Units of Instruction/Big Ideas

1. **Technology in Motion**: Over time, technological change has had a profound influence on individuals, society, and the environment and that these changes are neither good nor bad and can have far reaching positive and negative impacts.
2. **Design and Engineering**: The design process is a method that can be used to solve technological challenges to change transportation-related vehicles.
3. **Human Exploration**: As humans explore beyond the earth, they face many technological challenges.

Length of the Course: 9 weeks @ 5 hours/week = 45 contact hours
Prerequisites for the Course: None

Course Goals and Objectives

At the end of this course, students *will know and understand*:

1. The characteristics & scope of technology (STL – 1)
2. The cultural, social, economic and political effects of technology (STL – 4)
3. The role of society in the development and use of technology (STL – 6)
4. The attributes of design (STL – 8)
5. Engineering design (STL – 9)

At the end of this course, *students will be able to:*

1. Apply the design process (STL – 11)
2. Use and maintain technological products and systems (STL – 12)
3. Select and use information and communication technologies (STL – 17)
4. Select and use information and transportation technologies (STL – 18)
5. Select and use information and manufacturing technologies (STL – 19)

Course Assessment Criteria

1. Student pre-assessment
    a. Structured Response Pre-Assessment
    b. Constructed Response Pre-Assessment
    c. Constructed Response Pre-Assessment Rubric
2. Performance assessments
    a. Design, construct, and test solutions to various technological challenges
    b. Utilize the Internet to locate pertinent information
    c. Deliver presentation(s)
    d. Completion of group tasks
    e. Use software to organize and present information using proper layout techniques
    f. Work cooperatively to complete design activities
3. Written assessments
    a. Concept map that shows impacts of a technological product
    b. Engineering journal that shows learning through sketched ideas with annotations
    c. Pre Test to measure student knowledge & abilities in order to appropriately deliver content
    d. Authentic unit posttests to measure students ability to follow the design process

Course Content Outline

Units of Instruction	Big Idea	Lessons Identified	Assessment Criteria
Unit 1: Technology in Motion	Over time, technological change has had a profound influence on individuals, society, careers, and the environment. These changes are neither good nor bad and can have far reaching positive and negative impacts.	U1L1 – What is Technology? U1L2 – Push Pull Manufacturing U1L3 – Automation: Good or Bad?	
Unit 2: Design and Engineering	The engineering design process is a method that is used to solve technological challenges to change and improve products for the way we live.	U2L1: Documenting Ideas U2L2: Engineering Design Process U2L3: Transportation Design Activity	
Unit 3: Human Exploration	Humans have always had an innate desire to explore past the boundaries of earth to the moon and beyond. To that end, there are many technological, societal, and safety-related challenges that are associated with travel to and habitation of the lunar surface.	U3L1 – Understanding the Challenge (3-4 hours) U3L2 – Experts Coming Together (3-4 hours) U3L3 – Lunar Colony Design and Development (7-8 hours) U3L4 – Going Public U3L5 – Putting it all Together	

Unit 4: Greenhouse Design	The production and distribution of plant products grown in human-made ecological structures requires understandings from various fields of technology, science, and mathematics. In addition, structures must follow various codes to be properly designed and constructed.	U4L1 – Greenhouse Design Challenge (5-6 hours) U4L2 – "Greenhouse Effects" (5-6 hours) U4L3 – The Greenhouse Structure (5-6 hours) U4L4 – Putting it all Together (14-18 hours + plant growth time)	

Exploring Technology Model Course Guide Analysis
Unit 1: Technology in Motion (≈13 days)

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	STDS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES
Technology in Motion 1. Define and explain technology. 2. List examples of how technology has impacted society, individuals, and the environment. 3. Differentiate between intended and unintended impacts of technology. 4. Defend the benefits and drawbacks of using robots in manufacturing. 5. Work cooperatively to manufacture a product. 6. Identify the changing nature of careers as a result of technological change.	**What is Technology?** • Develop a definition for "technology" and related terms. • Discuss the interrelatedness of technology, science, and engineering • Identify various types of technologies. • List desirable and undesirable outcomes of technology.	4	Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (4-D)	Define and explain technology
			Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (4-E)	Differentiate between desirable and undesirable outcomes of technology.
				Recognize that all technology has the potential to have positive and/or negative results.
	Push/Pull Manufacturing • Review "What's Up in Factories" video • Identify new trends in manufacturing • Participate in a Push/Pull Activity • Calculate Quality Control rate calculation • Calculate Production rate calculation	19	Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning them. (19-F) Manufactured goods may be classified as durable and non-durable. (19-G)	Describe the role of manufacturing in the United States and the world.
				Explain how manufacturing impacts their lives.
				Compare and contrast push and pull manufacturing processes.
	Automation: Good or Bad? • How machines work • Lecture/discussion on automation • Toll booth Scenario • Automation reflective essay	4	Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (4-D) Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (4-E)	Compare and contrast the advantages and disadvantages of automation technology.
				Describe the systematic function of automated machines.
				Evaluate the ethical dilemmas with using automated machinery instead of humans.

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Unit 2: Design and Engineering (≈14 days)

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	STDS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES
Design and Engineering 1. List and explain the steps of the engineering design process. 2. Create sketches drawn to scale, with annotations, in an engineering design journal. 3. Define the subsystems of transportation. 4. Utilize computer technology to access and retrieve data. 5. Use the engineering design process to solve design challenges in transportation.	**Documenting Ideas** • Create sketches that represent an object or idea. • Develop an Engineering Design Journal (EDJ). • Compile sketches and notes in an Engineering Design Journal. • View examples of how an inventor documents their ideas. • Redesign a pencil for a specific job or career.	**9, 11**	Expressing ideas to others verbally and through sketches and models is an important part of the design process. (9-B)	Create sketches that technically represent an object or idea Compile sketches and notes in an Engineering Design Journal.
			Design involves a set of steps, which can be performed in different sequences and repeated as needed. (9-F)	Describe the characteristics of an Engineering Design Journal developed by an expert inventor.
			Apply a design process to solve problems in and beyond the laboratory-classroom. (11- H)	Explain the purpose of accurately and systematically developing an Engineering Design Journal (EDJ)
			Specify criteria and constraints for the design. (11- I)	
			Make two-dimensional and three-dimensional representations of the designed solution. (11- J)	
			Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. (11- K)	
			Make a product or system and document the solution. (11- L)	
	Engineering Design Process • Organize cards into an engineering design process (EDP) • Compare problem solving in science, mathematics, and technology. • Write examples of each step of the EDP	**9**	Design involves a set of steps, which can be performed in different sequences and repeated as needed. (9-F)	Explain the Engineering Design Process (EDP) as it relates to solving technological challenges.
				Compare and contrast the EDP with problem solving processes in science and mathematics
	Transportation Design Activity • Write examples of each of the transportation subsystems. • Design, construct, and test a transportation vehicle following the EDP • Give presentation about transportation vehicle.	**18, 11**	Transporting people and goods involves a combination of individuals and vehicles. (18- F)	Identify and distinguish between the subsystems of transportation vehicles in various environments.
			Transportation vehicles are made up of subsystems, such as structural, propulsion, suspension, guidance, control, and support, that must function together for a system to work effectively. (18- G)	
			Apply a design process to solve problems in and beyond the laboratory-classroom. (11- H)	Apply the Engineering Design Process to solve a transportation technology design challenge Describe and calculate velocity as it relates to the speed of the transportation vehicle that was constructed.
			Specify criteria and constraints for the design. (11- I)	
			Make two-dimensional and three-dimensional representations of the designed solution. (11- J)	
			Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. (11- K)	
			Make a product or system and document the solution. (11- L)	

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Unit 3: Human Exploration (≈24 days)

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	STDS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES
Human Exploration • Explain the benefits and challenges of lunar colonization. • List and explain the types of technology that are needed to safely and efficiently colonize on the lunar surface. • Utilize computer technology to develop print media material. • Communicate orally, in writing, and by graph, the results of a public opinion survey regarding colonization on the moon. • Design and construct a scale model of space habitats by following an engineering design process.	**Understanding the Challenge** • Take unit pretest • View "Off to the Moon" PowerPoint • Review lunar colony design challenge • Compare, contrast and calculate differences between the moon and earth. • View "Planning for Space Exploration" PowerPoint • Review scoring rubric	**1, 6**	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. (1- F)	Recognize that space travel and colonization is extremely complicated, time consuming, and expensive.
			Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. (6 - D)	Describe the mission to explore space and establish lunar colonies.
				Identify characteristics of the moon as compared the earth.
	Experts Coming Together • Conduct research with expert group • Present research to base group • Clarify lunar colony design challenge	**8, 11**	Design is a creative planning process that leads to useful products and systems. (8 - E)	Define and explain the limitations and constraints of living on the moon.
			Specify criteria and constraints for the design. (11 - I)	
			Apply a design process to solve problems in and beyond the laboratory-classroom. (11 - H)	Conduct research related to lunar colonization in one of four areas. • Energy Considerations • Shelter Design • Transportation • Sustainability
			Requirements for a design are made up of criteria and constraints. (8 - G)	
	Lunar Colony Design and Development • Create designs for a lunar colony model. • Construct a model of a lunar colony based on designs. • Calculate scale.	**2, 6, 8, 11**	Trade-off is a decision process recognizing the need for careful compromises among competing factors. (2 - S)	Explain the purpose of model building
			Design is a creative planning process that leads to useful products and systems. (8 - E)	Create a variety of sketches either electronically on paper to represent possible lunar colony ideas
			There is no perfect design. (8 - F)	Design and develop a model of a possible lunar colony
			Requirements for a design are made up of criteria and constraints. (8 - G)	
			Apply a design process to solve problems in and beyond the laboratory-classroom. (11- H) Specify criteria and constraints for the design. (11- I) Make two-dimensional and three-dimensional representations of the designed solution. (11- J) Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. (11- K) Make a product or system and document the solution. (11- L)	Design and develop a model of a possible lunar colony
	Going Public • Create a survey regarding lunar colonization	**3, 6**	A product, system, or environment developed for one setting may be applied to another setting. (3 - E)	Design and develop a survey related to lunar colonization. Implement their survey and explain the results of the data compilation
			Knowledge gained from other fields of study has a direct effect on the development of technological products and systems. (3 - F)	

	• Implement the survey • Tabulate and present the data in graphical form. • Conduct assessment of lunar colony model		Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies. (6- D)	Evaluate the quality and accuracy of their lunar colony model.
	Putting it all Together • Design a PowerPoint presentation about their lunar colony model and findings • Present findings and model	**11, 17**	Make a product or system and document the solution. (11- L)	Utilize PowerPoint to create an electronic slide show containing graphs, pictures, and text.
			The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message. (17- J)	Design and deliver a cooperative presentation about the lunar colony project including information about the lunar colony survey, model, and research.

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Unit 4: Greenhouse Design (≈39 days)

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	STDS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES
Greenhouse Design • Design, construct, and test a greenhouse structure that can successfully grow a plant product. • Work cooperatively to follow an engineering design process by documenting work in an engineering design journal. • Describe the basic components of a structure. • Explain how the "Greenhouse Effect" can be used to grow plant products in a human-made structure. • Monitor and record the progress a plant as it grows	**Greenhouse Design Challenge** • Complete Greenhouse Crossword Puzzle • Review Greenhouse Memorandum • Review Greenhouse Model Code Book of Ordinances	**2, 8, 9, 11, 20**	Requirements are the parameters placed on the development of a product or system. (2 - R)	Recognize that defining design constraints and limitations are necessary to solve technological challenges
			Requirements for a design are made up of criteria and constraints. (8 - G)	
			Design involves a set of steps that can be performed in different sequences and repeated when needed. (9-F)	Describe how to use the Engineering Design Process to design, construct, and test a greenhouse
			Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. (9 - G)	
			Specify criteria and constraints for the design. (11 - I)	Describe how ordinances are used to regulate the design and construction of buildings
			The selection of designs for structures is based on factors such as building laws and codes, style, convenience, cost, climate, and function. (20 - F)	
	"Greenhouse Effects" • Conduct Greenhouse Effect Experiment • Conduct Greenhouse Humidity Experiment • Complete the Greenhouse Quiz	**10, 15**	Artificial ecosystems are human-made complexes that replicate some aspects of the natural environment. (15 - I)	Explain the scientific basis for the greenhouse effect in the environment and in a contained structure.
				Identify the strengths and weaknesses of growing plants in a greenhouse.
			Some technological problems are best solved through experimentation. (10 - H)	Differentiate between how temperature and humidity impact the growing conditions in a greenhouse.
				Describe possible ways to monitor and control the environment in a greenhouse to maintain the optimal growing conditions.
	The Greenhouse Structure • Identify pros and cons of various greenhouse foundation options • Review the mathematics of angles • Determine the material to be used for the greenhouse structure and covering	**3, 11, 20**	Technological systems often interact with one another. (3 - D)	Explain the purpose, design, and make-up of a greenhouse foundation, structure, and covering.
			Structures rest on a foundation. (20 - G)	
			Some structures are temporary, while others are permanent. (20 - H)	
			Buildings generally contain a variety of subsystems. (20 - I)	
			Make two-dimensional and three-dimensional representations of the design solution. (11-J)	Design a greenhouse model following the specifications, criteria, and requirements given
			The selection of designs for structures is based on factors such as building laws and codes, style, convenience, cost, climate, and function. (20 - F)	
	Putting it all Together • Follow the Engineering Design Process to design, construct, and test greenhouse • Monitor greenhouse results of plant growth • Monitor temperature	**2, 9, 11, 15**	Technological systems include input, processes, output, and, at times, feedback. (2 - M)	Explain how the group's greenhouse model functions and its positive and negative attributes
			An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback. (2 - O)	
			Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. (9 - H)	
			Specify criteria and constraints for the design. (Benchmark I)	
			Make two-dimensional and three-dimensional representations of the designed solution. (Benchmark J)	Design, construct, and test a greenhouse model.