, STL 2-V)
Explain that some **systems** are found in nature and that others are made by humans.
Explain that **systems** have parts or components that work together to accomplish a goal.
Identify and describe technological **systems** including their input, processes, output, and at times, feedback.
Recognize and explain that **systems-thinking** involves considering how every part relates to others.

Indicator Statement:
Develop an understanding of the relationships among technologies and the connections between technology and other fields of study. (ITEA, STL 3)

Objective(s):

Describe how technology systems often interact with each other. (ITEA, STL 3-E)
Explain that knowledge gained from other fields of study has a direct effect on the development of technological products and systems. (ITEA, STL 3-F)
Recognize and explain that technology systems are often combined to create more complex systems.

The Impacts of Technology:
Students will develop abilities to assess **the impacts of technology**.

Indicator Statement:
Develop abilities to assess the impacts of products and systems. (ITEA, STL 13)

Objective(s):

Design and use instruments to gather data. (ITEA, STL 13-F)
Identify trends and monitor potential consequences of technological development. (ITEA, STL 13-H)
Interpret and evaluate the accuracy of the information obtained and determine if it is useful. (ITEA, STL 13-I)
Determine if the human use of a product or system creates positive or negative results.

Indicator Statement:
Develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA, STL 4)

Objective(s):

Explain that the use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. (ITEA, STL 4-D)
Explain that technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (ITEA, STL 4-E)
Explain that the development and use of technology poses ethical issues. (ITEA, STL 4-F)
Explain that economic, political, and cultural issues are influenced by the development and use of technology. (ITEA, STL 4-G)
Recognize and explain that when using technology, results can be good or bad. (State Curriculum Science/ Skills and Processes/History of Science)
Recognize and explain that the use of technology can have unintended consequences.
Describe achievements of men and women from diverse ethnic and cultural backgrounds and people with disabilities who have made various contributions to technology and science. (STATE CURRICULUM Science/ Skills and Processes/History of Science)
Evaluate the historical impact of various technological and scientific contributions. (STATE CURRICULUM Science/ Skills and Processes/History of Science)

Indicator Statement:
Develop an understanding of the effects of technology on the environment. (ITEA, STL 5)

Objective(s):

Explain that the management of waste produced by technological systems is an important societal issue. (ITEA, STL 5-D)
Explain that decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another. (ITEA, STL 5-F)
Recognize and explain that technological changes and advances have consequences for the immediate environment as well as for other places and future times. (STATE CURRICULUM Science/Environment Science/Environmental Issues)

Indicator Statement:
Develop an understanding of the role of society in the development and use of technology. (ITEA, STL 6)

Objective(s):

Explain that throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, and societies. (ITEA, STL 6-D)

Explain that the use of inventions and innovations has led to changes in society and the creation of new needs and wants. (ITEA, STL 6-E)

Explain that social and cultural priorities and values are reflected in technological devices. (ITEA, STL 6-F)

Explain that meeting societal expectations is the driving fore behind the acceptance and use of products and systems. (ITEA, STL 6-G)

Explain that social and cultural priorities and values are reflected in technological devices.

Identify historical examples of human innovation in the areas of food production, clothing, and self-defense.

Indicator Statement:

Develop an understanding of technology on history. (ITEA, STL 7)

Objective(s):

Explain that many inventions and innovations have evolved by using slow and methodical processes of tests and refinements.. (ITEA, STL 7-D)

The specialization function has been at the heart of many technological improvements. (ITEA, STL 7-E)

Engineering Design and Development:

Students will demonstrate knowledge of and apply the **engineering design and development** process.

Indicator Statement:

Develop an understanding of the attributes of design. (ITEA, STL 8)

Objective(s):

Explain that design is a creative planning process that leads to useful products and systems. (ITEA, STL 8-E)

Explain that there is no perfect design. (ITEA, STL 8-F)

Explain that requirements for a design are made up of criteria and constraints. (ITEA, STL 8-G)

Indicator Statement:

Develop an understanding of engineering design. (ITEA, STL 9)

Objective(s):

Explain that design involves a set of steps, which can be performed in different sequences and repeated as needed. (ITEA, STL 9-F)

Explain that brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open form. (ITEA, STL 9-G)

Indicator Statement:

Develop abilities to apply the design process. (ITEA, STL 11)

Objective(s):

Apply a design process to solve problems in and beyond the laboratory-classroom. (ITEA, STL 11-H) Specify criteria and constraints for the design. (ITEA, STL 11-I)
Make tow-dimensional and three-dimensional representations of the design solution. (ITEA, STL 11-J) Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. (ITEA, STL 11-K)
Make a product or system and document the solution. (ITEA, STL 11-L)
Define a problem.
Generate ideas.
Select a solution.
Select and use tools, equipment and materials to make a prototype.
Test the prototype.
Collect, organize, display, analyze, and interpret data to make decisions and predictions. (STATE CURRICULUM Mathematics/Statistics)
Evaluate the effectiveness of a model and recommend necessary changes. (STATE CURRICULUM Science/ Skills and Processes/Technology)
Present results.

Indicator Statement:
Select and use tools and equipment correctly and safely.

Objective(s):

Select and use the appropriate tools and equipment in:

- making two-dimensional and three-dimensional representations of design solutions. (STATE CURRICULUM Mathematics/Knowledge of Measurement)
- forming and molding processes. o

machining processes.

- assembly processes.

Select and use appropriate tools based on the property of materials
Select and use tools and equipment in the testing and evaluation of design solutions.

Indicator Statement:
Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)

Objective(s):

Explain that troubleshooting is a problem solving method used to identify the cause of a malfunction in a technological system. (ITEA, STL 10-F)
Explain that invention is the process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it. (ITEA, STL 10-G)
Explain that some technological problems are best solved through experimentation. (ITEA, STL 10-H)

Indicator Statement:
Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)

Objective(s):

Use information provided in manuals, protocols, or by experienced people to understand how things work. (ITEA, STL 12-H)
Use computers and calculators in various applications. (ITEA, STL 12-J)

Core Technologies:
Students will demonstrate knowledge of and skills related to the **core technologies**, the building blocks of the designed world.

Indicator Statement:
Describe the functioning and applications of core technologies applied in common technology systems.

Objective(s):

Use a graphic organizer or note-taking technique to record important ideas or information about the core technologies. (STATE CURRICULUM Reading Comprehension)

- Identify and describe the core technologies (mechanical, structural, electrical, electronic, thermal, fluid, optical, bio, and material): the building blocks of all technology systems.
- Distinguish core technologies in common technology systems.

Indicator Statement:
Explore the functioning and applications of mechanical systems.

Objective(s):

Identify and describe science concepts and mathematic processes applied in mechanical technology. At least - -

- Force
- Motion
- Energy
- Work
- Power
- Efficiency
- Gravity
- Friction

Identify and describe applications of mechanical technology in the designed world.

The Designed World:
Students will demonstrate knowledge of the major enterprises that produce the goods and services of **the designed world**.

Indicator Statement:
Explore the major enterprises of the designed world.

Objective(s):

Identify and discuss the major enterprises of the designed world (medical, agricultural and related biotechnologies, energy and power, information and communication, transportation, manufacturing, and construction)
At least - -

- Processes
- Products

Indicator Statement:
Develop an understanding of medical technologies. (ITEA, STL 14)

Objective:

Explain that advances and innovations in medial technology are used to improve health. (ITEA, STL 14-G)

Explain that sanitation processes used in the disposal of medical products help to protect people form harmful organisms and disease and shape the ethics of medical safety. (ITEA, STL 14-H)

Explain that the vaccines developed for use immunization require specialized technologies to support environments in which a sufficient amount of vaccines are produced. (ITEA, STL 14-I)

Explain that genetic engineering involves modifying the structure of DNA to produce novel genetic make-ups. (ITEA, STL 14-J)

Indicator Statement:
Develop an understanding of agricultural and biotechnologies. (ITEA, STL 15)

Objective:

Explain that technological advances in agriculture directly affect the time and number of people required to produce food for a large population. (ITEA, STL 15-F)

Explain that biotechnology applies the principles of biology to create commercial products and processes. (ITEA, STL 15-H)

Explain that artificial ecosystems are human-made complexes that replicate some aspects of the natural environment. (ITEA, STL 15-I)

Explain that the development of refrigeration, freezing, dehydration, preservation, and irradiation provide long-term storage of food and reduce health risks caused by tainted food. (ITEA, STL 15-J)

Indicator Statement:
Develop an understanding of energy and power technologies. (ITEA, STL 16)

Objective(s):

Energy is the capacity to do work. (ITEA, STL 16-E)

Explain that power is the rate at which is converted from one form to another or transferred from one place to another, or the rate at which work is done. (ITEA, STL 16-G)

Explain that much of the energy used in our environment is not used efficiently. (ITEA, STL 16-I)

Indicator Statement:
Develop an understanding of information and communication technologies. (ITEA, STL 17)

Objective(s):

Explain that information and communication systems allow information to be transferred from human to human, human to machine, and machine to human. (ITEA, STL 17-H)

Explain that communication systems are made up of a source, encoder, transmitter, receiver, decoder, and destination. (ITEA, STL 17-I)

Explain that the design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message. (ITEA, STL 17-J)

Explain that the use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas. (ITEA, STL 17-K)

Indicator Statement:
Develop an understanding of transportation technologies. (ITEA, STL 18)

Objective(s):

Identify and describe types of transportation systems.
At least - -

- Land
- Water
- Air
- Space

Investigate and describe the functioning of vehicular subsystems. At least –

- Structural
- Propulsion
- Suspension
- Guidance
- Control

Recognize and explain the role transportation plays in the operation of other enterprises.
Explain that transporting people and goods involves a combination of individuals and vehicles. (ITEA, STL 18-F)

Develop an understanding of manufacturing technologies. (ITEA, STL 19)

Objective(s):

Explain that manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning them. (ITEA, STL 19-F)
Explain that manufactured goods may be classified as durable and non-durable. (ITEA, STL 19-G)
Explain that chemical technologies are used to modify or alter chemical substances. (ITEA, STL 19-I)
Explain that materials must first be located before they can be extracted from the earth through such processes as harvesting, drilling, and mining. (ITEA, STL 19-J)

Develop an understanding of construction technologies. (ITEA, STL 20)

Objective(s):

Explain that the selection of designs for structures is based on factors such as building laws and codes, style, convenience, cost climate, and function. (ITEA, STL 20-F)
Explain that structures rest on a foundation. (ITEA, STL 20-G)
Explain that some structures are temporary, while others are permanent. (ITEA, STL 20-H)

Technology Education Grade 7 State Curriculum

INVENTION AND INNOVATION

The Nature of Technology:
Students will develop an understanding of the nature of technology

Indicator Statement:
Develop an understanding of the nature, characteristics and scope of technology. (ITEA, STL 1)

Objective(s):

Understand, acquire and use new vocabulary related to technology. (STATE CURRICULUM Reading Processes/Vocabulary)
Identify and discuss various definitions of "technology."
Explain that technology is evident in every culture, regardless of its level of sophistication or stage of development.
Recognize and describe that the rate of technological innovation and diffusion is increasing rapidly.
Recognize and explain that technology involves inventing new things and modifying the old ones to make them more efficient.
Describe technology as a process for transforming raw materials into useful goods and services.
Explain that new products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (ITEA, STL 1-F)
Explain that the development of technology is a human activity and is the result of individual or collective needs and the ability to be creative. (ITEA, STL 1-G)
Explain that technology is closely linked to creativity, which has resulted in innovation. (ITEA, STL 1-H) Explain that corporations can often create demand for a product by bringing it onto the market and advertising it. (ITEA, STL 1-I)

Indicator Statement:
Develop an understanding of the core concepts of technology. (ITEA, STL 2)

Objective(s):

Explain that an open-loop **system** has no feedback path and requires human intervention to make adjustments.
Recognize and explain that malfunctions in **systems** may affect the function and quality of the system.
Define **requirements** as the parameters placed on the development of a product or system.
Explain that a **trade-off** is a decision process recognizing the need for careful compromises among competing factors.
Explain that technology systems include input, processes, output, and, at times, feedback. (ITEA, STL 2-M)
Explain that systems thinking involves considering how every part relates to others. (ITEA, STL 2-N) Explain that technology systems can be connected to one another. (ITEA, STL 2-P)
Explain that malfunctions in any part of a system may affect the function and quality of the system. (ITEA, STL 2-Q)
Explain that trade-off is a decision process recognizing the need for careful compromises among competing factors. (ITEA, STL 2-S)

Explain that different technologies involve different sets of processes. (ITEA, STL 2-T)
Explain that maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability. (ITEA, STL 2-U)

Indicator Statement:
Develop an understanding of the relationships among technologies and the connections between technology and other fields of study. (ITEA, STL 3)

Objective(s):
Explain that a product or system designed for one purpose may be applied to another purpose.
Identify and describe the interaction between science, math and technology.
Explain that a product, system, or environment developed for one setting may be applied to another setting. (ITEA, STL 3-E)
Explain that knowledge gained from other fields of study has a direct effect on the development of technological products and systems. (ITEA, STL 3-F)

The Impacts of Technology:
Students will develop abilities to assess the **impacts of technology**.

Indicator Statement:
Develop abilities to assess the impacts of products and systems. (ITEA, STL 13)

Objective(s):
Use data collected to analyze and interpret trends in order to identify the positive or negative effects of technology. (ITEA, STL 13-G)
Interpret and evaluate the accuracy of the information obtained and determine if it is useful. (ITEA, STL 13-I)
Analyze important ideas and messages in informational text to determine the impact of a technology product or system. (STATE CURRICULUM Reading/Comprehension of Informational Texts)
Investigate the influence of a specific technology on the individual, family, and community.

Indicator Statement:
Develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA, STL 4)

Objective(s):
Cite instances where technology has caused cultural, social, economic, and political changes.
Describe instances when the use of a new technology yielded unintended consequences.
Describe achievements of men and women from diverse ethnic and cultural backgrounds and people with disabilities who have made various contributions to technology and science. (STATE CURRICULUM Science/ Skills and Processes/History of Science)
Evaluate the historical impact of various technological and scientific contributions. (STATE CURRICULUM Science/ Skills and Processes/History of Science)
Explain that the use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. (ITEA, STL 4-D)
Explain that technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (ITEA, STL 4-E)

Explain that the development and use of technology poses ethical issues. (ITEA, STL 4-F)
Explain that economic, political, and culture issues are influenced by the development and use of technology. (ITEA, STL 4-G)

Indicator Statement:
Develop an understanding of the effects of technology on the environment. (ITEA, STL 5)

Objective(s):

Explain that decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another. (ITEA, STL 5-F)
Identify and describe a local, regional or global issue surrounding technology (STATE CURRICULUM Science/Environmental Science/ Environmental Issues)

Indicator Statement:
Develop an understanding of the role of society in the development and use of technology. (ITEA, STL 6)

Objective(s):

Explain how the use of inventions and innovations has lead to changes in society and the creation of new needs and wants.
Recognize and explain that meeting societal expectations is the driving force behind the acceptance and use of products and systems.
Describe how many inventions and innovations evolved by a slow and methodical process of testing and refinement.
Construct various timelines of key events, people, and periods of the historic eras studied and explain how major events are related to each other.
Explain that throughout history, new technologies have results form the demands, values, interests of individuals, businesses, industries, and societies. (ITEA, STL 6-D)
Explain that the use of inventions and innovations has led to changes in society and the creation of needs and wants. (ITEA, STL 6-E)
Explain that social and cultural priorities and values are reflected in technological devices. (ITEA, STL 6-F
Explain that meeting societal expectations is the driving fore behind the acceptance and use of products and systems. (ITEA, STL 6-G)

Indicator Statement:
Develop an understanding of the influence of technology on history. (ITEA, STL 7)

Objective(s):

- Explain that many inventions and innovations have evolved slowly by using slow and methodical processes of tests and refinements. (ITEA, STL 7-C)
- Explain that the specialization of function has been at the heart of many technological improvements. (ITEA, STL 7-D)
- Explain that in the past, an invention or innovation was not usually developed with the knowledge of science. (ITEA, STL 7-F)

Engineering Design and Development:
Students will demonstrate knowledge of and apply the **engineering design and development** process.

Indicator Statement:
Develop an understanding of the attributes of design. (ITEA, STL 8)

Objective(s):

Recognize and explain how every design has some negative aspects.
Describe why there may be more than one viable design solution
Evaluate and modify designs and products created to solve a problem and explain how one solution can cause other problems. (STATE CURRICULUM Science/Skills and Processes/Technology)
Explain that design is a creative planning process that leads to useful products and processes. (ITEA, STL 8-E)
Explain that there is no perfect design. (ITEA, STL 8-F)
Explain that requirements for a design are made up of criteria and constraints. (ITEA, STL 8-G)

Indicator Statement:
Develop an understanding of engineering design. (ITEA, STL 9)

Objective(s):

Define brainstorming as a group problem-solving design process in which each person in the group presents ideas.
Explain that design involves a set of steps, which can be performed in different sequences and repeated as needed. (ITEA, STL 9-F)
Explain that brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open form. (ITEA, STL 9-G)
Explain that modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. (ITEA, STL 9-H)

Indicator Statement:
Develop abilities to apply the design process. (ITEA, STL 11)

Objective(s)

Apply the design process to solve problems in and beyond the classroom. (ITEA, STL 11-H)
Specify criteria and constraints for design. (ITEA, STL 11-I)
Make two-dimensional and three-dimensional representations of the design solution. (ITEA, STL 11-J) Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. (ITEA, STL 11-K)
Make a product or system and document the solution. (ITEA, STL 11-L)
Design, plan, and construct objects in response to a particular need or problem (e.g., instruments, machines, structures, and systems). (STATE CURRICULUM Science/Skills and Processes/ Technology) At least - -

- Identify the problem.
- Gather the needed information.
- Search for creative solutions.
- Create scale drawings to solve problems.
- Use tools, materials, and machines to make a prototype.
- Identify attributes, units, or systems of measurements or apply a variety of techniques, formulas, tools or technology for determining measurements.
- Make predictions or draw conclusions from available information.
- Test the prototype.
- Refine the design.

Describe the reasoning processes used to reach the solution to a problem.

Indicator Statement:
Select and use tools and equipment correctly and safely.

Objective(s):

Select and use the appropriate tools and equipment in:

- making two-dimensional and three-dimensional representations of design solutions.
- forming and molding processes.
- machining processes.
- assembly processes.

Select and use appropriate tools based on the property of materials
Select and use tools and equipment in the testing and evaluation of design solutions.

Indicator Statement:
Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)

Objective(s):

Make connections between the use of thinking, imagining, and inventing skills and the solution of practical problems.
Compare the processes of invention and innovation.
Explain that invention is the process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it. (ITEA, STL 10-G)
Explain that some technological problems are best solved through experimentation. (ITEA, STL 10-H)

Indicator Statement:
Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)

Objective(s):

Use information provided in manuals, protocols, or by experienced people to understand how things work. (ITEA, STL 12-H)
Use tools, materials, and machines to safely diagnose, adjust, and repair systems. (ITEA, STL 12-I) Use computers and calculators in various applications. (ITEA, STL 12-J)
Use tools, materials, and machines to safely diagnose, adjust, and repair systems.

Core Technologies:
Students will demonstrate knowledge of and skills related to the **core technologies**, the building blocks of the designed world.

Indicator Statement:
Explain the functioning and applications of core technologies applied in common technology systems.

Objective(s):

Explain the functioning the core technologies (mechanical, structural, electrical, electronic, thermal, fluid, optical, bio, and material)
In terms of:

- Common components
- Basic system design
- Safety

Identify and describe applications of the core technology in the designed world.

Indicator Statement:
Describe the functioning and applications of **structural technology systems**.

Objective(s):

Identify and explain science concepts and mathematic processes applied in structural technology.
At least - -

- Compression
- Tension
- Efficiency
- Center of gravity

Identify and describe applications of structural technology in the designed world.

The Designed World:
Students will demonstrate knowledge of the major enterprises that produce the goods and services of **the designed world**.

Indicator Statement:
Discuss the major enterprises of the designed world.

Objective(s):

Describe the major enterprises of the designed world (medical, agricultural and related biotechnologies, energy and power, information and communication, transportation, manufacturing, and construction) At least - -

- Occupations
- Processes
- Products

Indicator Statement:
Develop an understanding of medical technologies. (ITEA, STL 14)

Objective(s):

Explain that advances and innovations in medial technology are used to improve health. (ITEA, STL 14-G)

Indicator Statement:
Develop an understanding of information and communication technologies. (ITEA, STL 17)

Objective(s):

Explain that the use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas. (ITEA, STL 17-K)

Indicator Statement:
Develop an understanding of information and communication technologies. (ITEA, STL 18)

Objective(s):

Explain that governmental regulations often influence the design and operation of transportation systems. (ITEA, STL 18-H)

Indicator Statement:
Develop an understanding of manufacturing technologies. (ITEA, STL 19)

Objective(s):

Describe manufacturing processes.

At least - -

- Designing
- Developing
- Producing
- Servicing

Classify mechanical processes that change the form of materials.

At least - -

- Separating
- Forming
- Combining
- Conditioning

Describe the role manufacturing plays in the operation of other enterprises.

Explain that marketing a product involves informing the public about it as well as selling and distributing it. (ITEA, STL 19-K)

Technology Education Grade 8 State Curriculum

TECHNOLOGICAL SYSTEMS

The Nature of Technology:
Students will develop an understanding of the nature of technology.

Indicator Statement:
Develop an understanding of the nature, characteristics and scope of technology. (ITEA, STL 1)

Objective(s):

Understand, acquire, and use new vocabulary related to technology. (STATE CURRICULUM Reading Processes/ Vocabulary)

- Compare various definitions of "technology."

Explain that technological innovation is driven by the profit motive.

Explain that technology creates new economic opportunities and social benefits and, at the same time, produces new social problems.

Describe how and why people use technology to modify their natural environment and the impact of those modifications. (STATE CURRICULUM Social Studies/Geography)

Explain that technology incorporates human knowledge into physical hardware that will eventually respond to some human need or desire.

Explain that new products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (ITEA, STL 1-F)

Explain that corporations can often create demand for a product by bringing it onto the market and advertising it. (ITEA, STL 1-I)

Indicator Statement:
Develop an understanding of the core concepts of technology. (ITEA, STL 2)

Objective(s):

Explain that technology systems include input, processes, output, and, at times, feedback. (ITEA, STL 2-M)Explain that systems thinking involves considering how every part relates to others. (ITEA, STL 2-N)

Explain that an open-loop system has n o feedback path and requires human intervention, while a closed-loop system uses feedback. (ITEA, STL 2-O)

Explain that technology systems can be connected to one another. (ITEA, STL 2-P)

Explain that malfunctions in any part of a system may affect the function and quality of the system. (ITEA, STL 2-Q)

Explain that requirements are the parameters placed on the development of a product or system. (ITEA, STL 2-R)

- Explain that different technologies involve different sets of processes. (ITEA, STL 2-T)
- Explain that maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability. (ITEA, STL 2-U)

Recognize and explain that different technologies involve different sets of **processes**.Explain that controls are mechanisms or particular steps that people perform using information about the system that causes systems to change. (ITEA, STL 2-V)

Explain that complex systems have many layers of **controls** and multiple feedback loops.

Indicator Statement:
Develop an understanding of the relationships among technologies and the connections between technology and other fields of study. (ITEA, STL 3)

Objective(s):

Explain that knowledge gained from other fields of study has a direct effect on the development of technological products and systems.
Describe how technological ideas are sometimes protected through the process of patenting.
Recognize and explain that technological progress promotes the advancement of science and mathematics.
Describe how technology systems often interact with each other. (ITEA, STL 3-E)
Explain that a product, system, or environment developed for one setting may be applied to another setting. (ITEA, STL 3-E)
Explain that knowledge gained from other fields of study has a direct effect on the development of technological products and systems. (ITEA, STL 3-F)

The Impacts of Technology:
Students will develop abilities to assess the **impacts of technology**.

Indicator Statement:
Develop abilities to assess the impacts of products and systems. (ITEA, STL 13)

Objective(s):

Design and use instruments to gather data. (ITEA, STL 13-F)
Use data collected to analyze and interpret trends in order to identify the positive or negative effects of technology. (ITEA, STL 13-G)
Identify trends and monitor potential consequences of technological development. (ITEA, STL 13-H)
Interpret and evaluate the accuracy of the information obtained and determine if it is useful. (ITEA, STL 13-I)
Analyze important ideas and messages in informational text to determine the impact of a technology product or system. (STATE CURRICULUM Reading/Comprehension of Informational Texts)
Examine the trade-offs of using a product or system and defend its use. Design an instrument to gather data about a product or system.
Use data collected to analyze the positive or negative effects of a technology.

Indicator Statement:
Develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA, STL 4)

Objective(s):

Explain that the use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use. (ITEA, STL 4-D)
Recognize and explain how technology affects the way people of different cultures live, the kind of work they do, and the decisions they have to make.
Examine how technology used in education has changed learning environments. Describe how the use of technology poses ethical problems.
Describe achievements of men and women from diverse ethnic and cultural backgrounds and people with disabilities who have made various contributions to technology and science. (STATE CURRICULUM Science/ Skills and Processes/History of Science)

Evaluate the historical impact of various technological and scientific contributions. (STATE CURRICULUM Science/ Skills and Processes/History of Science)

Indicator Statement:
Develop an understanding of the effects of technology on the environment. (ITEA, STL 5)

Objective(s):

Explain that the management of waste produced by technological systems is an important societal issue. (ITEA, STL 5-D)

Describe how technologies can be used to repair damage caused by natural disasters and break down waste form the use of various products and systems. (ITEA, STL 5-E)

Describe how technologies can be used to break down waste that results from the use of various products and systems.

Indicator Statement:
Develop abilities to assess the impact of products and systems. (ITEA, STL 13)

Objective(s):

Explain that throughout history, new technologies have results form the demands, values, interests of individuals, businesses, industries, and societies. (ITEA, STL 6-D)

Design and use instruments to gather data. (ITEA, STL 13-F)

Use data collected to analyze and interpret trends in order to identify the positive or negative effects of technology. (ITEA, STL 13-G)

Identify trends and monitor potential consequences of technological development. (ITEA, STL 13-H)

Interpret and evaluate the accuracy of the information obtained and determine if it is useful. (ITEA, STL 13-I)

Indicator Statement:
Develop an understanding of the role of society in the development and use of technology. (ITEA, STL 6)

Objective(s):

Describe achievements of men and women from diverse ethnic and cultural backgrounds and people with disabilities who have made various contributions to science, technology and mathematics.

Explain that individual, family and community concerns may expand or limit the development of technologies.

Describe how measurement, control systems, and an understanding of spatial relationships contributed to the design of structures throughout history.

Analyze the effects of technological change, such as factories, machinery, transportation, communication, and new technology and resource use on economic growth. (STATE CURRICULUM Social Studies/Economics)

Explain that the specialization of function has been at the heart of many technological improvements.

Indicator Statement:
Develop an understanding of the influence of technology on history. (ITEA, STL 7)

Objective(s):

Explain that the design and construction of structures for service or convenience have evolved from the development of techniques for measurement, controlling systems, and the understanding spatial relationships. (ITEA, STL 7-E)

Engineering Design and Development:
Students will demonstrate knowledge of and apply the **engineering design and development** process.

Indicator Statement:
Develop an understanding of the attributes of design. (ITEA, STL 8)

Objective(s):

Explain that requirements for a design are made up of criteria and restraints.

Indicator Statement:
Develop an understanding of engineering design. (ITEA, STL 9)

Objective(s):

Explain that modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.

Indicator Statement:
Develop abilities to apply the design process. (ITEA, STL 11)

Objective(s):

Identify the people needed to solve a problem.
Gather information (either in print or electronic media) to gain background knowledge related to a problem.
Follow a prescribed time line to solve a problem.
Select and use appropriate tools and machines. Use
appropriate materials to solve a problem.
Acquire the capital needed to solve a problem.
Use appropriate energy resources needed to solve a problem.
Design and construct tables, charts, databases, spreadsheets, and graphs to display data. (STATE CURRICULUM Science/Skills and Processes/Scientific Inquiry)

Indicator Statement:
Select and use tools and equipment correctly and safely.

Objective(s):

Select and use the appropriate tools and equipment in:

- making two-dimensional and three-dimensional representations of design solutions. (STATE CURRICULUM Mathematics/Knowledge of Measurement)
- forming and molding processes. o

machining processes.

- assembly processes.

Select and use appropriate tools based on the property of materials
Select and use tools and equipment in the testing and evaluation of design solutions.

Indicator Statement:
Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)

Objective(s):

Describe experimentation as the method of testing an idea, device, or process under controlled conditions. Explain that troubleshooting is a problem solving method used to identify the cause of a malfunction in a technological system. (ITEA, STL 10-F)

Indicator Statement:
Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)

Objective(s):

Use information provided in manuals, protocols, or by experienced people to understand how things work. (ITEA, STL 12-H)
Use tools, materials, and machines to safely diagnose, adjust, and repair systems. (ITEA, STL 12-I) Operate and maintain systems in order to achieve a given purpose. (ITEA, STL 12-K)

Core Technologies:
Students will demonstrate knowledge of and skills related to the **core technologies**, the building blocks of the designed world.

Indicator Statement:
Discuss the functioning and applications of core technologies applied in common technology systems.

Objective(s):

Explain the functioning of the core technologies: mechanical, structural, electrical, electronic, thermal, fluid, optical, bio, and material.
In terms of:
- Common components
- Basic system design
- Safety
- Simple controls
- System performance evaluation

Classify and describe applications of the core technologies in the designed world.

Indicator Statement:
Investigate **materials technology**.

Objective(s):

Classify industrial materials. At least - -
- Metals
- Alloys
- Nonmetals
- Composites
- Biomaterials

Identify and explain science concepts and mathematic processes applied in structural technology.
At least - -

- o Strength of shapes o
- Forces
- o Center of gravity o
- Moments of inertia o
- Stress
- o Strain
- o Deflection
- o Efficiency

The Designed World:
Students will demonstrate knowledge of the major enterprises that produce the goods and services of **the designed world**.

Indicator Statement:
Discuss the major enterprises of the designed world.

Objective(s):

Explain the major enterprises of the designed world (medical, agricultural and related biotechnologies, energy and power, information and communication, transportation, manufacturing, and construction)
At least - -

- o Occupations o
- Processes
- o Products o
- Problems

Indicator Statement:
Develop an understanding of medical technologies. (ITEA, STL 14)

Objective(s):

Explain that the vaccines developed for use immunization require specialized technologies to support environments in which a sufficient amount of vaccines are produced. (ITEA, STL 14-I)
Explain that genetic engineering involves modifying the structure of DNA to produce novel genetic make-ups. (ITEA, STL 14-J)

Indicator Statement:
Develop an understanding of agricultural and biotechnologies. (ITEA, STL 15)

Objective(s):

Explain that a wide range of specialized equipment and practices is used to improve the production of food, fiber, fuel, and other useful products and in the care of animals. (ITEA, STL 15-G)

Indicator Statement:
Develop an understanding of energy and power technologies. (ITEA, STL 16)

Objective(s):

Explain that energy can be used to do work, using many processes. (ITEA, STL 16-F)

Explain that power systems are used to drive and provide propulsion to other technological products and systems. (ITEA, STL 16-H)

Indicator Statement:
Develop an understanding of information and communication technologies. (ITEA, STL 17)

Objective(s):

Explain that information and communication systems allow information to be transferred from human to human, human to machine, and machine to human. (ITEA, STL 17-H)
Explain that communication systems are made up of a source, encoder, transmitter, receiver, decoder, and destination. (ITEA, STL 17-I)
Explain that the use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas. (ITEA, STL 17-K)
Identify and describe the parts of a communication system.
At least - -

- Source
- Encoder
- Transmitter
- Receiver
- Decoder
- Destination

Indicator Statement:
Develop an understanding of transportation technologies. (ITEA, STL 18)

Objective(s):

Explain that transporting people and goods involves a combination of individuals and vehicles. (ITEA, STL 18-F)
Explain that transportation vehicles are made up of subsystems (structural, propulsion, suspension, guidance, control, and support) that must function together for a system to work effectively. (ITEA, STL 18-G)
Explain that governmental regulations often influence the design and operation of transportation systems. (ITEA, STL 18-H)
Explain that processes such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently. (ITEA, STL 18-I))

Indicator Statement:
Develop an understanding of manufacturing technologies. (ITEA, STL 19)

Objective(s):

Explain that the manufacturing process includes designing, development, making, and servicing of products and systems. (ITEA, STL 19-H)

Indicator Statement:
Develop an understanding of construction technologies. (ITEA, STL 20)

Objective(s):

Explain that structures rest on a foundation. (ITEA, STL 20-G)
Explain that some structures are temporary, while others are permanent. (ITEA, STL 20-H)
Explain that buildings generally contain a variety of subsystems. (ITEA, STL 20-I)

Technology Education Grades 9-12 State Curriculum

FOUNDATIONS OF TECHNOLOGY

The Nature of Technology:
Students will develop an understanding of the nature of technology.

Indicator Statement:
Develop an understanding of the nature, characteristics and scope of technology. (ITEA, STL 1)

Objective(s):

Refine and extend a conceptual understanding of new words regarding technology. (STATE CURRICULUM Reading Processes/ Vocabulary)

- *Analyze various definitions of "technology."*

Explain that technology creates new economic opportunities and social benefits and, at the same time, produces new social problems.

Recognize and explain that technological innovation is often driven by the profit motive.

Explain that technology liberates us from demeaning and demanding labor and, therefore, creates more leisure.

Explain that technology has increased human life span by conquering many debilitating diseases.

Describe how technology can be intrusive in our lives and may threaten our right to privacy.

Indicator Statement:
Develop an understanding of the core concepts of technology. (ITEA, STL 2)

Objective(s):

Explain that systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems. (ITEA, STL 2-X)

Explain that the stability of a technological system is influenced by all of the components of the system, especially those in the feedback loop. (ITEA, STL 2-Y)

Explain that selecting resources involves trade-offs between competing values, such as availability, cost, durability, and waste. (ITEA, STL 2-Z)

- Explain that new technologies create new processes. (ITEA, STL 2-CC)
- Explain that management is the process of planning, organizing, and controlling work. (ITEA, STL 2-EE)

Recognize and explain that systems-thinking applies logic and creativity with appropriate compromises in complex real-life problems.

Explain that requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development. (ITEA, STL 2-AA)

Define optimization as an ongoing process of designing or making a product and is dependent on criteria and constraint.

Indicator Statement:
Develop an understanding of the relationships among technologies and the connections between technology and other fields of study. (ITEA, STL 3)

Objective(s):

Explain that technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. (ITEA, STL 3-G)

Explain that technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across fields. (ITEA, STL 3_H)
Explain that technological ideas are sometimes protected by the process of patenting. (ITEA, STL 3-I)
Explain that technological progress promotes the advancement of science and mathematics. (ITEA, STL 3-J)
Explain the strong relationship between technology and the study of science including the common interest in natural scientific laws, systems, design, and modeling.
Express that mathematical concepts such as the use of measurement, symbols, estimation, accuracy, and the idea of scaling and proportion are key to the development of technology.
Explain how the development of computer databases has revolutionized research in the social sciences.

The Impacts of Technology:
Students will develop abilities to assess the **impacts of technology**.

Indicator Statement:
Develop abilities to assess the impacts of products and systems. (ITEA, STL 13)

Objective(s):

Refine and extend comprehension skills by selecting, reading, analyzing and evaluating a variety of print and electronic texts about products and systems. (STATE CURRICULUM Reading Comprehension /Informational Texts)
Collect information and evaluate its quality. (ITEA, STL 13-J)
Defend and rationalize the development and use of a proposed technology.

At least - -

- *Who will have access to the technology?*
- *Who will control it?*
- *What are the costs of not developing or using the technology?*
- *Who will benefit and who will lose by the technology?*
- *What will the impact of the technology be on my family, my community, and me?*

Indicator Statement:
Develop an understanding of the cultural, social, economic, and political effects of technology. (ITEA, STL 4)

Objective(s):

Explain that changes in society caused by the use of technology can range from gradual to rapid and from subtle to obvious. (ITEA, STL 4-H)
Explain that decisions about the use of technology involve trade-offs between positive and negative effects. (ITEA, STL 4-I)
Cite instances where ethical considerations have impacted the development, selection, and use of technologies. (ITEA, STL 4-J)
Explain how the transfer of technology from one society to another affects culture, society, economics, and politics. (ITEA, STL 4-K)
Explain situations where technological development has magnified the inequities among peoples and societies.
Justify the contention that individual citizens have to make informed decisions about the development and use of technology

Indicator Statement:
Develop an understanding of the effects of technology on the environment. (ITEA, STL 5)

Objective(s):

Explain that humans devise technologies to reduce the negative consequences of other technologies. (ITEA, STL 5-K)

Analyze the relationship between technological processes and natural processes.

Investigate technologies designed to reduce the negative consequences of other technologies.

Research and report on processes (reusing, reducing, and recycling) that conserve water, soil, and energy.

Assess the effectiveness of the use of technology to monitor environmental conditions.

Indicator Statement:
Develop an understanding of the role of society in the development and use of technology. (ITEA, STL 6)

Objective(s):

Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.

Defend the proposition that the evolution of civilization has been directly affected by, and has been in turn affected, the development and use of tools and materials.

Explain that early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.

Analyze the development and use of technology in the pre-agricultural, agricultural, industrial, and information ages.

Identify and describe instances where societal opinions and demands or corporate interests have influenced the decision to develop a technology.

Explain that a number of different factors, such as advertising, the strength of the economy, the goals of the company, and the latest fads contribute to shaping the design of and demand for various technologies. (ITEA, STL 6-J)

Indicator Statement:
Develop an understanding the influence of technology on history. (ITEA, STL 7)

Objective(s):

Analyze how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.

Explain that most technological development has been evolutionary, the result of a series of refinements to a basic invention. (ITEA, STL 7-G)

Explain that the evolution of civilization has been directly affected by, and has in turn affected the development of tools and materials. (ITEA, STL 7-H)

Explain that throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape. (ITEA, STL 7-I)

Explain that early in the history of technology, the development of many tools and machines was not based on scientific knowledge but on technological know-how. (ITEA, STL 7-J)

Explain that the Iron Age was defined by the use of iron and steel as the primary materials for tools. (ITEA, STL 7-K)

Explain that the Middle Ages saw the development of many technological devices that produced long-lasting effects on technology and society. (ITEA, STL 7-L)

Explain that the Renaissance, a time of rebirth of the arts and humanities, was also an important period in the history of technology. (ITEA, STL 7-M)

Explain that the Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time. (ITEA, STL 7-N)
Explain that the Information Age places emphasis on the processing and exchange of information. (ITEA, STL 7-O)

Engineering Design and Development:
Students will demonstrate knowledge of and apply the **engineering design and development** process.

Indicator Statement:
Develop an understanding of the attributes of design. (ITEA, STL 8)

Objective(s):

Explain that the design process is a systematic, iterative, approach to problem solving that yields design solutions.
Explain that the design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating a design, using specifications, refining a design, creating or making it, and communicating processes and results. (ITEA, STL 8-H)
Explain that design problems are seldom presented I a clearly defined form. (ITEA, STL 8-
I) Analyze the phases of the design process.
Explain why designs need to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (ITEA, STL 8-J)
Explain that requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (ITEA, STL 8-K)

Indicator Statement:
Develop an understanding of engineering design. (ITEA, STL 9)

Objective(s):

Describe the personal characteristics involved in engineering.
At least - -

- *Creativity*
- *Resourcefulness*
- *Ability to visualize and think abstractly*

Explain that established design principles are used to evaluate existing designs, to collect date, and to guide the design process. (ITEA, STL 9-I)
Explain that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. (ITEA, STL 9-J)
Explain that a prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (ITEA, STL 8-K)
Explain that the process of engineering design takes into account a number of factors. (ITEA, STL 8-L)
Explain constraints on the engineering design process.
At least –

- *Safety*
- *Reliability*

o *Economic considerations* o
Quality control
o *Environmental concerns* o
Manufacturability
o *Maintenance*
o *Human factors engineering (ergonomics)*

Indicator Statement:
Develop abilities to apply and analyze the design process. (ITEA, STL 11)

Objective(s):

Identify the design problem to solve and to decide whether to address it. (ITEA, STL 11-M)
Identify criteria and constraints and determine how these will affect the design process. (ITEA, STL 11-N)
Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (ITEA, STL 11-O)
Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed. (ITEA, STL 11-P)
Develop and produce a product or system using a design process. (ITEA, STL 11-Q)
Evaluate final solutions and communicate observations, processes, and results of the entire design process, suing verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. (ITEA, STL 11-R)
Define the problem.
Brainstorm.
Research and generate ideas.
Identify criteria and specify constraints. Explore possibilities.
Select an approach.
Develop a design proposal.
Make a model or prototype.
Test and evaluate the design. Redesign.
Create or make it.
Communicate processes or results.

Indicator Statement:
Select and use tools and equipment correctly and safely.

Objective(s):

Select and use the appropriate tools and equipment in:
o *making two-dimensional and three-dimensional representations of design solutions.* o *forming and molding processes.*
o *machining processes.* o *assembly processes.*
Select and use appropriate tools based on the properties of materials.
Select and use tools and instruments in the testing and evaluation of design solutions.

Indicator Statement:
Develop an understanding of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (ITEA, STL 10)

Objective(s):

Explain that 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. (ITEA, STL 10-I)

Explain that not all problems are technological, and not every problem can be solved using technology. (ITEA, STL 10-K)

Explain that technological problems require a multidisciplinary approach. (ITEA, STL 10-L)

Apply the research and development problem-solving approach to prepare devices and systems for the marketplace.

Explain why technological problems must be researched before they can be solved.

Identify and describe problems that cannot be solved through the use of technology.

Indicator Statement:
Develop abilities to use and maintain technological products and systems. (ITEA, STL 12)

Objective(s):

Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques. (ITEA, STL 12-L)

Diagnose a system that is malfunctioning and use tools, materials, and knowledge to repair it. (ITEA, STL 12-M)

Operate systems so that they function in a way they were designed. (ITEA, STL 12-O)

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

Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate. (ITEA, STL 12-P).

Core Technologies:
Students will demonstrate knowledge of and skills related to the **core technologies**, the building blocks of the designed world.

Indicator Statement:
Discuss the functioning and applications of core technologies applied in common technology systems.

Objective(s):

Describe the core technologies (mechanical, structural, electrical, electronic, thermal, fluid, optical, bio, and material) as they are applied in the designed world.

Analyze the functioning of the core technologies in the designed world. In terms of:

- *common components*
- *basic system design*
- *safety*
- *simple controls*
- *system performance evaluation*

Indicator Statement:
Analyze the functioning and applications of mechanical systems.

Objective(s):

Identify and describe applications of mechanical technology in the designed world. Such as:

- *Levers*
- *Inclined planes*
- *Wedges*
- *Wheels and axles*
- *Pulleys*
- *Screws*
- *Gears*
- *Cams*
- *Linkages*

Explain science concepts and mathematic processes applied in mechanical technology. Such as:

- *Force*
- *Motion*
- *Energy*
- *Work*
- *Power*
- *Efficiency*
- *Gravity*
- *Friction*

Indicator Statement:
Analyze the functioning and applications of structural systems.

Objective(s):

Identify and describe applications of structural technology in the designed world. Such as:

- *Post and beam structures*
- *Frame structures*
- *Suspension structures*
- *Cantilever structures*
- *Mass structures*
- *Pressurized structures*

Explain science concepts and mathematical concepts applied in mechanical technology. Such as:

- *Compression*
- *Tension*
- *Efficiency*
- *Center of gravity*

Indicator Statement:
Analyze the functioning and applications of materials technology.

Objective(s):

Identify and describe applications of materials technology in the designed world. Such as:

- *Metals*
- *Alloys*
- *Nonmetals*
- *Composites*
- *Biomaterials*

Explain science concepts and mathematical concepts applied in materials technology. Such as:

- *Strength of shapes*
- *Forces*
- *Center of gravity*
- *Moments of inertia*
- *Stress*
- *Strain*
- *Deflection*
- *Efficiency*

Indicator Statement:
Analyze the functioning and applications of electrical systems.

Objective(s):

Identify and describe applications of electrical technology in the designed world. Such as:

- *Generators*
- *Electric motors*
- *Alarm systems*
- *Automobile electrical systems*

Explain science concepts and mathematical concepts applied in electrical technology. Such as:

- *Measure resistance*
- *Conduction*
- *Semi-conduction*
- *Current (alternating and direct)*
- *Voltage*
- *Power*
- *Circuits*
- *Magnetism*
- *Ohm's law*
- *Ratio*

Identify and describe how various types of electric circuits (i.e., series and parallel) provide a means of transferring and using electrical energy to produce heat, light, sound, as well as chemical changes.

Analyze the magnetic effects of current (i.e., electromagnet) and the electric effects of magnets (i.e., motors).
Solve for the unknown in a linear equation related to electrical technology.

Indicator Statement:
Analyze the functioning and application of electronic technology systems.

Objective(s):

Identify and describe applications of electronic technology in the designed world.
Such as:

- *Computers*
- *Telephones*
- *Radio and television*

Explain science concepts and mathematical concepts applied in electronic technology. Such as:

- *Electromagnetic waves*
- *Digital logic*
- *Binary numbers*
- *Frequency*
- *Amplification*

Indicator Statement:
Analyze the functioning and application of thermal technology systems.

Objective(s):

Identify and describe applications of thermal technology in the designed world.
Such as:

- *Thermometer*
- *Refrigerator*
- *Furnace*
- *Air conditioner*
- *Heat engines*

Explain science concepts and mathematical concepts applied in thermal technology. Such as:

- *Convection*
- *Conduction*
- *Radiation*
- *Insulation*
- *Efficiency*

Indicator Statement:
Analyze the functioning and applications of fluid technology systems.

Objective(s):

Identify and describe applications of fluid technology in the designed world.
Such as:

- *Air pumps*

- *Water pumps*
- *Automobile brakes*
- *Airfoils*

Explain science concepts and mathematical concepts applied in fluid technology. Such as:

- *Pressure*
- *Vacuum*
- *Volume*
- *Area*
- *Ratio*

Indicator Statement:
Analyze the functioning and application of optical systems.

Objective(s):

Identify and describe applications of optical technology in the designed world. Such as:

- *Microscope and magnifier*
- *Laser*
- *Fiber optics*
- *Optical telescope*
- *Bar code reader*
- *Scanner*

Explain science concepts and mathematical concepts applied in optical technology. Such as:

- *Light waves*
- *Frequency*
- *Period*
- *Reflection*
- *Refraction*
- *Diffraction*
- *Proportion (direct and indirect)*
- *Superposition*
- *Interference*
- *Doppler effect*

Indicator Statement:
Analyze the functioning and application of biotechnology systems.

Objective(s):

Identify and describe applications of biotechnology in the designed world. Such as:

- *Genetically modified food*
- *DNA fingerprinting*
- *Oil biodegradation*
- *Insulin production*
- *Bioethics*

Explain science concepts and mathematical concepts applied in biotechnology. Such as:

- *Genes*
- *Genetic code*
- *DNA structure*
- *Enzymes*
- *Proteins*
- *Cloning*
- *Mutations*
- *Chromosome number*
- *Genetic recombination*
- *Anaerobic conversion*
- *Fermentation*

The Designed World:
Students will demonstrate knowledge of the major enterprises that produce the goods and services of **the designed world**.

Indicator Statement:
Discuss the major enterprises of the designed world.

Objective(s):

Analyze the major enterprises of the designed world (medical, agricultural and related biotechnologies, energy and power, information and communication, transportation, manufacturing, and construction) At least - -

- *Occupations*
- *Processes*
- *Products*
- *Problems*

Indicator Statement:
Develop an understanding of medical technologies. (ITEA, STL 14)

Objective(s):

Explain the functioning and application of medical processes and products. Such as:

- *Prevention and rehabilitation*
- *Vaccines and pharmaceuticals*
- *Surgical procedures*

Explain that medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained. (ITEA, STL 14-K)

Explain that telemedicine reflects the convergence of technological advances and advances in other fields. At least - -

- Medicine
- Telecommunications
- Virtual presence
- Computer engineering

Indicator Statement:
Develop an understanding of agricultural and related biotechnologies. (ITEA, STL 15)

Objective(s):

Explain the production and application of agricultural processes and products. Such as:

- *Food*
- *Fiber*
- *Fuel*
- *Chemical*

Explain the application of biotechnology processes and products.
At least - -

- Agricultural
- Pharmaceuticals
- Food and beverages
- Medicine
- Energy

Explain that agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products.
Explain that biotechnology has applications in such as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering. (ITEA, STL 15-L)

Indicator Statement:
Develop an understanding of energy and power technologies. (ITEA, STL 16)

Objective(s):

Explain that energy cannot be created nor destroyed; however, it can be converted from one form to another. (ITEA, STL 16-J)
Explain that energy can be grouped into major forms: thermal, radiant, electrical, mechanical, chemical, nuclear, and others. (ITEA, STL 16-K)
Explain that it is impossible to build an engine to perform work that does not exhaust thermal energy to the surroundings. (ITEA, STL 16-L)
Explain that energy resources can be renewable or non-renewable. (ITEA, STL 16-M)
Explain that power systems must have a source of energy, a process, and loads. (ITEA, STL 16-N)
Explain the production, conversion, transmission, and application of different forms of energy. Such as:

- *Mechanical*
- *Radiant*
- *Chemical*
- *Thermal*
- *Electrical*
- *Nuclear*

Indicator Statement:
Develop an understanding of information and communication technologies. (ITEA, STL 17)

Objective(s):

Explain that information and communication systems include inputs, processes, and outputs associates with sending and receiving information. (ITEA, STL 17-L)

Explain that information and communication systems allow information a to be transferred from human to human, human to machine, machine to human, and machine to machine. (ITEA, STL 17-M)

Explain that information and communication systems can be used to inform, persuade, entertain, control, manage, and educate. (ITEA, STL 17-N)

Identify and describe the parts of a communication system. (ITEA, STL 17-O) At least - -

- Source
- Encoder
- Transmitter
- Receiver
- Decoder
- Destination

Explain that there are many ways to communicate information, such as graphic and electronic means. (ITEA, STL 17-P)

Explain that technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. (ITEA, STL 17-Q)

Analyze the functioning and applications of information processing machines. Such as:

- *Printing*
- *Telephone*
- *Radio and television*
- *Computer*

Indicator Statement:

Develop an understanding of transportation technologies. (ITEA, STL 18)

Objective(s):

Explain that transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture. (ITEA, STL 18-J)

Analyze transportation systems. Such as:

- *Land*
- *Water*
- *Air*
- *Space*

Analyze the role transportation plays in the operation of other enterprises, such as manufacturing, construction, communication, health and safety, and agriculture.

Explain that intermodalism is the use of different modes of transportation in an interconnected system that moves people and goods. (ITEA, STL 18-K)

Research and report on "smart technologies."

Indicator Statement:

Develop an understanding of manufacturing technologies. (ITEA, STL 19)

Objective(s):

Analyze manufacturing processes.
At least - -

- *Designing*
- *Development*
- *Producing*
- *Servicing*

Describe mechanical processes that change the form of materials. At least - -

- Separating
- Forming
- Combining
- Conditioning

Explain that materials have different qualities and may be classified as natural, synthetic, or mixed. (ITEA, STL 19-M)
Explain that durable goods are designed to operate for a long period of time, while non-durable goods are designed to operate for a short period of time. (ITEA, STL 19-N)
Explain that marketing involves establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it. (ITEA, STL 19-R)
Classify manufacturing systems as being customized production, batch production, or continuous production.
Describe how the interchangeability of parts increases the effectiveness of a manufacturing process.
Research chemical technologies used to modify or alter chemical substances in the manufacturing process.
At least –

- Synthetic fibers
- Pharmaceuticals
- Plastics
- Fuels

Indicator Statement:
Develop an understanding of construction technologies. (ITEA, STL 20)

Objective(s):

Explain that infrastructure is the underlying base or basic framework of a system. (ITEA, STL 20-J)
Explain that structures are constructed using a variety of processes and procedures. (ITEA, STL 20-K)
Explain that the design of structures includes a number of requirements. (ITEA, STL 20-L)
Explain that structures require maintenance, alteration, or renovation periodically to improve them or to alter their intended use. (ITEA, STL 20-M)
Explain that structures can include prefabricated materials. (ITEA, STL 20-N)
Analyze heavy engineering structures. Such as:

- *Highways*
- *Rail lines*
- *Bridges*

o *Airports* o
Canals o
Pipelines
o *Power transmission and communication towers* o
Hydroelectric and flood control dams

Analyze types of buildings.

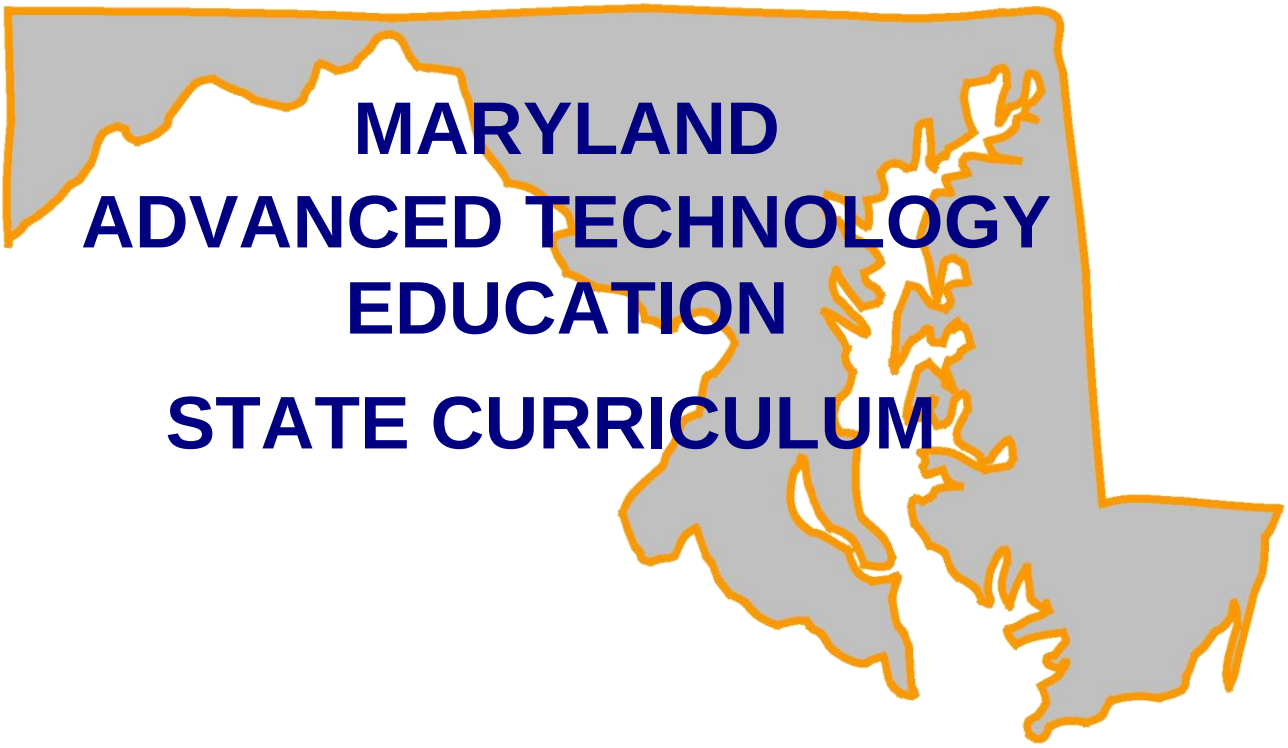
Such as:

o *Residential* o
Commercial o
Industrial

Analyze the steps in the construction process.

At least - -

o Preparing the site o
Setting foundations
o Building the framework o
Enclosing the structure o
Installing utilities
o Finishing the interior and exterior
o Completing the site



MARYLAND ADVANCED TECHNOLOGY EDUCATION

STATE CURRICULUM

Maryland Advanced Technology Education
State Curriculum

Advanced technology education is an instructional program in which students develop advanced skills and understandings related to the use, assessment, design, and production of technological systems. It is a series of course offerings that meet Maryland's high school graduation requirement for advanced technology education.

Advanced technology education courses provide expectations and opportunities for students to:

- Work independently at an accelerated pace,
- Engage in more rigorous and complex content and processes, and
- Develop authentic products that reflect students' understanding of key concepts.

Courses involve accelerated and enriched learning experiences that require abstract and higher -order thinking skills. Completion of two or more advanced technology education courses enables students to achieve an enhanced level of technological literacy where students are engaged (intrinsically engaged) with the community and advocate for technology at defined levels of society. Advanced technology education courses prepare students for further education in the areas of Sciences, Technology, Engineering or Mathematics (STEM). Using the Center to Advance the Teaching of Technology and Science (CATTS) curriculum, Maryland's Advanced Technology Education program is based on seven principles as the guiding format for its program model and the development of courses and curricula:

1. Technology affects everyday life
2. Technology drives invention and innovation
3. Technologies combine to make systems
4. Engineering through design improves life
5. Technology creates issues
6. Technology has impacts
7. Technology is the basis for improving on the past and creating the future

The areas identified for advanced technology education study include Impacts of Technology, Technological Issues and Engineering Design. Maryland's State Curriculum (STATE CURRICULUM) for Technology Education identifies five overarching standards that serve as the basis for all technology education courses. They state that students will:

1. Develop an understanding of the **nature of technology**
2. Develop abilities to assess the **impacts of technology**
3. Demonstrate knowledge of and apply the **engineering design and development** process
4. Demonstrate knowledge of and skills related to the **core technologies**, the building blocks of the designed world, and
5. Demonstrate knowledge of the major enterprises that produce the goods and services of the **designed world**.

These standards, which are based on the national *Standards for Technological Literacy (STL)*, identify what students should know and be able to do (cognitive, performance, affective domains) in order to be technologically literate. Where courses that meet the technology education requirement dealt with all five standards comprehensively, advanced technology education courses provide students with opportunities to develop deeper understandings and more sophisticated skills related to a more discrete aspect of technology.

Advanced Technology Education Grades 10-12 State Curriculum

IMPACTS OF TECHNOLOGY

The Nature of Technology:
Students will develop an understanding of the nature of technology.

Indicator Statement:
Analyze the connections that exist both within the various fields of science and among science and other disciplines including mathematics, social studies, language arts, fine arts, and technology. (MD CLG, Science)

Objectives:

Describe how the nature and development of technological knowledge and processes are functions of the setting.
Explain that the rate of technological development and diffusion is increasing rapidly.

Indicator Statement : Identify and use resources and strategies for keeping abreast of advances in technologies. (MD CLG, Skills for Success)

Objectives:

Identify and demonstrate how the selection of resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.
Explain that quality control is a planned process to ensure that a product, service, or system meets established criteria.
Describe how with the aid of technology, various aspects of the environment can be monitored to provide information for decision-making.

Indicator Statement: Design and conduct research related to the nature of technology. (MD CLG, Science)

Objectives:

Identify and demonstrate that complex systems have many layers of controls and feedback loops to provide information.
Explain when new technologies are developed to reduce the use of resources, considerations of trade-offs are important.

The Impacts of Technology:
Students will develop abilities to assess the **impacts of technology**.

Indicator Statement: Identify and evaluate the impact of scientific ideas and/or advancements in technology on society. (MD CLG, Science)

Objectives:

Explain how Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious.
Identify and demonstrate how making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.
Explain and demonstrate how humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.

Describe how the decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures.

Indicator Statement: Analyze the impact of technology as it contributes to continuity and change in the political and social order. (MD CLG, World History)

Objectives:

Explain how ethical considerations are important in the development, selection, and use of technologies.
Describe and demonstrate how the alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.
Demonstrate how humans devise technologies to reduce the negative consequences of other technologies.

Indicator Statement: Explain significant changes that are considered turning points or benchmarks in world history from historical, political, and social perspectives. (MD CLG, World History)

Objectives:

Explain the transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees.
Describe how decisions regarding the implementation of technologies involves the weighing of trade-offs between predicted positive and negative effects on the environment.
Explain how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
Explain how throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.
Describe how the Middle Ages saw the development of many technological devices that produced long-lasting effects on technology and society.
Describe how the Renaissance, a time of rebirth of the arts and humanities, was also an important development in the history of technology.
Describe how the Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.
Describe how the Information Age places emphasis on the processing and exchange of information.

Engineering Design and Development: Students will demonstrate knowledge of and apply the engineering design and development process.

Indicator Statement: Develop an understanding of the cultural, social, economic, and political impacts of engineering design and development.

Objectives:

Demonstrate and document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate

Indicator Statement: Develop an understanding of the environmental impacts of engineering design and development.

Objectives:

Use assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.

Design forecasting techniques to evaluate the results of altering natural systems.

Indicator Statement: Develop an understanding of the impact of society on engineering design and development.

Objectives:

Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and environment.

Core Technologies:
Students will demonstrate knowledge of and skills related to the **core technologies** the building blocks of the designed world.

Indicator Statement: Use knowledge related to the core technologies to assess the environmental impacts of technology.

Objectives:

Identify and collect information and evaluate its quality.

The Designed World:
Students will demonstrate knowledge of the major enterprises that produce the goods and services of the **designed world**.

Indicator Statement: Conduct research on the impacts of medical technologies, agricultural and biotechnologies, energy and power technologies, information and communication technologies, transportation technologies, manufacturing technologies, and construction technologies.

Objectives:

Explain how medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained.

Explain how telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.

Explain how the sciences of biochemistry and molecular biology have made it possible to manipulate the genetic information found in living creature

Identify and demonstrate how conservation is the process of controlling soil erosion, reducing sediment in waterways, conserving water, and improving water quality.

Explain and demonstrate how it is impossible to build an engine to perform work that does not exhaust thermal energy to the surroundings.

Explain and demonstrate how information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.

Demonstrate that there are many ways to communicate information, such as graphic and electronic means.

Demonstrate how transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.
Explain how intermodalism is the use of different modes of transportation, such as highways, railways, and waterways as part of an interconnected system that can move people and goods easily from one mode to another.
Explain and demonstrate how the design of intelligent and non-intelligent transportation systems depends on many processes and innovative techniques
Identify and demonstrate how servicing keeps products in good operating condition.
Explain how chemical technologies provide a means for humans to alter or modify materials and to produce chemical products.

Advanced Technology Education Grades 10-12 State Curriculum

TECHNOLOGICAL ISSUES

The Nature of Technology:
Students will develop an understanding of the nature of technology.

Indicator Statement: Analyze the connections that exist both within the various fields of science and among science and other disciplines including mathematics, social studies, language arts, fine arts, and technology. (MD CLG, Science)

Objectives:

Identify and explain how the rate of technological development and diffusion is increasing rapidly.
Demonstrate how selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.
Identify and demonstrate how technological progress promotes the advancement of science and mathematics.
Demonstrate how many technological problems require a multidisciplinary approach.

Indicator Statement : Identify and use resources and strategies for keeping abreast of advances in technologies. (MD CLG, Skills for Success)

Objectives:

Identify and explain how most development of technologies these days is driven by the profit motive and the market.
Demonstrate how requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
Demonstrate how management is the process of planning, organizing, and controlling work.

Indicator Statement: Design and conduct research related to the nature of technology. (MD CLG, Science)

Objectives:

Demonstrate how inventions and innovations are the results of specific, goal-oriented research.
Describe and demonstrate how systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.
Identify and explain the design problem to solve and decide whether or not to address it

The Impacts of Technology:
Students will develop abilities to assess the impacts of technology

Indicator Statement: Research current technologies used to meet a variety of needs, including accessing and managing information, communicating, performing work, and solving problems in a variety of situations (MD CLG, Skills for Success)

Objectives:

Demonstrate how the stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.
Explain how complex systems have many layers of controls and feedback loops to provide information.
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.

Indicator Statement: Identify needs not being met by current technologies and emerging technological solutions that may meet those needs (MD CLG, Skills for Success)

Objectives:

Identify and explain how technological ideas are sometimes protected through the process of patenting.
Describe and demonstrate how design problems are seldom presented in a clearly defined form
Explain how requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.
Explain how technological problems must be researched before they can be solved.

Indicator Statement: Assess how technological advances have created and continue to create opportunities for competition, cooperation, conflict, and interdependence. (MD CLG, World History)

Objectives:

Explain and demonstrate how making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.
Explain how ethical considerations are important in the development, selection, and use of technologies.
Describe that not all problems are technological, and not every problem can be solved using technology.

Engineering Design and Development:
Students will demonstrate knowledge of and apply the engineering design and development process.

Indicator Statement: Develop an understanding of the cultural, social, economic, and political impacts of engineering design and development.

Objectives:

Describe how the transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees.
Identify and describe that a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies.
Explain how the Information Age places emphasis on the processing and exchange of information.
Identify criteria and constraints and determine how these will affect the design process.

Indicator Statement: Develop an understanding of the environmental impacts of engineering design and development.

Objectives:

Explain and demonstrate how humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
Identify and describe how decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.
Explain how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.

Indicator Statement: Develop an understanding of the impact of society on engineering design and development.

Objectives:

Explain that when new technologies are developed to reduce the use of resources, considerations of trade-offs are important.

Identify and demonstrate how humans devise technologies to reduce the negative consequences of other technologies.

Explain and demonstrate how the decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures.

Explain how the Iron Age was defined by the use of iron and steel as the primary materials for tools.

Core Technologies:
Students will demonstrate knowledge of and skills related to the core technologies the building blocks of the designed world.

Indicator Statement: Use knowledge related to the core technologies to assess the environmental impacts of technology.

Objectives:

Explain that with the aid of technology, various aspects of the environment can be monitored to provide information for decision-making.

Demonstrate how to collect information and evaluate its quality.

Demonstrate and explain how to synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and environment.

Design forecasting techniques to evaluate the results of altering natural systems.

The Designed World: Students will demonstrate knowledge of the major enterprises that produce the goods and services of the designed world.

Indicator Statement: Conduct research on current technological issues related to medical technologies, agricultural and biotechnologies, energy and power technologies, information and communication technologies, transportation technologies, manufacturing technologies, and construction technologies.

Objectives:

Explain that the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.

Explain that throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.

Describe how telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.

Describe how the sciences of biochemistry and molecular biology have made it possible to manipulate the genetic information found in living creatures.

Describe how agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.

Describe how biotechnology has applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.

Demonstrate and explain how conservation is the process of controlling soil erosion, reducing sediment in waterways, conserving water, and improving water quality.

Describe how the engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna.

Identify and describe how energy resources can be renewable or nonrenewable.

Demonstrate and explain that information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.
Describe how transportation services and methods have led to a population that is regularly on the move.
Demonstrate and explain how materials have different qualities and may be classified as natural, synthetic, or mixed.
Identify and demonstrate how structures are constructed using a variety of processes and procedures.
Demonstrate how the design of structures includes a number of requirements.

Advanced Technology Education Grades 10-12 State Curriculum

ENGINEERING DESIGN

The Nature of Technology:
Students will develop an understanding of the nature of technology.

Indicator Statement: Explain that the nature of development of technological knowledge and processes are functions of the setting.

Objectives:

Identify and demonstrate how the nature and development of technological knowledge and processes are functions of the setting.
Explain how different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.
Identify and explain how the decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures.

Indicator Statement: Explain that inventions and innovations are the result of specific, goal-oriented research.

Objectives:

Identify and describe how inventions and innovations are the results of specific, goal-oriented research.
Describe that most development of technologies these days is driven by the profit motive and the market.
Demonstrate and explain how a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies.

Indicator Statement: Explain that optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.

Objectives:

Demonstrate how systems-thinking applies logic and creativity with appropriate compromises in complex real-life problems.
Explain and demonstrate how requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.
Identify and describe how optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.
Explain how quality control is a planned process to ensure that a product, service, or system meets established criteria.

The Impacts of Technology:
Students will develop abilities to assess the impacts of technology.

Indicator Statement: Describe changes cause by the use of technology can range form gradual to rapid and from subtle to obvious.

Objectives:

Demonstrate and explain how complex systems have many layers of controls and feedback loops to provide information.

Explain that technological ideas are sometimes protected through the process of patenting.

Indicator Statement: Make informed decisions about the use of technology, weighing the trade-offs between positive and negative effects.

Objectives:

Identify and demonstrate how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.

Demonstrate and explain that technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.

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

Indicator Statement: Explain that humans can devise technologies to conserve water, soils, and energy through such techniques as reusing, reducing, and recycling.

Objectives:

Explain that ethical considerations are important in the development, selection, and use of technologies.

Identify and explain how the alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.

Identify and explain how humans devise technologies to reduce the negative consequences of other technologies.

Explain that decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.

Engineering Design and Development:
Students will demonstrate knowledge of and apply the engineering design and development process.

Indicator Statement: Apply the design process (STL-11)

Objectives:

Demonstrate and describe that the design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.

Demonstrate and explain that design problems are seldom presented in a clearly defined form.

Explain how the design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.

Identify and describe that requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

Identify the design problem to solve and decide whether or not to address it.

Identify criteria and constraints and determine how these will affect the design process.

Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final produce

Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.

Develop and produce a product or system using a design process.

Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.

Indicator Statement: Use and maintain technological products and systems (STL-12)

Objectives:

Demonstrate and explain how established design principles are used to evaluate existing designs, to collect data, and to guide the design process.
Demonstrate and describe how engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
Demonstrate that a prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
Identify and explain how the process of engineering design takes into account a number of factors.
Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.

Indicator Statement: Select and use manufacturing technologies (STL-19)

Objectives:

Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
Operate systems so that they function in the way they were designed.
Demonstrate and describe that materials have different qualities and may be classified as natural, synthetic, or mixed.
Demonstrate and explain that the interchangeability of parts increases the effectiveness of manufacturing processes.

Indicator Statement: Conduct a structured research and development (R&D) process as part of a design problem.

Objectives:

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.
Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate
Collect information and evaluate its quality.

Core Technologies:
Students will demonstrate knowledge of and skills related to the core technologies the building blocks of the designed world

Indicator Statement: Analyze the functioning of the core technologies (mechanical, structural, electrical, fluid, thermal, optical, materials, and bio technologies) in terms of common components, basic system design, safety, simple controls, and system performance evaluation.

Objectives:

Describe that the engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna.
Demonstrate and describe how the design of structures includes a number of requirements. Structures require maintenance, alteration, or renovation periodically to improve them or to alter their intended use.

Indicator Statement: Use knowledge of the core technologies in the engineering design process.

Objectives:

Identify and demonstrate how energy resources can be renewable or nonrenewable.

Identify and demonstrate how power systems must have a source of energy, a process, and loads

Designed World: Students will demonstrate knowledge of the major enterprises that produce the goods and services of the designed world.

Indicator Statement: Describe how the engineering design process is applied in medical technologies, agricultural and biotechnologies, energy and power technologies, information and communication technologies, transportation technologies, manufacturing technologies, and construction technologies.

Objectives:

Demonstrate and describe that technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.

Demonstrate that the design of intelligent and non-intelligent transportation systems depends on many processes and innovative techniques

Glossary

Accuracy: Degree of conformity of a measure to a standard value.

Adhesion: The process of fastening two parts by the application of a third material such as glue, epoxy, etc.

Agriculture – The raising of crops and animals for food, feed, fiber, fuel, or other useful products.

Alloy: A substance composed of two or more metals or of a metal and a nonmetal intimately united usually by being fused together and dissolving in each other when molten.

Analog: Of, relating to, or being a mechanism in which data is represented by continuously variable physical quantities.

Annealing: The process of softening metal for improved machinability or cold working by heating it to its critical temperature, holding it there until the temperature is uniform, then cooling it slowly at a controlled rate.

Artifact - A human-made object.

Assembly: Consisting of individual parts fitted together to create a final product

Automation: A machine or system that operates with minimal human control: using automated machines as control for production.

Bernoulli's Law: A change in the velocity of a fluid caused by a constriction produces an opposite change in pressure.

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.

Biotechnology – The technology of using, adapting, and altering organisms and biological processes for a desired outcome - one of the nine core technologies.

Bonding: Adhering materials with cement or glue.

Boyle's Law: The volume of a gas at a constant temperature is inversely proportional to its pressure.

Brainstorming - A method of shared problem solving in which all members of a group spontaneously and in an unrestrained discussion generate ideas.

Build - To make something by joining materials or components together into a composite whole.

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.

Cam: A mechanical device used to change simple rotary motion into a more complex motion.

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.

Center of Gravity: The point at which the entire weight of a body may be considered as concentrated so that if supported at this point the body would remain in equilibrium in any position - same location as center of mass.

Ceramic: A compound of metallic and nonmetallic elements, for which the inter-atomic bonding is predominantly ionic.

Charles' Law: **The volume of a gas at a constant pressure is directly proportional to its temperature.**

Closed-loop system - A system that uses feedback from the output to control the input.

Cohesion: The process of fusing two like materials for the purpose of fastening. Examples include friction welding, spot welding, electron beam welding and laser welding).

Cold forming: The process of working metal into shape below the temperature of recrystallization. Cold forming improves the strength; machinability, dimensional stability and surface finish of metals.

Combining -The joining of two or more materials by such processes as fastening, coating, and making composites.

Communication - The successful transmission of information through a common system of symbols, signs, behavior, speech, writing, or signals.

Communication system - A system that forms a link between a sender and a receiver making possible the exchange of information.

Component - A part or element of a whole that can be separated from or attached to a system.

Composite: A multiphase material formed from a combination of materials that differ in composition or form, remain bonded together, and retain their identities and properties.

Compound: A substance of two or more elements in fixed proportions. Compounds can be decomposed into their constituent elements.

Compression: The effect of a force, which tends to shorten an object in the direction of the force. Such a force is called a compressive force, and the object it acts on is said to be in compression. For example, the towers of a suspension bridge are in compression.

Computer aided drafting (CAD): The use of a computer to create drawings.

Computer Numeric Control (CNC): A combination of a computer, a digital control system and a machine tool that enables the machine to accept standard codes and automatically make parts.

Concurrent: Occurring at the same time; running parallel; acting in conjunction.

Conditioning processes - Processes (using force, heat, cold, electricity, etc.) in which the internal structure of a material is changed to alter its properties to make it stronger, improve its function or appearance.

Conduction: (Thermal definition) The transfer of heat energy by physical contact.

Conservation - The preservation and protection of the environment and the wise use of natural resources.

Constraint - A limit to the design process. Constraints may be such things as appearance, funding, space, materials, and human capabilities.

Construction - The systematic act or process of building, erecting, or constructing buildings, roads, or other structures.

Control - An arrangement of chemical, electronic, electrical, and mechanical components that commands or directs the management of a system.

Control system - An assemblage of control apparatus coordinated to execute a planned set of actions.

Convection: The transfer of heat energy by moving a heated substance from one place to another.

Core technologies – The building blocks of technology systems including mechanical, structural, electrical, electron, fluid, thermal, optical, material, and bio technologies.

Creative thinking -The ability or power used to produce original thoughts and ideas based upon reasoning and judgment.

Criterion - A desired specification (element or feature) of a product or system.

Critical thinking -The ability to acquire information, analyze and evaluate it, and reach a conclusion or answer by using logic and reasoning skills.

Culture -The beliefs, traditions, habits, and values con- trolling the behavior of the majority of the people in a social-ethnic group. These include the people's way of dealing with their problems of survival and existence as a continuing group.

Current: The total amount of electrons flowing through a circuit per unit time; measured in Amperes (one coulomb of electrons passing a single point per second).

Curriculum - The subject matter that teachers and students cover in their studies. It describes and specifies the methods, structure, organization, balance and presentation of the content.

Curriculum development -The process of planned development of curriculum pedagogy, instruction, and presentation modes.

Custom production - A type of production in which products are designed and built to meet the specific needs and wants of an individual.

Data - Raw facts and figures that can be used to draw a conclusion.

Data processing system - A system of computer hard- ware and software to carry out a specified computational task.

Decision making - The act of examining several possible behaviors and selecting from them the one most likely to accomplish the individual's or group's intention. Cognitive processes such as reasoning, planning, and judgment are involved.

Decode -To convert a coded message into understandable form using ordinary language.

Density: Mass per unit volume.

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.

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.

Design Constraints: Requirements and limitations under which the design process takes place.

Design principle - Design rules regarding rhythm, balance, proportion, variety, emphasis, and harmony, used to evaluate existing designs and guide the design process.

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.

Design proposal - A written plan of action for a solution to a proposed problem.

Desktop Publishing: Creating and publishing a document using a PC and output device such as a laser printer.

Destructive Testing: Material or product testing in which information is learned about the material/product via careful measurements and recordings as the material/product is destroyed.

Develop - To change the form of something through a succession of states or stages, each of which is preparatory to the next. The successive changes are undertaken to improve the quality of or refine the resulting object or software.

Diagnose - To determine, by analysis, the cause of a problem or the nature of something.

Digital: An information system whose signals have only two states, 1 (closed) or 0 (open).

Dimension: Numerical value used on a drawing to describe size, shape, or geometric characteristic.

Discipline - A formal branch of knowledge or teaching (e.g., biology, geography, and engineering) that is systematically investigated, documented, and taught.

Drawing - A work produced by representing an object or outlining a figure, plan, or sketch by means of lines. A drawing is used to communicate ideas and provide direction for the production of a design.

Drilling: To bore or drive a hole in. A machining process that produces a hole.

Ductility: The amount of plastic strain that a material can withstand before fracture. Ductile materials generally have a yield point in the stress-strain curve.

Dynamics: The behavior of matter when in motion; (physics) the study of why objects move.

Economy - The system or range of economic activity, such as production, distribution, and consumption in a country, region, or community that manages domestic affairs and resources.

Educational technology - Using multimedia technologies or audiovisual aids as a tool to enhance the teaching and learning process.

Efficient - Operating or performing in an effective and competent manner with a minimum of wasted time, energy, or waste products.

Electrical: Of, relating to, or operated by electricity.

Electrical technology – The technology of producing, storing, controlling, transmitting and getting work from electrical energy - one of the nine core technologies.

Electromagnet: A core of magnetic material surrounded by a coil of wire through which an electric current is passed to magnetize the core

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.

Encode -To change a message into symbols or a form that can be transmitted by a communication system.

Energy - The ability to do work. Energy is one of the basic resources used by a technological system.

Engineer - A person who is trained in and uses technological and scientific knowledge to solve practical problems.

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.

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.

English system: (U.S. Customary System) A measurement system in which the foot is the fundamental unit for length and pound is the fundamental unit for weight.

Ergonomics - The Study of workplace equipment design or how to arrange and design devices, machines, or workspace so that people and things interact safely and most efficiently. Also called human factors analysis or human factors engineering.

Equilibrium: A state of balance due to the equal action of opposing forces in a structure.

Ethical - Conforming to an established set of principles or accepted professional standards of conduct.

Ethics: a. a set of moral principles or values b. a theory or system of moral values (the present-day materialistic ethic) c. plural but singular or plural in construction: the principles of conduct governing an individual or a group (professional ethics) d. a guiding philosophy.

Experimentation -1. The act of conducting a controlled test or investigation. 2. The act of trying out a new procedure, idea, or activity.

Fact - A statement or piece of information that is true or a real occurrence.

Fastening: The joining of two or more parts or materials through the application of mechanical devices, adhesive materials or a cohesive process.

Fatigue: The failure or decay of mechanical properties after repeated applications of stress. Fatigue tests give information on the ability of a material to resist the development of cracks (which eventually bring about failure) as a result of a large number of cycles.

Feedback - Using all or a portion of the information from the output of a system to regulate or control the processes or inputs in order to modify the output.

Ferrous: Related to iron (derived from the Latin ferrum); iron base alloys.

Figure - A written symbol, other than a letter, representing an item or relationship, especially a number, design, or graphic representation.

Finishing: The final processes applied during the production or a part. (examples include coating, de-burring, blast finishing, coloring, cleaning, etc.)

Fluid: The medium used to transfer power can be a liquid or a gas.

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.

Force: A push or pull exerted by one object on another.

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.

Forging: The working of a piece of metal into a predetermined shape by applying pressure or impact blows. Forging increases the strength of a part by compressing and aligning the surface to the shape of the die.

Forming -The process that changes the shape and size of a material without cutting it.

Free Body Diagram: A sketch of an object (body) of interest with all the surrounding objects stripped away and all of the forces acting on the object (body) shown.

Friction: A force that opposes the motion or intended motion of a body in contact with another body.

Gear: A wheel with teeth that will allow the transfer of power when coupled to another gear.

Generator: A device that converts mechanical energy to electrical energy.

Graph: A diagram (as a series of one or more points, lines, line segments, curves, or areas) that represents the variation of a variable in comparison with that of one or more other variables.

Graphics: A graphic representation (as a picture, map, or graph) used especially for illustration.

Guidance system - A system that provides information for guiding the path of a vehicle by means of built-in equipment and control.

Hardening: The process by which a piece of metal is hardened by heating it to or above the critical temperature then cooling it rapidly, usually by quenching in an oil or water solution.

Hardness: The measure of a material's resistance to deformation by surface indentation or by abrasion.

Heat Engine: **Device that converts the energy of heat into mechanical energy.**

Human wants and needs - Human wants refers to something desired or dreamed of and human needs refers to something that is required or a necessity.

Hydraulic fluid: A liquid that is used in hydraulic systems to transfer energy; usually an oil-based substance

Hydroponics - A technique of growing plants without soil, in water or sometimes an inert medium (e.g., sand) containing dissolved nutrients.

Impact - The effect or influence of one thing on another. Some impacts are anticipated, and others are unanticipated.

Inclined plane – A flat sloping surface along which an object can be pushed or pulled; a plane surface that makes an oblique angle with the plane of the horizon - one of six simple machines.

Industrial Revolution - A period of inventive activity, beginning around 1750 in Great Britain. During this period, industrial and technological changes resulted in mechanized machinery that replaced much of which was j previously manual work. The Industrial Revolution was responsible for many social changes, as well as changes in, the way things were manufactured.

Information - One of the basic resources used by technological systems. Information is data and facts that have been organized and communicated in a coherent and meaningful manner.

Information Age - A period of activity starting in the 1950s and continuing today in which the gathering, manipulation, classification, storage, and retrieval of information is central to the workings of society. Information is presented in various forms to a large population of the world through the use of machines, such as computers, facsimile machines, copiers, and CD-ROMs. The Information Age was enhanced by the development of the Internet; an electronic means to exchange information in short periods of time, often instantaneously.

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.

Infrastructure - 1. The basic framework or features of a system or organization. 2. The basic physical systems of a country's or a community's population, including transportation and utilities.

Innovation - An improvement of an existing technological product, system, or method of doing something.

Inorganic - Lacking the qualities, structure, and composition of living organisms; inanimate.

Input - Something put into a system, such as resources, in order to achieve a result.

Instructional technology - The use of computers, multi-media, and other technological tools to enhance the teaching and learning process. Sometimes referred to as educational technology.

Integration -The process of bringing all parts together into a whole.

Intelligent transportation system - Proposed evolution of the entire transportation system involving the use of information technologies and advances in electronics in order to revolutionize all aspects of the transportation network. These technologies include the use of the latest computers, electronics, communications, and safety systems to provide traffic control, freeway and incident management, and emergency response.

Internet -The worldwide network of computer links, begun in the 1970s, which today allows computer users to connect with other computer users in nearly every country, and speaking many languages.

Invention - A new product, system, or process that has never existed before, created by study and experimentation.

Iron Age -The period of human culture characterized by the smelting of iron and its use in industry beginning after the Bronze Age somewhat before 1000 B.C. in western Asia and Egypt.

Irrigation system - A system that uses ditches, pipes, or streams to distribute water artificially.

Iterative - Describing a procedure or process that repeatedly executes a series of operations until some condition is satisfied. An iterative procedure may be implemented by a loop in a routine.

Kinetic energy - The energy possessed by a body as a result of its motion.

Laboratory-classroom - The formal environment in school where the study of technology takes place. At the elementary school, this environment will likely be a regular classroom. At the middle and high school levels, a separate laboratory with areas for hands-on activities, as well as group instruction, could constitute the environment.

LASER: Light Amplification by the Stimulated Emission of Radiation. A device that produces a concentrated beam of light

Lever: A rigid piece that transmits and modifies force or motion when forces are applied at two points and it turns about a third; specifically: a rigid bar used to exert a pressure or sustain a weight at one point of its length by the application of a force at a second and turning at a third on a fulcrum.

Literacy - Basic knowledge and abilities required to function adequately in one's immediate environment.

Machine - A device with fixed and moving parts that modifies mechanical energy in order to do work.

Magnetism: A force that exists around magnets that attracts ferrous materials and is used in motors and generators.

Maintenance - The work needed to keep something in proper condition; upkeep.
Management - The act of controlling production processes and ensuring that they operate efficiently and effectively; also used to direct the design, development, production, and marketing of a product or system.

Malleability: Capable of being altered or controlled by outside forces or influences.

Manufacturing - The process of making a raw material into a finished product; especially in large quantities.

Manufacturing system - A system or group of systems used in the manufacturing process to make products for an end user.

Marketing - The act or process of offering goods or services for sale.

Mass production -The manufacture of goods in large quantities by means of machines, standardized design and parts, and, often, assembly lines.

Material - The tangible substance (chemical, biological, or mixed) that goes into the makeup of a physical object. One of the basic resources used in a technological system.

Materials technology – The technology of producing, altering, and combining materials - one of the nine core technologies.

Mathematics - The science of patterns and order and the study of measurement, properties, and the relationships of quantities; using numbers and symbols.

Measurement - The logical study of shape, arrangement, quantity and related topics.

Mechanical - A form of energy, which uses motion to do work.

Mechanical fastener - A mechanical device such as a nail, screw, bolt, and etc. that is used to fasten two parts together.

Mechanical technology – The technology of putting together mechanical parts to produce, control and transmit motion - one of the nine core technologies.

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.

Medicine -The science of diagnosing, treating, or pre- venting disease and other damage to the body or mind.

Message -1. The information sent by one source to another, usually short and transmitted by words, signals, or other means. 2. An arbitrary amount of information whose beginning and end are defined or implied.

Metal: An opaque lustrous elemental chemical substance that is a good conductor of heat and electricity and, when polished, a good reflector of light; most elemental metals are malleable, ductile, and are generally denser than the other elemental substances; metals are structurally distinguished from nonmetals by their atomic bonding and electron availability; the electron band structure of metals is characterized by a partially filled valence band; the "free electrons" lost from the outer shells of metallic atoms are available to carry an electric current; the defining property of a metal is that it is an element with a positive thermal coefficient of resistively, meaning the electrical resistively of a metal continuously increases as temperature increases.

Metric system: A measuring system in which the meter is the fundamental unit of length and gram is the fundamental unit of weight.

Micro-processing system - A computer made up of integrated circuits that are capable of high-speed electronic operations.

Microprocessor: A complex digital chip that performs the computer functions of arithmetic, logic and supervision.

Middle Ages - The period in European history between antiquity and the Renaissance, often dated from A.D. 476 to 1453.

Milling: A process of cutting or material removal, which combines a rotating cutter and a traversing worktable allowing for processes such as slotting, facing and pocketing.

Mock-up: A full-sized structural model built accurately to scale chiefly for study, testing, or display.

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.

Module - A self-contained unit.

Moment: The tendency to rotate about a point determined by the product of a force multiplied by the distance from this force to this point

Motor: A device used to convert electrical energy to mechanical energy.

Multimedia - Information that is mixed and transmitted from a number of formats (e.g., video, audio, and data).

Natural material - Material found in nature, such as wood, stone, gases, and clay.

Network - An interconnected group or system. The Internet is a network of computers.

Newton's First Law: (The Law of Inertia) – Objects at rest tend to stay at rest, and objects in motion tend to stay in motion at a constant speed in a straight line unless acted upon by an unbalanced force.

Newton's Second Law: **The net force acting on an object in a given direction is equal to the mass of the object multiplied by the acceleration of the object in the same direction as the net force.**

Newton's Third Law: The force of one object (object 1) acting on another object (object 2) is equal in magnitude and opposite in direction to the force of the second object acting upon the first.

Nonrenewable - An object, thing, or resource that cannot be replaced.

Nuclear energy: Nuclear energy is the energy associated with nuclear bonding of the nucleus of an atom. (Nuclear energy is the energy, E, represented in the famous equation $E=mc^2$. The mass in this equation is not the mass of the nucleus. The mass of an atom's nucleus is actually less than the sum of the mass of the individual protons and neutrons within the nucleus. The difference between these masses is known as the "mass defect," and is the "m" in the $E=mc^2$. In addition, "c" is the speed of light.)

Nuclear power- Power, the source of which is nuclear fission or fusion.

Obsolescence - Loss in the usefulness of a product or system because of the development of an improved or superior way of achieving the same goal.

Ohm's Law: The relationship of voltage, current and resistance in a circuit I=V/R, V=IR, R=V/I

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.

Optical: Of or relating to the science of optics or vision.

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.

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.

Orthographic: Right angle projection. The views of an object are drawn in perpendicular planes to one another.

Output - The results of the operation of any system.

Pascal's Law: A law that states when a force is exerted on a fluid, the fluid transfers this force equally against the walls of the vessel.

People - One of the basic resources in a technological system. Humans design, develop, produce, use, manage, and assess products and systems.

Plan - A set of steps, procedures or programs, worked out beforehand in order to accomplish an objective or goal.

Plastics: Any of numerous organic synthetic or processed materials that are mostly thermoplastic or thermosetting polymers of high molecular weight and that can be made into objects.

Political - Of or relating to the structure and affairs of a government, state, or locality and their related politics.

Pollution -The changing of a natural environment, either by natural or artificial means, so that the environment becomes harmful or unfit for living things; especially applicable to the contamination of soil, water, or the atmosphere by the discharge of harmful substances.

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.

Potential energy - The energy of a particle, body, or system that is determined by its position or structure.

Power: Force over time. Measured in Ft Lbs Newton Meters or Watts.

Power system - A technological system that transforms energy resources to power.

Pressure: The force generated when energy is applied to a fluid; force per unit area

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.

Process: The action of going through several steps to reach a desired goal.

Produce -To create, develop, manufacture, or construct a human-made product.

Product - A tangible artifact produced by means of either human or mechanical work, or by biological or chemical processes.

Production system -A technological system that involves producing products and systems by manufacturing (on the assembly line) and construction (on the job).

Programming language - A set of instructions used to operate a machine or processor to perform a task.

Propulsion system - A system that provides the energy source, conversion, and transmission of power to move a vehicle.

Prototype - A full-scale working model used to test a design concept by making actual observations and necessary adjustments.

Pulley - A wheel-like simple machine used to reduce input force, change the direction of force applied, or to increase the input distance.

Pump: A device that converts mechanical energy to fluid energy.

Qualitative: Of, relating to, or involving the measurement of quality or kind without extensive mathematical analysis

Quality assurance: The use of quality control techniques associated with a process.

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.

Quantitative: Relating to, or expressible in terms of quantity, typically displayed in a line graph.

R-Value: A numeric expression of thermal insulation. R-values are the reciprocals of U-values.

Radiation: (Thermal definition) Transfer of heat by temporarily transforming the heat (kinetic motion of an objects atoms or molecules) into electromagnetic waves (in the infrared part of the EM spectrum). These waves then travel until absorbed by another object and transferred back into atomic/molecular kinetic energy, which is heat.

Receiver - The part of a communication system that picks up or accepts a signal or message from a channel and converts it to perceptible forms.

Recycle - To reclaim or reuse old materials in order to make new products.

Reliability: The probability of satisfactory operation of the product in a given environment over a specified time interval.

Renaissance -The transitional movement in Europe between medieval and modern times beginning in the 14th century in Italy, lasting into the 17th century, and marked by a humanistic revival of classical influence expressed in a flowering of the arts and literature and by the beginnings of modern science.

Renewable - Designation of a commodity or resource, such as solar energy or firewood, that is inexhaustible or capable of being replaced by natural ecological cycles or sound management practices.

Requirements - The parameters placed on the development of a product or system. The requirements include the safety needs, the physical laws that will limit the development of an idea, the available resources, the cultural norms, and the use of criteria and constraints.

Research: Careful or diligent search; studious inquiry or examination; especially **:** investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws; the collecting of information about a particular subject.

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.

Resistance: The ratio of the potential difference across an electrical component to the current passing through it. It is thus a measure of the component's opposition to the flow of electric charge. In general, the resistance of a metallic conductor increases with temperature whereas the resistance of a semiconductor decreases with temperature.

Resource -The things needed to get a job done. In a technological system, the basic technological resources are: energy, capital, information, machines and tools, materials, people, and time.

Risk - The chance or probability of loss, harm, failure, or danger.

Robotics: The specialized field of engineering and computer science that deals with the design and application of robots.

Sanitation - The design and practice of methods for solving basic public health problems, such as drainage, water and sewage treatment, and waste removal.

Scale - A proportion between two sets of dimensions used in developing accurate, larger or smaller prototypes or models of design ideas.

Schematic - A drawing or diagram of a chemical, electrical, or mechanical system.

Science - The study of the natural world through observation, identification, description, experimental investigation, and theoretical explanations.

Scientific inquiry - The use of questioning and close examination using the methodology of science.

Sender - A person or equipment that causes a message to be transmitted.

Semiconductor: Materials whose electrical conductivity can be precisely altered by appropriate manufacturing processes.

Separating -The process of using machines or tools to divide materials.

Service - 1. The installation, maintenance, or repairs provided or completed by a dealer, manufacturer, owner, or contractor. 2.The performance of labor for the benefit of another.

Shear: Force that acts parallel to the surface of the material

Simple Machine: any of various elementary mechanisms formerly considered as the elements of which all machines are composed and including the lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw.

Sketch - A rough drawing representing the main features of an object or scene and often made as a preliminary study.

Skill - An ability that has been acquired by training or experience.

Society - A community, nation, or broad grouping of people having common traditions, institutions, and collective activities and interests.

Soldering: The joining of metal surfaces with a different metal (solder) that melts at a temperature below the red heat temperature of iron.

Solid modeling: Three-dimensional CAD representation used to describe, simulate and predict the behavior of objects.

Solution - A method or process for solving a problem.

Spring: A mechanical device that stores energy by expansion or contraction due to pressure, force or stress applied, that will release energy and return to shape when the force or stress is removed.

Standardization - The act of checking or adjusting by comparison with a standard.

Statics: The study of objects in a state of equilibrium.

Stone Age - The first known period of prehistoric human culture characterized by the use of stone tools.

Strain: The elongation of a material under stress divided by the material's length prior to stress; symbol: "epsilon"

Stress: A material's internal resistance to force; symbol:, "sigma"; calculated by dividing the force in the material by the area of the material that is subjected to the force:

Structural system - A system comprised of the framework or basic structure of a vehicle.

Structure - Something that has been constructed or built of many parts and held or put together in a particular way.

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.

Subsystem - A division of a system that, in itself, has the characteristics of a system.

Symbol - An arbitrary or conventional sign that is used to represent operations, quantities, elements, relations, or qualities or to provide directions or alert one to safety.

Synthetic material - Material that is not found in nature, such as glass, concrete, and plastics.

System - A group of interacting, interrelated, or interdependent elements or parts that function together as a whole to accomplish a goal.

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.

Technical writing: Treating a document with the goal of providing clear and concise information, rather than entertainment or story telling; a technical document/report incorporates diagrams and multi-media information to provide technical information.

Technological design - See Engineering design.

Technological literacy -The ability to use, manage, understand, and assess technology.

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.

Technology content standard - A written statement that specifies the knowledge (what students should know) and process (what students should be able to do) students should possess in order to be technologically literate.

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.

Technological studies - See Technology education.

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.

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.

Tempering: A heat treating process that reduces the brittleness of a hardened piece of steel by heating it to a point below the critical temperature and cooling it at some rate.

Tension: A situation in which force is applied to an object that stretches, expands or lengthens the object.

Tensile: Of or relating to tension; a "tensile" force is a force that serves to stretch, expand, or lengthen an object.

Test -1. A method for collecting data. 2. A procedure for critical evaluation.

Thematic unit - Set of lesson presentations that organize classroom instruction around certain texts, activities, and learning episodes related to a topic(s). A thematic unit might integrate several content areas.

Thermal: of, relating to, or caused by heat.

Thermal technology - The technology of producing, sorting, controlling, transmitting and getting work from heat energy.

Thermodynamics: The study of thermal energy as it moves from one substance to another.

Thermoplastic: A material capable of being repeatedly softened by increases in temperature and hardened by decreases in temperature. Thermoplastics are those materials whose change upon heating is substantially physical rather than chemical. They are largely one- or two-dimensional molecular structures such as: nylons, polycarbonates, acetals, polysulfones, and vinyls.

Tolerance: The difference between the maximum and minimum dimensions allowed within the design of a product. **Tool** - A device that is used by humans to complete a task.

Torque: A turning or twisting force that produces or tends to produce rotation or torsion

Torsion: The twisting or wrenching of a body by the exertion of forces tending to turn one end or part about a longitudinal axis while the other is held fast or turned in the opposite direction.

Toughness: The energy required to break a material, which is equal to the area under the stress-strain curve. The toughest materials are those with very great elongations to break accompanied by high tensile strengths such materials nearly always have yield points.

Trade-off - An exchange of one thing in return for another; especially relinquishment of one benefit or advantage for another regarded as more desirable.

Transmit - To send or convey a coded or non-coded message from a source to a destination.

Transportation system - The process by which passengers or goods are moved or delivered from one place to another.

Trend - 1. A tendency; 2. A general direction.

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.

Trial and error - A method of solving problems in which many solutions are tried until errors are reduced or minimized.

Troubleshoot - To locate and find the cause of problems related to technological products or systems.

Use -The act or practice of employing something to put it into action or service.

Valve: Any of numerous mechanical devices by which the flow of liquid, gas, or loose material in bulk may be started, stopped, or regulated by a movable part that opens, shuts, or partially obstructs one or more ports or passageways.

Viscosity: The thickness or flow characteristic of a liquid; the more viscous, the slower a liquid will flow.

Voltage: The electromotive force in a circuit.

Volume: The amount of space occupied by a three-dimensional object as measured in cubic units.

Watt's Law: The mathematical relationship expressing that power is the product of Voltage and Current.

Welding: The process of joining metal together by heating to the fusion point.

Weight: The gravitational pull (force) on an object.

Wheel and Axle: 1. A simple machine in which a larger diameter wheel requires less force to turn than a smaller diameter axle (e.g. valve handles, steering wheel); 2. A simple machine that turns rotary motion into linear motion whereby increasing the diameter of the wheel, the linear distance traveled for one revolution of the axle can be increased; 3. a rotating lever

Work - The transfer of energy from one physical system to another expressed as the product of a force and the distance through which it moves a body in the direction of that force.