Curriculum Guide

Foundational Engineering Skills for STEM Scholars Hub, Aligned with NGSS Standards

Lesson Title	NGSS Standard	Concept	Objective	Practical Application	Grade Level	Suggested Days to Teach
1. Introduction to Engineering Design	3-PS2-4 Forces and Interactions	Engineering Principles and Design Challenges	Students will learn basic engineering concepts and how engineers solve problems.	Design a simple machine to move objects.	3-5	2-3
2. Understanding Simple Machines	4-PS3-4 Energy	Simple Machines and Mechanical Advantage	Students will understand the role of simple machines in engineering.	Build a lever to lift a small weight.	3-5	2-3
3. Exploring Forces and Motion	3-PS2-4 Forces and Interactions	Newton's Laws of Motion	Students will learn how forces affect motion in engineering designs.	Experiment with toy cars to study motion and force.	3-5	2-3
4. Building a Bridge	4-ETS1-2 Engineering Design	Structural Engineering	Students will learn how to design and test a bridge.	Build and test a paper bridge to hold weight.	4-6	3-4
5. Introduction	3-PS2-4	Renewable Energy	Students will	Build a small	4-6	3-4

to Renewable Energy	Forces and Interactions	Sources	understand renewable energy sources in engineering.	solar-powered vehicle.		
6. Investigating Buoyancy	3-PS2-4 Forces and Interactions	Forces and Buoyancy	Students will learn about buoyancy and its role in engineering.	Design a boat that floats using various materials.	3-5	2-3
7. Designing a Simple Motor	4-PS3-4 Energy	Electrical Engineering	Students will learn how electric motors work in engineering.	Build a simple motor using a battery, wire, and magnet.	4-6	3-4
8. Exploring Wind Energy	5-PS3-3 Energy	Wind Power and Renewable Energy	Students will understand wind as a renewable energy source.	Create a simple windmill to generate power.	4-6	3-4
9. Introduction to Robotics	4-ETS1-2 Engineering Design	Robotics and Automation	Students will learn basic robotics and automation concepts.	Build and program a simple robot using a kit.	5-8	4-5
10. Investigating Heat Transfer	4-PS3-4 Energy	Heat Transfer and Insulation	Students will learn how heat is transferred and its engineering applications.	Test materials for their insulating properties.	4-6	3-4
11. Designing a	3-PS2-4	Kinetic and	Students will	Build a model	4-6	4-5

Roller Coaster	Forces and Interactions	Potential Energy	understand kinetic and potential energy in design.	roller coaster and test its efficiency.		
12. Engineering with Magnets	3-PS2-5 Forces and Interactions	Magnetism and Electromagnetism	Students will explore how magnets are used in engineering.	Build an electromagnet to lift small objects.	3-5	2-3
13. Solar Power in Engineering	4-PS3-1 Energy	Solar Energy and Conversion	Students will understand how solar power is used in engineering.	Design a solar-powered car or device.	4-6	3-4
14. Creating a Sustainable City	4-ETS1-3 Engineering Design	Sustainable Engineering and Design	Students will explore how engineers design sustainable cities.	Plan and design a model of an eco-friendly city.	5-8	4-5
15. Engineering a Tower	4-PS3-1 Energy	Structural Engineering	Students will learn about stability and structure in engineering.	Build the tallest tower using limited materials.	4-6	3-4
16. Investigating Sound Waves	3-PS2-4 Forces and Interactions	Sound and Vibration	Students will understand how sound travels and its applications in engineering.	Build a simple sound recorder or amplifier.	3-5	2-3
17. Building a	4-ETS1-3	Water Filtration	Students will	Design and test a	4-6	3-4

Water Filter	Engineering Design	and Purification	learn about filtration systems in engineering.	water filtration system.		
18. Exploring the Engineering Design Process	5-ETS1-1 Engineering Design	Problem Solving and Iteration	Students will learn how engineers approach problem-solving.	Use the engineering design process to solve a real-world problem.	5-8	4-5
19. Understanding Structural Stability	5-PS1-3 Matter and Its Interactions	Materials and Their Properties	Students will explore material properties in engineering design.	Test various materials for strength and stability.	4-6	3-4
20. Exploring the Science of Flight	3-PS2-4 Forces and Interactions	Aerodynamics and Flight	Students will learn the basic principles of flight in engineering.	Build and test paper airplanes or small models.	3-5	2-3
21. Understanding Friction and Motion	5-PS3-4 Energy	Friction and Kinetic Energy	Students will explore the role of friction in engineering.	Design a ramp to study the effect of friction on moving objects.	4-6	3-4
22. Investigating Water Pressure	4-PS3-3 Energy	Fluid Mechanics	Students will learn about fluid pressure and its applications.	Design a water pressure system using bottles and tubes.	4-6	3-4
23. Exploring the Engineering	3-PS2-4 Forces and	Vehicle Design and Forces	Students will learn how forces	Build a small car and test how it	4-6	3-4

of Vehicles	Interactions		affect vehicle design.	moves on different surfaces.		
24. Designing a Wind Tunnel	4-PS3-4 Energy	Wind and Air Flow	Students will explore how wind tunnels are used in engineering.	Create a simple wind tunnel to test objects' airflow.	5-8	4-5
25. Investigating Environmental Impact	4-ETS1-2 Engineering Design	Environmental Engineering	Students will understand how engineers consider environmental impact.	Research and design a solution to reduce waste.	4-6	3-4
26. Exploring Robotics in Space	5-PS2-4 Forces and Interactions	Robotics and Space Engineering	Students will explore how robots are used in space exploration.	Build and program a robot to simulate space exploration.	5-8	4-5
27. Understanding the Water Cycle	3-ESS2-1 Earth's Systems	Water Systems and Sustainability	Students will learn about water systems and how they affect engineering.	Build a model showing the water cycle and its impact on engineering.	4-6	3-4
28. Exploring the Role of Engineers in Medicine	3-PS2-5 Forces and Interactions	Biomedical Engineering	Students will understand how engineering principles are applied in	Design a simple prosthetic or medical tool.	5-8	4-5

			medicine.			
29. Investigating the Importance of Recycling	4-PS3-4 Energy	Recycling and Environmental Engineering	Students will explore how recycling is used in engineering solutions.	Build a model that promotes recycling in a community.	4-6	3-4
30. Designing Sustainable Transportation	5-PS3-3 Energy	Transportation Engineering	Students will explore sustainable transportation solutions.	Design a sustainable vehicle using recyclable materials.	5-8	4-5

Note: The NGSS standards are used in this curriculum because they are widely adopted across states in the United States and provide a cohesive framework for teaching science and engineering concepts. The NGSS standards focus on hands-on, inquiry-based learning, which aligns well with the goals of engineering education, and support the integration of scientific and engineering practices in the classroom. This makes the lessons accessible and applicable for a broad audience of students, including those in both elementary and middle school settings.

Reference:
Next Generation Science Standards (NGSS). (2013). *Next Generation Science Standards: For States, By States*. Retrieved from https://www.nextgenscience.org

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