8th Grade – Technological Systems

Lesson 1 – How Systems Work
Duration – Three hours

Big Idea – A system is a group of interrelated components that collectively achieve a desired result.

Learning Objectives – Students will learn to:
1. 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.
2. Explain why the development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.
3. Compare and contrast natural and human-made systems.
4. Describe how parts or components of a system work together to accomplish a goal.
5. Define the term "system."
6. Make a two-dimensional representation of a technological system.
7. Explain that an open-loop system has no feedback path and requires human intervention; while a closed-loop system uses feedback.
8. Use systems thinking to consider how every part relates to another in a system.
9. Explain that technology systems can be connected to one another and provide examples.
10. Describe systems in terms of inputs, processes, outputs, and at times, feedback.

Lesson 2 Inventing and Innovating Technological Systems
Duration – Five hours

Big Idea – The manufacturing process includes the designing, development, making, and servicing of products and systems.

Learning Objectives – Students will learn to:
1. Identify requirements that are placed on the development of a system.
2. Describe how the design and construction of structures for service or convenience have evolved from the development of techniques for measurement, controlling systems, and the understanding of spatial relationships.
3. Differentiate between invention and innovation.
4. Explain that the manufacturing process includes the designing, development, making, and servicing of products and systems.
5. Differentiate between light and sound waves.
6. Identify constructive and destructive interference.
7. Make a product or system and document the process
8. Safely use tools, products, and systems for specific tasks.
9. Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.
10. Use computers and calculators in order to achieve a given purpose.

Lesson 3 Impacts of Technological Systems

Duration – Three hours

Big Idea – Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.

Learning Objectives – Students will learn to:

1. Describe how technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems.
2. 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.
3. Describe the role of vaccines in the prevention of disease and the challenges of large-scale production.
4. Define genetic engineering and provide examples of past, current, and potential future uses.
5. Describe how specialized equipment and practices are used to improve the production of food, fiber, fuel, and other useful products and in the care of animals.
6. Identify the impacts made by specialized equipment and practices in the field of agriculture.
7. Explain that the management of waste produced by technological systems is an important societal issue.
8. Describe how the management of agricultural waste is an important societal issue.

Lesson 4 Data Acquisition and Analysis

Duration – Five hours

Big Idea – The use of instruments to gather data can help us understand the impacts of technology systems.

Learning Objectives - Students will learn to:

1. Use instruments to gather data.
2. Explain that computers have become invaluable in science because they speed up and extend people's ability to collect, store, compile, and analyze data, prepare research reports, and share data and ideas with investigators all over the world.
3. Use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology.
4. Interpret and evaluate the accuracy of information and determine if it is useful.
5. Describe how energy cannot be created or destroyed, but only changed from one form into another and provide examples.

6. Describe how mathematical statements can be used to describe how one quantity changes when another changes.
7. Identify trends and monitor potential consequences of technological development.
8. Use computers and calculators in order to achieve a given purpose.

Lesson 5 Computer Aided Design
Duration –3 hours

Lesson 6 System Interactions
Duration –6 hours

Big Idea – Systems are usually connected to other systems, both internally and externally. Thus a system may be thought of as containing subsystems and as being a subsystem of a larger system.

Learning Objectives - Students will learn to:
1. Identify and describe a technology system that is made up of a number of subsystems.
2. Analyze a technology system by identifying and describing the system's input, processes, output, and at times, feedback.
3. Explain that systems thinking involves considering how every part relates to others.
4. Cite examples where malfunctions of any part of a system negatively affect the function and quality of the system.
5. Explain that systems fail because they have faulty or poorly matched parts that are used in ways that exceed what was intended by the design, or were poorly designed to begin with.
6. Describe how heat is transferred through various materials.
7. Describe and provide examples of how technology systems can be connected to one another.
8. Explain that systems often interact with one another.
9. Explain that energy comes in many forms and can do work using many processes.
10. Explain that power systems are used to drive and provide propulsion to other technological products and systems.
11. Identify the subsystems that must function together for a transportations system to work effectively.
12. Identify the processes necessary to make a transportation system operate efficiently.

Lesson 7 Controlling Technology Systems
Duration –Five hours

Big Idea Controls are mechanisms or activities that use information to cause systems to change.

Learning Objectives - Students will learn to:
1. Explain the functioning and applications of controls in technology systems.
2. Identify how controls are used to maintain or change a system.

3.   Create and manage a system using controls.
4.   Use computer software to program and control a system.
5.   Develop a control system using the engineering design process.
6.   Identify systems that were developed for one setting but are being used in another setting.
7.   Use the language of mathematics to express mathematical ideas precisely.
8.   Analyze communication systems by identifying the systems' source, encoder, transmitter, receiver, decoder, and destination.
9.   Explain that information and communication systems allow information to be transferred from human to human, human to machine, and machine to human.

Lesson 8 Technology Interactions: The STEM Connection
Duration –6 hours

Big Idea There is a significant relationship between science, technology, engineering, and mathematics.

Learning Objectives - Students will learn to:
1.   Identify useful knowledge from other fields that will influence the design of a system.
2.   Collect and use data to calibrate a thermal control system.
3.   Apply the engineering design process to solve a problem.
4.   Identify requirements for a control system
5.   Explain the various ways heat can transfer.
6.   Identify characteristics of structures including examples of subsystems.
7.   Use the language of mathematics to express mathematical ideas precisely.

Lesson 9 Resources for Maintaining Technology Systems
Duration –3 hours

Big Idea System failures can be prevented through maintenance and corrected through troubleshooting.

Learning Objectives - Students will learn to:
1.   Describe maintenance as 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.
2.   Select and safely use tools, products, and systems to conduct maintenance on a technology system.
3.   Identify and select resources that are useful in maintaining systems.
4.   Demonstrate an ability to use information provided in manuals, protocols, or by experienced people to see and understand how things work and how they should be maintained.

5. Explain that troubleshooting is a problem solving method used to identify the cause of a malfunction in a technological system.
6. Identify and select resources that are useful in maintaining systems.

Course Timeline

Lesson	Title	Hours
1	**How Systems Work**	3
2	**Inventing and Innovating Technological Systems**	5
3	**Impacts of Technological Systems**	3
4	**Data Acquisition and Analysis**	5
5	**Computer Aided Design**	3
6	**System Interactions**	6
7	**Controlling Technology Systems**	5
8	**Technology Interactions: The STEM Connection**	6
9	**Resources for Maintaining Technology Systems**	3
	Total hours	39