Engineering I

Unit Title: Engineering Design Process and Drawing

Stage 1: Desired Results

Standards & Indicators:

NJSLS for Computer Science and Design Thinking

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.

8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).

8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).

8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.

8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment

Computer Science and Design Thinking

Standard	Performance Expectations	Core Ideas
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.	Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization.
8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.	
8.2.12.ED.5	Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.
8.2.12.ED.6	Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).	
8.2.12.NT.1	Explain how different groups can contribute to the overall design of a product	Engineers use science, mathematics, and other disciplines to improve technology. Increased collaboration among engineers, scientists, and mathematicians can improve their work and designs. Technology, product, or system redesign can be more difficult than the original design.

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8.2.12.ETW.2	Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment	Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time
Career Readiness, Life Literacies and Key Skills		
Standard	**Performance Expectations**	**Core Ideas**
9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).	With a growth mindset, failure is an important part of success.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).	
9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).	
9.4.12.CT.4	Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.	
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6.).	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.
9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.	
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).	

Central Idea/Enduring Understanding:	**Essential/Guiding Question:**
The complexity of the object determines the type of drawing to be created. Engineers use accurate drawings to communicate design intent.	• What is the engineering process? • Why are different types of drawings needed? • What makes a good drawing? • How can using CAD help solve engineering problems? • How important is accuracy?

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Different engineering professions improve different aspects of a society's quality of life.	• How do engineers use drawings to communicate with one another? • How do different types of engineers affect your daily life?
Content: • Engineering design process • Common drawing terminology • Components of drawing • Commands and functions on TinkerCad	**Skills(Objectives):** Identify and explain steps of the engineering design process. Proficiently use a CAD program to set up and create the correct drawing type for a given object/application. Use CAD programs to communicate design intent. Describe the role that engineers play in society.
Interdisciplinary Connections: As students learn concepts, they will develop projects that demonstrate their proficiency in science, math, literacy, and computer science. Activity: Write an essay on a selected engineering profession and how it positively impacts/improves the quality of life.	
Stage 2: Assessment Evidence	
Performance Task(s): Students created 3D drawings using TinkerCad. Using illustrations of drawings, students will identify the types of drawing and its applications. Create a multi-view drawing	**Other Evidence:** Engineering Logbooks Project Rubrics Quizzes Peer Review Tests Self-Assessment by student of their learning activities Teacher observation of student performance during learning activities
Stage 3: Learning Plan	
Learning Opportunities/Strategies: Individual and group presentations Demonstrations Programming Design Presentations Small group work Guest Speakers	**Resources:** TinkerCad Videos 3D Printers Google Classroom LGBT and Disabilities Resources: • LGBTQ-Inclusive Lesson & Resources by Garden State Equality and Make it Better for Youth • LGBTQ+ Books DEI Resources: • Learning for Justice • GLSEN Educator Resources • Supporting LGBTQIA Youth Resource List • Respect Ability: Fighting Stigmas, Advancing Opportunities • NJDOE Diversity, Equity & Inclusion Educational Resources • Diversity Calendar

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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**
On Grade level activities plus additional projects and leadership roles on project teams. Mentoring other students	Projects Engineering Logbooks Presentations Project Meeting minutes	On Grade level activities plus projects based on the student's ability. Extra time One on One coaching opportunities during study hall and after school tutoring Work with a student mentor.	Any student requiring further accommodations and/or modifications will have them individually listed in their 504 Plan or IEP. These might include, but are not limited to: breaking assignments into smaller tasks, giving directions through several channels (auditory, visual, kinesthetic, model), and/or small group instruction for reading/writing ELL supports should include, but are not limited to, the following:: Extended time Provide visual aids Repeated directions Differentiate based on proficiency Provide word banks Allow for translators, dictionaries

Pacing Guide

Engineering I	Content/Resources	Standards
UNIT 1:		
Engineering Design Process and Drawing (90 Days)	TinkerCad Videos 3D Printers Google Classroom	8.2.12.ED.1: 8.2.12.ED.2: 8.2.12.ED.5 8.2.12.ED.6: 8.2.12.NT.1: 8.2.12.ETW.2