

Engineering and Design		Scope and Sequence
Unit	Lesson	Objectives
INTRODUCTION TO ENGINEERING AND DESIGN AND THE DESIGN PROCESS		
	Design Opportunities All Around Us	<p>Define the basic requirements of engineers and skills required for the occupation.</p> <p>Demonstrate the use of design information in real-world applications.</p> <p>Identify engineering concepts that are applied in the real world.</p> <p>Describe the function of a biomedical engineer.</p>
	Design Improvements	<p>Identify an item that is used every day that could be improved for easier use.</p> <p>Define and understand basic design concepts and how they are used daily.</p> <p>Define the problem, and be able to communicate the solution.</p> <p>Identify problems that can lead to new design solutions.</p>
	Project: Creating a Product Discussion Forum	
	Improvements of Everyday Items	<p>Define a problem.</p> <p>Communicate the solution.</p> <p>Recognize the specifications and limitations.</p> <p>Brainstorm possible designs.</p> <p>Identify and design an engineering project.</p>
	Project: Model or Prototype Suggestion Presentation	
	Basic Engineering Concepts	<p>Identify the critical thinking skills needed to solve problems using engineering.</p>

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		Develop the problem-solving skills required to solve the engineering challenges in everyday life.
		Apply engineering knowledge to problem-solving situations.
		Identify STEM careers in engineering.
		Identify key attributes that engineers must display to work effectively.
	Choosing Materials for Design	
		Explain the importance of design and engineering concepts in how they apply to sustainability.
		Apply engineering knowledge to problem-solving situations.
		Identify STEM careers in engineering.
		Describe the skills needed to be successful on the STEM career path in engineering.
		Identify properties of inorganic substances.
	Project: Researching Materials Designs	
	Application of Materials	
		Identify the critical thinking skills needed to solve problems using engineering.
		Develop the problem-solving skills required to solve the engineering challenges in everyday life.
		Apply engineering knowledge to problem-solving situations.
		Understand the basic foundations of design and engineering concepts and how they translate into problem-solving applications and products.
		Develop creative thinking in relation to design applications.
	Project: Designing a Destructive Test	
	Test	
FLUID SYSTEMS: ENERGY AND POWER TECHNOLOGIES IN ENGINEERING		
	Fluid Power Systems	
		Define and understand the basic concepts of fluid power, including hydraulic, gas, and water.

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		Define and understand the properties of gases and liquids.
		Differentiate between closed fluid systems and open fluid systems.
	Fluid Power Devices	
		Define and understand how forces are transmitted with fluid systems.
		Understand the components of each fluid power system.
		Define a problem that can be resolved with a new design solution using fluid power.
		Explain common uses for fluid systems in engineering.
	Project: Researching a Fluid Power System Goal	
	Designing Fluid Power Systems for Future Developments	
		Define moving and stationary fluid systems.
		Define a problem that can be solved through new designs using fluid power.
		Communicate design solutions that use fluid power.
	Project: Creating a Fluid Power System for the Future	
	Common Applications for Fluid Power Systems	
		Identify the variables of fluid power.
		Describe the career of an aerospace engineer.
		Identify devices that use fluid power.
		Identify and classify fluid systems: hydraulic and pneumatic power.
		Discuss fluid systems applications.
		Discuss common applications for fluid power systems.
	Project: Identifying Fluid Power in Daily Life	

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	Efficient Fluid Power Designs	<p>Discuss applications and future capabilities of fluid systems.</p> <p>Discuss efficiency through materials.</p> <p>Identify devices that use fluid power and their efficiency.</p>
	Designing a Fluid Power Lifting System	<p>Apply the problem-solving skills and knowledge of fluid power to engineering challenges.</p> <p>Communicate and produce optimal fluid power solutions.</p> <p>Integrate engineering and scientific concepts with fluid power capabilities.</p> <p>Explore a career in agricultural engineering.</p>
	Project: Designing a Fluid Power Lift System	
	Test	
MODELING AND SKETCHING		
	Introduction to Technical Sketching and Drawing	<p>Define and identify sketching techniques.</p> <p>Practice technical sketching techniques, and apply them to a given design.</p> <p>Define and understand the importance of sketching skills.</p>
	Project: Interview an Engineer About Sketching	
	Geometric Shapes and Solids in Engineering	<p>Identify geometric figures that form the structure of everyday objects.</p> <p>Design sketches of everyday objects using engineering lines.</p>
	Drawing to Scale	<p>Develop sketching skills and techniques.</p>

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		Produce detailed sketches of components in the design of a real-world object to scale.
		Understand and explain the concepts of technical sketching and drawing.
		Understand ratios and scales.
	Project: Creating a Technical Sketch of an Everyday Object to Scale	
	The Applications for Modeling in Engineering	Explain the importance of modeling for engineers.
		Describe the use of modeling for problematic and challenging locations and applications.
	Modeling and Prototypes	Define the purpose and importance of modeling and prototypes.
		Explain real-world applications of modeling and prototypes.
		Develop and explain sketch models.
	Project: Researching Model Uses in Remote or Dangerous Locations	
	Designing a Sketch Model	Employ sketch modeling techniques.
		Utilize sketch models to determine the feasibility of a product or design.
	Project: Presenting a Sketch Model of a Designed Pet Toy	
	Test	
REVERSE ENGINEERING		
	Reverse Engineering: Visual Analysis	Define and identify visual design principles and elements.
		Practice reverse engineering techniques, and apply them to a design.

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		Understand and explain the concepts of reverse engineering.
	Reverse Engineering: Functional Analysis	Practice reverse engineering techniques, and apply them to a design.
		Determine the goals of reverse engineering of a product.
		Define and understand the functional requirements of a design.
	Project: Creating a Function Structure Diagram or Product Teardown Chart	
	Reverse Engineering: Structural Analysis	Practice reverse engineering techniques and apply them to a design.
		Determine the goals of reverse engineering of a product.
		Define and understand the structural requirements of a design.
		Explore a career in computer engineering.
	Project: Creating a Morphological Matrix	
	Finding the Product: The Reverse Engineering and Design Process Applied	Define the purpose of reverse engineering for product improvement.
		Identify team and brainstorming techniques.
		Analyze a design, and identify opportunities for innovation.
	Implementing the Procedure: Reverse Engineering a Product	Define the purpose of reverse engineering for product improvement.
		Analyze a design, and identify its opportunities for innovation.
		Use decision matrices to make design decisions based on logic and analysis.
		Demonstrate the process of reverse engineering using the process of improving a product.

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	Project: Reverse Engineering Documentation and Presentation	
	Calculating the Process: Materials, Time, and Cost for Improvement	
		Conduct a materials analysis on an engineering project.
		Conduct a cost analysis on an engineering project.
		Conduct a time analysis on an engineering project.
	Project: Researching Materials, Time, and Cost for Product Modifications	
	Test	
ENGINEERING TO IMPROVE SUSTAINABILITY		
	Environmental Engineering Introduction	
		Define and understand how environmental engineering impacts our society and problems.
		Explain environmental engineering and how it can better our society.
		Understand the career of an environmental engineer and its area of impact, including global sustainability.
		Identify and research environmental issues and challenges.
	Project: Researching a Local Sustainability Issue	
	Energy and Air Quality	
		Define and understand the properties of renewable and nonrenewable resources.
		Define and understand how energy is an important part of environmental engineering.
		Define and understand how air quality and water quality are important parts of environmental engineering.
		Identify environmental issues and challenges.
	Green Buildings and Green Initiatives	

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		Understand the components of green building and initiatives.
		Define a sustainability problem, and be able to communicate the solution.
		Identify problems that can lead to new design solutions using environmental engineering.
		Develop problem-solving applications to meet sustainability challenges.
	Project: LEED Ratings for Building Construction	
	Environmental Assessment and Impacts	
		Identify and research environmental issues and challenges.
		Define and understand how environmental engineering impacts our society and problems.
		Explain environmental engineering and how it can better our society.
		Develop an understanding of the concept of an environmental life cycle.
	Project: Researching Life Cycles for Assessment	
	Green Design Principles: Systems and Environment	
		Understand how engineers impact global sustainability.
		Define and understand how environmental engineering impacts our society and problems.
		Explain environmental engineering and how it can improve our society.
	Incorporating Green Engineering Principles	
		Develop problem-solving applications to meet sustainability challenges.
		Develop problem-solving skills, and apply their knowledge to social and industrial environmental issues.
		Understand the strengths and weaknesses of the environmental models.
		Explore a career in civil engineering.
	Project: Creating a Decision Matrix for an Environmental Issue	

Unit Lesson

Objectives

Test

COURSE PROJECT, REVIEW, AND EXAM

Review

Exam