Elementary GATE - Grade 3

Unit Title: Third Grade Unit One (Introduction to Engineering and the Engineering Design Process)

Stage 1: Desired Results

Standards & Indicators:

National Standards in Gifted and Talented Education

- **1.1** - Self-Understanding. Students with gifts and talents recognize their interests, strengths, and needs in cognitive, creative, social, emotional, and psychological areas.
- **2.1** - Identification. All students in Pre-K through grade 12 with gifts and talents have equal access to the identification process and proportionally represent each campus.
- **2.5** - Learning Progress. Students self assess their learning progress.
- **3.2** - Talent Development. Students with gifts and talents demonstrate growth in social and emotional and psychosocial skills necessary for achievement in their domain(s) of talent and/or areas of interest.
- **3.3** - Responsiveness to Diversity. Students with gifts and talents develop knowledge and skills for living in and contributing to a diverse and global society.
- **3.4** - Instructional Strategies. Students with gifts and talents demonstrate their potential or level of achievement in their domain(s) of talent and/or areas of interest.
- **3.5** - Instructional Strategies. Students with gifts and talents become independent investigators
- **4.1** - Personal Competence. Students with gifts and talents demonstrate growth in personal competence and dispositions for exceptional academic and creative productivity. These include self-awareness, self-advocacy, self-efficacy, confidence, motivation, resilience, independence, curiosity, and risk taking.
- **4.2** - Social Competence. Students with gifts and talents develop social competence manifested in positive peer relationships and social interactions.6.1. Talent Development. Students identify and fully develop their talents and gifts as a result of interacting with educators who possess content pedagogical knowledge and meet national teacher preparation standards in gifted education and the Standards for Professional Learning.

Computer Science and Design Thinking

Standard	Performance Expectations	Core Ideas
8.2.5.ED.1	Explain the functions of a system and its subsystems	Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge. Often, several design solutions exist, each better in some way than the others
8.2.5.ED.3	Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task	
8.2.5.ED.4	Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).	Engineering design requirements include desired features and limitations that need to be considered
8.2.5.ITH.2	Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have	A new tool may have favorable or unfavorable results as well as both positive and negative effects on society. Technology spurs new businesses and careers.

Career Readiness, Life Literacies and Key Skills

Standard	Performance Expectations	Core Ideas
9.2.5.CAP.1	Evaluate personal likes and dislikes and identify careers that might be suited to	An individual's passions, aptitude and skills can affect his/her

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	personal likes.	employment and earning potential.
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.	
9.4.5.CI.4	Research the development process of a product and identify the role of failure as a part of the creative process.	Curiosity and a willingness to try new ideas (intellectual risk-taking) contributes to the development of creativity and innovation skills.

Central Idea/Enduring Understanding:	**Essential/Guiding Question:**
● The engineering design process emphasizes open-ended problem solving and encourages students to learn from failure.	● How does the engineering design process help solve real world problems?
Content: ● Research famous inventors ● Telegraph Machine ● Kinetoscope ● Electricity	**Skills (Objectives):** ● Research a famous inventor and present how their invention has contributed to today's technology ● Design and build a Telegraph using morse code ● Create a film strip for a real motion picture player ● Compare and contrast how series circuits and parallel circuits produce different results

Interdisciplinary Connections:

NJSLS - Science

- 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. •
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

NJSLS - Math

- MP.2 Reason abstractly and quantitatively. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)
- MP.4 Model with mathematics. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)
- MP.5 Use appropriate tools strategically. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)

NJSLS - Language Arts

- L.KL.3.1. Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- L.VL.3.2. Determine or clarify the meaning of unknown and multiple-meaning academic and domain-specific words and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.
- L.VI.3.3. Demonstrate understanding of figurative language, word relationships and nuances in word meanings.
- RI.IT.3.3. Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- RI.PP.3.5. Distinguish their own point of view from that of the author of a text.
- RI.MF.3.6. Use information gained from text features (e.g., illustrations, maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).
- W.AW.3.1. Write opinion texts to present an idea with reasons and information.
- W.IW.3.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- W.WR.3.5. Generate questions about a topic and independently locate related information from at least two reference sources (print and non-print) to obtain information on that topic.
- W.SE.3.6. Use discussion, books, or media resources to gather ideas, outline them, and prioritize the information to include while planning to write about a topic.

- W.RW.3.7. Engage in independent and task-based writing for both short and extended periods of time, producing written work routinely.

Stage 2: Assessment Evidence

Performance Task(s):

- Complete a presentation outlining how past inventors contributed to today's technology
- Students compare and discuss different ways to communicate and build a telegraph
- Students design a film strip to be used on a kinetoscope
- Assemble a working parallel circuit

Other Evidence:

- Group discussion of technology
- Students reflect on their original plan and how it differed from their final plan.
- Students show the ability to improve on their design further.

Stage 3: Learning Plan

Learning Opportunities/Strategies:

Lesson 1

- Students will work in a group to complete a digital breakout to review the parts of the Engineering Design Process

Lesson 2

- Students will work in pairs to research past inventors and choose one to research further

Lesson 3

- Complete a presentation on how an inventor of the past used the engineering design process to contribute to today's technology

Lesson 4

- Students will recognize the important morse code and create a message using morse code.
- Students will discuss Samuel Morse's contributions to modern day technology

Lesson 5

- Students will plan their telegraph design using the Engineering design process and start building a prototype

Lesson 6

- Students use the materials provided from the kit to build a device telegraph and test design. Discuss with the class any improvements that need to be made.

Lesson 7

- Students will investigate how Thomas Edisons' kinetoscope contributed to today's film industry

Resources:

Lesson 1

- Link to Digital Breakout

Lesson 2

- Graphic organizer
- Engineering Design Process Journal

Lesson 3

- Engineering Design Process Journal

Lesson 4

- Lakeshore STEM Famous Inventors Problem Solving Kit, task card 1

Lesson 5

- Lakeshore STEM Famous Inventors Problem Solving Kit, task card 2,3
- Engineering Design Process Journal

Lesson 6

- Lakeshore STEM Famous Inventors Problem Solving Kit, task card 2,3
- Engineering Design Process Journal

Lesson 7

- Lakeshore STEM Famous Inventors Problem Solving Kit, task card 1
- Engineering Design Process Journal

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• Students will start brainstorming ideas for a real-motion film strip **Lesson 8** • Students will use kit to create a working kinetoscope **Lesson 9** • Students will test their kinetoscope and make improvements as needed. • Students will watch each other's filmstrips and offer feedback **Lesson 10** • Students will brainstorm ways that we use electricity engineers might do. • Complete the Electricity at Home task card **Lesson 11** • Students will watch a demonstration on complete and incomplete circuits. Discuss why incomplete circuits won't work. Complete task card. **Lesson 12** • Students will practice making a series circuit and a parallel circuit with switches and design an alarm for a pencil box.	• Thomas Edison video **Lesson 8** • Lakeshore STEM Famous Inventors Problem Solving Kit, task card 2,3 • Engineering Design Process Journal **Lesson 9** • Lakeshore STEM Famous Inventors Problem Solving Kit, task card 2,3 • Engineering Design Process Journal **Lesson 10** • Lakeshore Electricity Physical Science Lab Electricity at Home task card **Lesson 11** • Lakeshore Electricity Physical Science Lab Complete and Incomplete Circuits task card **Lesson 12** • Lakeshore Electricity Physical Science Lab Series Circuit and Parallel Circuit Task Cards • Engineering Design Process Journal

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to struggling and/or Special Needs Section for differentiation.

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Students will be provided with more challenging work based on their individual needs.	Students will be provided with more challenging work based on their individual needs.	Student and teacher will make plan to improve in certain areas as needed	Students will be allotted extra time as needed to finish projects Students will have the opportunity to work solo if needed .

Unit Title: 3rd Grade Unit Two (Engineering Earthquake-Resistant Buildings)

Stage 1: Desired Results

Standards & Indicators:

National Standards in Gifted and Talented Education

- **1.1** - Self-Understanding. Students with gifts and talents recognize their interests, strengths, and needs in cognitive, creative, social, emotional, and psychological areas.
- **2.1** - Identification. All students in Pre-K through grade 12 with gifts and talents have equal access to the identification process and proportionally represent each campus.
- **2.5** - Learning Progress. Students self assess their learning progress.

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- **3.2** - Talent Development. Students with gifts and talents demonstrate growth in social and emotional and psychosocial skills necessary for achievement in their domain(s) of talent and/or areas of interest.
- **3.3** - Responsiveness to Diversity. Students with gifts and talents develop knowledge and skills for living in and contributing to a diverse and global society.
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- **3.5** - Instructional Strategies. Students with gifts and talents become independent investigators
- **4.1** - Personal Competence. Students with gifts and talents demonstrate growth in personal competence and dispositions for exceptional academic and creative productivity. These include self-awareness, self-advocacy, self-efficacy, confi - dence, motivation, resilience, independence, curiosity, and risk taking.
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Computer Science and Design Thinking

Standard	Performance Expectations	Core Ideas
8.2.5.ED.1	Explain the functions of a system and its subsystems	Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge. Often, several design solutions exist, each better in some way than the others
8.2.5.ED.2	Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models	
8.2.5.ED.3	Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task	
8.2.5.ED.4	Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).	Engineering design requirements include desired features and limitations that need to be considered
8.2.5.ED.5	Describe how specifications and limitations impact the engineering design process.	
8.2.5.ED.6	Evaluate and test alternative solutions to a problem using the constraints and trade-offs identified in the design process	
8.2.5.ITH.2	Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have	A new tool may have favorable or unfavorable results as well as both positive and negative effects on society. Technology spurs new businesses and careers.
8.2.5.ITH.3	Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use	
8.2.5.NT.1	Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem	Technology innovation and improvement may be influenced by a variety of factors. Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world

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Career Readiness, Life Literacies and Key Skills		
Standard	**Performance Expectations**	**Core Ideas**
9.2.5.CAP.1	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.	An individual's passions, aptitude and skills can affect his/her employment and earning potential.
9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.	

Central Idea/Enduring Understanding:	**Essential/Guiding Question:**
• The engineering design process is involved in the creation and production of many items in our everyday lives.	• How does engineering and the engineering design process improve our lives?

Content:	**Skills (Objectives):**
• Tower Power • A Shaky Situation • Building Skeletons • Stop the Slide • Getting Braces • Create an Earthquake-Resistant Building • Showcase: Shake Things Up	• Students will engineer a index tower card that supports a stuffed animal • Students will explore how a shake table simulates an earthquake. • Students construct a building unit • Students will experiment with ways to stop building units from sliding • Students will engineer a way to prevent buildings from shearing • Students will engineer a model earthquake building that withstands an earthquake • Students will improve and present their earthquake resistant building design

Interdisciplinary Connections:

NJSLS - Science

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- RI.MF.3.6. Use information gained from text features (e.g., illustrations, maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).
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- W.RW.3.7. Engage in independent and task-based writing for both short and extended periods of time, producing written work routinely.

Stage 2: Assessment Evidence

Performance Task(s):

- Students will engineer a index tower card that supports a stuffed animal
- Students will explore how a shake table simulates an earthquake.
- Students will experiment with ways to stop building units from sliding
- Students will engineer a way to prevent buildings from shearing
- Students will engineer a model earthquake building that withstands an earthquake
- Students will improve and present their earthquake resistant building design

Other Evidence:

- Group discussion of improved backpacks.
- Students reflect on their original plan and how it differed from their final plan.
- Students show the ability to improve on their design further.

Stage 3: Learning Plan

Learning Opportunities/Strategies:

Lesson 1

- Students evaluate a message from travelers that tasks students to create a tower to hold a stuffed animal. Students use the engineering design process to plan, improve and test design

Lesson 2

- Read an article and watch a video about the 2010 earthquake in Haiti. Build a shake table and explore how it simulates an earthquake.

Lesson 3

- Students will decide on a budget for the building and map out a plan using materials from the store and adding up the total cost of the project.

Lesson 4

- Students will make building units and stack them up to make models of buildings .
- Use a shake table to determine which shape and size buildings best withstand earthquakes.

Resources:

Lesson 1

- EIE Shake Things Up: Engineering Earthquake Resistant Building Kit
- Engineering Design Process Journal

Lesson 2

- Haiti article
- Engineering Design Poster
- Materials to construct a shake table

Lesson 3

- Engineering Design Poster
- Shake Table
- Material Store with prices to construct model buildings

Lesson 4

- Engineering Design Poster
- Shake Table

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Lesson 5 ● Students work in groups to experiment ways to stop their building units from sliding.	**Lesson 5** ● Engineering Design Poster ● Shake Table ● Model buildings ● Building Codes Chart
Lesson 6 ● Students will engineer a way to prevent their buildings from shearing	**Lesson 6** ● Engineering Design Poster ● Shake Table ● Model buildings ● Building Codes Chart ● Engineering Design Process Journal
Lesson 7 ● Students will explore the many different ways to engineer braces to strengthen building units.	**Lesson 7** ● Engineering Design Poster ● Shake Table ● Model buildings ● Building Codes Chart Engineering Design Process Journal
Lesson 8 ● Students will work in groups to engineer a model earthquake resistant building that can withstand a 7.0 magnitude earthquake	**Lesson 8** ● Engineering Design Poster ● Shake Table ● Model buildings and material to improve ● Building Codes Chart ● Engineering Design Process Journal
Lesson 9 ● Students will work in groups to improve their model earthquake-resistant buildings and finalize their building codes	**Lesson 9** ● Chart paper and markers ● Engineering Design Poster ● Shake Table ● Model buildings and material to improve ● Building Codes Chart ● Engineering Design Process Journal
Lesson 10 ● Students will present their work and explain how they used the Engineering Design Process to engineer their model buildings.	**Lesson 10** ● Engineering Design Poster ● Shake Table ● Model buildings ● Building Codes Chart ● Engineering Design Process Journal
Lesson 11 ● Students combine their shake tables to create a model city and test how earthquake resistant the city is.	**Lesson 11** ● Engineering Design Poster ● Shake Table ● Model buildings from all groups ● Building Codes Chart ● Engineering Design Process Journal
Lesson 12 ● Students will propose a plan to present their building idea to an engineering company to	**Lesson 12** Engineering Design Process Journal ● Paper or computer to type on

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use in other cities and outline the costs of the building.	

Differentiation *Please note: Teachers who have students with 504 plans that require curricular accommodations are to refer to Struggling and/or Special Needs Section for differentiation.

High-Achieving Students	On Grade Level Students	Struggling Students	Special Needs/ELL
Students will be provided with more challenging work based on their individual needs.	Students will be provided with more challenging work based on their individual needs.	Student and teacher will make plan to improve in certain areas as needed	Students will be allotted extra time as needed to finish projects Students will have the opportunity to work solo if needed .

Pacing Guide

Course Name	Resource	Standards
UNIT 1 Introduction to Engineering and the Engineering Design Process 12 days 2 days per the 6 day cycle 12 weeks	A. Lakeshore STEM Famous Inventors Problem Solving Kit, Samuel Morse B. Lakeshore STEM Famous Inventors Problem Solving Kit, Thomas Edison C. Lakeshore Electricity Physical Science Lab	**National Standards in Gifted and Talented Education** 1.1, 2.1, 2.5, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 6.1 **NJSLS - Science** 3-5-ETS1-1, 2, 3 **NJSLS- Math** (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3). (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3) (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)(3-5-ETS1-1), (3-5-ETS1-2) **NJSLS- Language Arts** W.5.7, W.5.8
UNIT 2 Engineering Earthquake-Resistant Buildings 12 days 2 days per the 6 day cycle 12 weeks	A. EIE Shake Things Up: Engineering Earthquake-Resistant Buildings Kit	**National Standards in Gifted and Talented Education** 1.1, 2.1, 2.5, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 6.1 **NJSLS - Science** 3-5-ETS1-1, 2, 3 **NJSLS- Math** (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3). (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)

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		(3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)(3-5-ETS1-1), (3-5-ETS1-2) **<u>NJSLS- Language Arts</u>** W.5.7, W.5.8