Pascack Valley Regional High School District

Pascack Hills High School, Montvale, New Jersey
Pascack Valley High School, Hillsdale, New Jersey

Course Name: Honors Engineering Design I
***Engineer Your World* - University of Texas at Austin (Dual Enrollment)**

Born On: August, 2017
Revised On: August, 2022
Current Revision: August 2023
Board Approval: 8/28/2023

New Jersey Curricular Mandates for Technology Education

Disabled & LGBT:
18A:35-4.35 - History of disabled and LGBT persons included in middle and high school curriculum. A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards.

Diversity, Equity, and Inclusion (DEI):
C.18A:35-4.36a - Curriculum to include instruction on diversity and inclusion. 1. a. Beginning in the 2021-2022 school year, each school district shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards. b. The instruction shall: (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance; (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and (3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs. c. The Commissioner of Education shall provide school districts with sample learning activities and resources designed to promote diversity and inclusion.

Amistad Law:
N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Climate Change:
2020 NJSLS-Computer Science and Design Thinking: At the core of computer science and design thinking education, is the goal to prepare students with the essential knowledge and skills to make their local and global communities a better place to live. Learning experiences that enable students to apply content knowledge and employ computational thinking skills prepare students for the work of tomorrow by proposing solutions concerning the balancing of societal, environmental, and economic needs for a sustainable future. Further, leveraging topics such as computational sustainability and clean technology (Cleantech), technologies that either reduce or optimize the use of natural resources while reducing the negative effect that technology has on the planet and its ecosystems, is essential for developing a populace with the knowledge and skills necessary to mitigate the effects of climate change.

HONOR ENGINEERING DESIGN I - *Engineer Your World*

Unit 1: Introduction to Engineering – Mini design Challenge - Build a Better Car – using simple materials

The opening unit for the *Engineer Your World* curriculum is designed to lay the foundation for collaboration, documentation, and engineering skills and habits of mind for the entire year. Students will be exposed to the fields and practice of engineering, the need for collaboration and classroom norms, and the need for thorough and comprehensive documentation. The primary goal of the unit is to introduce the subject of the class (engineering) and to begin setting the norms for classroom behavior and interactions. Students will refer to, adhere to, and possibly revise these norms as they progress through the entire course.

Time Allotted: Approximately 1-2 Weeks

New Jersey Student Learning Standards (NJSLS)

8.2.2.ED.1: Communicate the function of a product or device.
8.2.2.ED.2: Collaborate to solve a simple problem, or to illustrate how to build a product using the design process.
8.2.2.ED.3: Select and use appropriate tools and materials to build a product using the design process.
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.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
9.3.12.AC.1 Use vocabulary, symbols and formulas common to engineering and construction.
9.3.12.AC.2 Use engineering and construction skills to create and manage a project.
9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC.7 Describe career opportunities and means to achieve those opportunities in each of the Engineering Discipline Career Pathways.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
● What constitutes complete and accurate documentation for engineers? ● How does such documentation support good engineering design?	● Identifying things that engineers have affected. ● Learning about the major branches of engineering and the state of diversity in engineering. ● Working with the teacher(s) and peers to establish the	● What is engineering video showing different disciplines ● How do you describe engineering? ● Engineer duties and responsibilities ● Make plans using detailed drawings.	● Assessment of the project notebook should not be a mere diary of team activities. It should be a complete, concise, neat record of all information used in project decision-making. Project notebook grades may

• How do engineers work effectively in teams?	norms (rules) by which they will abide. • Identifying personality types and use these to explain the successes and challenges of working in teams. • Explaining how various types of documentation (e.g., visual information, text-based instructions, statements of purpose and requirements) contribute to a complete understanding of a project. • Experiencing design without a design process. • Generating a list of important components of an engineering notebook.	• Prepare BOTH capital and time. • Create accurate project specifications. • Understand constraints and specifications • Design engineering experiments • 'True Colors' activity to recognize personality traits	produce different final letter grades for members of the same team. • Engineering notebooks to include but not limited to; organization, calculations, sketches with captions, empirical data, conclusions, & insights • Assessment of each 'Team' and credit for speaking professionally and giving a successful demonstration. • Assessment of the 'Engineering 'Language' including key terms discovered in the unit.
Resources/Materials	Cardboard, Compass, Paper, Ruler/Scale, X-Acto Knife, Self-Healing Cutting Mat, Scissors, Tape, Colored Pencils, Paper Clips, Index Cards, Rubber Bands, Pliers, Manila folders, Computers, Internet access		
Interdisciplinary Connections	NJSLSA.SL1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. NJSLSA.SL2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. RI.11-12.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.		
Life Literacies & Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving		
Information and Media Literacy & Technology	9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information.		

Literacy	9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified 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. 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 9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Career Readiness, Life Literacies & Key Skills Practices	Act as a responsible and contributing community member and employee Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide models of completed homework assignments,	● Provide extended time for the creation of products. ● Scaffolded explanations for proper use of equipment. ● Receive large projects as smaller tasks with individual deadlines.	● Incorporate student choice. ● Provide peer mentoring to improve techniques. ● Use effort and achievement rubrics ● Allow students many opportunities for practice and	● Offer choices, once finished with basic tasks, with personal interest being essential.

projects, etc. ● Assign a native language partner. ● Use sentence/paragraph frames to assist with projects.		learning. ● Use scaffolding for complex tasks. ● Evaluate students on the basis of individual mastery.	

HONORS ENGINEERING DESIGN – *Engineer Your World I*

Unit 2: Multidisciplinary Engineering – PinHole Camera

This unit guides students through an internalization of the engineering design process as they create a pinhole camera that meets both quantitative design specifications and qualitative requirements for usability by people with limited dexterity in their hands and wrists. Rather than give students the design process and walk them through steps that have been named for them, the teacher guides students through the unnamed steps, pausing after each step to ask students to give a name to what they have just done. The final lesson in the unit is a reflection and comparison on the process that the class has "discovered" to the "official" engineering design process employed by *Engineer Your World*, which they will use to solve the remaining challenges of the course. The purpose of this constructivist approach is to empower the students to "create" and "own" their version of a process that will be central to their experience in this course.

Throughout this unit, students learn that **engineering is not construction, but an intentional process that is more effective and efficient than pure trial-and-error.**

Time Allotted: Approximately 6-7 weeks

New Jersey Student Learning Standards (NJSLS)

9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
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).

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
● How do we 'Design' for all? ● Why is it important to follow a structured design process? ● What constitutes complete and	● Develop their own understanding of the engineering design process and its utility by ● Developing a mathematical model to describe the pinhole camera and use that model to	● Create a container that is 'light-tight' ● Design and create a shutter ● Design and create a film paper holder ● Design and locate the aperture	● Assessment of written and verbal mastery of unit-specific vocabulary, through conversation and writing samples. ● Assessment of modeling skills by drawing and labeling

accurate design documentation for engineers? How does such documentation support good engineering design? ● How do engineers decide which problems to solve?	determine their camera's internal geometry. ● Design an appropriate solution (i.e., pinhole camera) for a specified customer and user by:	● Design a 'system' to allow the user to be the same distance away from the object being photographed (without a tape measure) ● Create a 'system' to develop the film ● Describe the role of engineers in addressing changing societal needs by developing an historical timeline that demonstrates connections between imaging product evolution/innovation and the societal needs that prompted these changes (Unit Project). ● Creating clear and concise written documentation (i.e., manufacturing instructions, user instructions) to communicate their design solution to the customer.	diagrams, making analogies, building 3D structures, and/or making observational sketches. ● Unit Deliverable: UNIT 02 PIN HOLE CAMERA DELIVERABLE
Resources/Materials	● Light Meter, Oven Mitts, Sandpaper, Darkroom Safe Light, White Poster Board, Various Types of Containers (show box, oatmeal container, Coffee Tin), Black Plastic Sheeting, Cardboard, Plastic, fabric, Cylindrical Tubes, Index Cards, Manila Folder, Markers, Colored Pencils, Tape, String, Paint, Aluminum can, Straight Pin, Popsicle sticks, Film paper, Developer, Fixer, Stop Bath, Tongs to remove film, Trays, Paper clips, Rubber Bands, Scissors, X-Acto Knife, Ruler, Compass, Computers, Internet access, Resource Texts ● Machinery: Drill Press, Band Saw, Laser Cutter, Handheld Power Tools ● OSHA Safety Guidelines: https://www.osap.org/page/GuideOSHAh		
Interdisciplinary Connections	NJSLSA.SL1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.		

	NJSLSA.SL2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
Life Literacies & Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
Information and Media Literacy & Technology Literacy	9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified 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. 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 9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Career Readiness, Life Literacies & Key Skills	Act as a responsible and contributing community member and employee Demonstrate creativity and innovation.

Practices	Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Add written labels to equipment. ● Assign a native language partner. ● Provide extended time for written responses and reports.	● Provide an outline of lessons. ● Receive large project as smaller tasks with individual deadlines. ● Work or take a test in a different setting, such as a quiet room with few distractions.	● Allow students many opportunities for practice and learning. ● Use scaffolding for complex tasks.	● Offer choices, once finished with basic task, with personal interest being the key. ● Investigate the history of cameras, features and innovations/inventions

HONORS ENGINEERING DESIGN – *Engineer Your World I*

Unit 3: MECHANICAL ENGINEERING -Reverse Engineering – Pig Flashlight

To reinforce students' understanding of engineering design as a methodical, customer-centered process, this unit asks students to improve the functionality of a common consumer product to better meet the needs of a particular user group. Students employ a structured approach to gathering and analyzing customer input, benchmark similar consumer products, and develop design specifications. They then model product functionality on many levels before disassembling their product, analyzing its design, and recommending design improvements. Each step in the reverse engineering process offers opportunities for creative redesign while reinforcing the importance of strong communication, collaboration and documentation skills.

Throughout this unit, students learn that they are able to **successfully trace the lineage of their final design back to functionality and ultimately, customer needs.**

Time Allotted: Approximately 6-7 Weeks

New Jersey Student Learning Standards (NJSLS)

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 modification to increase optimization based on feedback.
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.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.
8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation.

9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.2 Use architecture and construction skills to create and manage a project.
9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• What is the relationship between engineers and customers? • How do the needs of potential customers impact the design of a product? • How do the concepts of universal design impact the work of engineers across multiple disciplines? • How do engineers focus redesign efforts to meet particular customers' needs? • How do engineers analyze a product to generate ideas for its redesign? • How do engineers model a system or product during the design process?	• Students will demonstrate understanding of the structured methods used to collect and analyze information about customer needs	• Use a scale to sketch a few simple as well as more complex objects. • Practice with tools and techniques for drawing the floor plan. • Practice sketching ideas, given a variety of "problems" or "situations" • Practice drawing sectional views. • Given a scale and general layout, practice drawing a floor plan and elevations • Create a detailed, scaled floor plan of a single-story home, including a sectional view of one wall and an elevation drawing. • Critique scaled floor plans and elevations that are purposely flawed.	• Physical Device / Artifact • Digital Presentation • Prototype Development • Class Participation • Research Documentation • Extent To Which Experiment Satisfies 'The Design Brief' • Quizzes • Unit Deliverable: UNIT 03 REVERSE ENGINEERING DELIVERABLE
Resources/Materials	• Computer with applications for CAD (2D), Adobe Illustrator, Color Printer, Mini screwdriver set, #0 to #1		

	Phillips and flat head, Hand-powered (piggy) flashlight, Dual-Range force sensor (DFS-BTA), Analog protoboard adapter (BTA-ELV), Luggage Scale, Light sensor (LS-BTA), Light Meter, Sound level meter, colored pencils, Eraser, Compass, Protractor, Tabloid size paper, Drawing Board, Triangles, Drafting Tape ● OSHA Safety Guidelines: https://www.osap.org/page/GuideOSHAh
Interdisciplinary Connections	NJSLSA.SL1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. NJSLSA.SL2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. RI.11-12.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
Life Literacies & Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
Information and Media Literacy & Technology Literacy	9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified 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. 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

	9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Career Readiness, Life Literacies & Key Skills Practices	Act as a responsible and contributing community member and employee Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● When possible, modify assignments so the ELL student writes less, has simpler questions to answer, fewer spelling words, etc. ● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner.	● Provide an outline of lessons. ● Get a written list of instructions. ● Receive large projects as smaller tasks with individual deadlines.	● Incorporate student choice. ● Encourage and ensure students that they can be successful. ● Allow students multiple opportunities for practice and learning.	● Offer choices, once finished with basic tasks, with personal interest being the key. ● Investigate past and current flashlights and develop new feature(s) for a flashlight in the future. ● Draw an orthographic projection (to scale) of your newly designed flashlight and label all of its parts and explain the features.

HONORS ENGINEERING DESIGN – *Engineer Your World I*

Unit 4: Chemical Engineering – Understanding Data – Coffee

Engineers gather and analyze data to inform their design decisions. The exploration also introduces students to the field of chemical engineering; chemical engineers design or aid in creating many common products and the processes behind these products.

This mini-exploration engages students in experimental design and demonstrates the usefulness of spreadsheets in analyzing data to inform design decisions; this serves as preparation for the upcoming unit.

Throughout this unit, students will learn **'How to Design an Experiment'.**

Time Allotted: Approximately 3-4 Weeks

New Jersey Student Learning Standards (NJSLS)

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.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
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.2: Redesign an existing product to improve form or function.
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.2 Use engineering and construction skills to create and manage a project.
9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• Why do engineers use data when solving problems? • What techniques do engineers use to organize and represent data for decision-making and communication purposes? • What do chemical engineers do in their profession?	• Students conduct a Design of Experiments with more than two factors. • Students learn to acquire and represent data, and to analyze these data to inform engineering decisions. • Students explore, investigate, and present about a field of chemical engineering and how it impacts society. • Students model liquid extraction over time mathematically.	• How to make a "Strong Coffee" brewing experiment. • "Chemical Engineer" research and presentation	• Physical Device / Artifact • Digital Presentation • Prototype Development • Class Participation • Research Documentation • Extent To Which Prototype Satisfies 'The Design Brief' • Quizzes • Unit 4 Deliverable: UNIT 04 CHEMICAL ENGINEERING DELIVERABLE
Resources/Materials	• Digital AquaPro Water Quality Electrical Conductivity Tester (or TDS/Conductivity Meter and thermometer), Heat-resistant container that can be covered >400mL, or pint-sized, String, pack of twist		

	ties, or tape, Water heating device, One brand/type of coffee ground into 4 different grain sizes >.5 pounds of each, Paper towels, Coffee filters, Water - 5L (tap and distilled), Computer with Excel ● OSHA Safety Guidelines: https://www.osap.org/page/GuideOSHAh
Interdisciplinary Connections	NJSLSA.SL1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. NJSLSA.SL2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
Life Literacies & Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
Information and Media Literacy & Technology Literacy	9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified 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. 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

	9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Career Readiness, Life Literacies & Key Skills Practices	Act as a responsible and contributing community member and employee Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Provide a variety of texts and resources on curriculum topics at a range of reading levels. ● Provide models of completed homework assignments, projects, etc. ● Provide extended time for written responses and reports.	● Receive large project as smaller tasks with individual deadlines ● Use an alarm to help with time management. ● Work with a partner	● Incorporate student choice ● Provide peer mentoring. ● Use scaffolding for complex tasks.	● Offer choices, once finished with basic tasks, with personal interest being the key. ● How can you brew mild coffee? ● Create a scale to differentiate the strength of the brew

HONORS ENGINEERING DESIGN – *Engineer Your World I*

Unit 5: Civil Engineering – Designing with Data – Apartment Building Structure in India (Earthquake Environment)

This unit demonstrates the importance of acquiring and analyzing data to inform design decisions. Students use the engineering design process to redesign an apartment building for improved safety in an earthquake-prone region of northeast India. Through three rounds of building and testing scale models and analyzing the resultant data, students learn about the challenges of collecting, interpreting, displaying, and analyzing data to make and defend informed design decisions while considering necessary trade-offs between building height, building cost, and public safety. After testing their final designs, students document the results. If their designs do not meet performance goals, students must explain what they think went wrong and what next steps they would take if they were to continue on the project; this introduces the important engineering concept of "failing forward".

Time Allotted: Approximately 7-9 Weeks

New Jersey Student Learning Standards (NJSLS)

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.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.
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.2 Use architecture and construction skills to create and manage a project.
9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• What test equipment do engineers use to analyze a problem and how is this equipment used? • How do engineers analyze the data of the information gathered from these test?	• Students will acquire and analyze data to inform decisions about design modifications: • Students will demonstrate understanding of the science, technology, and math relevant to the system • Students will demonstrate understanding of the engineering relevant to the system.	• Create a 'Know' and 'Need to Know' list for each stakeholder • Create a 2-d drawing to scale that will be used as a template to create your 8 story tower • Test your structure on the shake table with a 'dead load' and 'live load'	• Physical Device / Artifact • Digital Presentation • Prototype Development • Class Participation • Research Documentation • Extent To Which Prototype Satisfies 'The Design Brief' • Quizzes • Unit Deliverable: UNIT 05 DELIVERABLE

• How do engineers make informed decisions?	• Students will demonstrate an understanding of the importance of conservative or "worst-case" testing • Students will analyze collected data • Students will analyze tested models • Students will demonstrate an understanding of the advantages and disadvantages of setting engineering codes, standards, and policies • Students will redesign an existing building, according to updated specifications and constraints	• Test your structure with and without a snow load • Using the allowed budget create a strategy to maximize the budget while making the new tower safe	
Resources/Materials	• Computer with CAD 2D, Adobe Illustrator, Laser Cutter, 3D Printer, Large Format Printer, Cereal Boxes, Foam Core, Mass Scale, Balsa wood: 1/16" square X 36" long, Balsa wood: 1/4" square X 36" Long, Balsa wood: 1/8" square X 36" Long, Binder clips - small, 3/4", Carpenter square, 8"x12", C-clamps, 3"x2" OR 3" x 4.5" (opening x width), Torpedo Levels, National Instruments (NI) myQuake, Washers - plain steel, for 0.5" screw, 9/16" ID, 1-3/8" OD, 5/64" or 0.8" thick, Camera phone with Slo-Mo Video Capability, Computer with Excel, myQuake Shaker Table by PITSCO, EYW Quake Software • OSHA Safety Guidelines: https://www.osap.org/page/GuideOSHAh		
Interdisciplinary Connections	NJSLSA.SL1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. NJSLSA.SL2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. NJSLSA.SL3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.		
Life Literacies & Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving		
Information and Media Literacy & Technology Literacy	9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience		

	9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified 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. 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 9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Career Readiness, Life Literacies & Key Skills Practices	Act as a responsible and contributing community member and employee Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Provide a variety of texts and resources on curriculum topics at a range of reading levels. ● Provide models of completed homework assignments, projects, etc.	● Receive large projects as smaller tasks with individual deadlines. ● Only create one 8-story building, instead of a building with more floors AND a second building	● Use scaffolding for complex tasks. ● Allow students many opportunities for practice and learning	● Offer choices, once finished with basic tasks, with personal interest being the key.

• Assign a native language partner.			

HONORS ENGINEERING DESIGN – *Engineer Your World I*

Unit 6: Electrical / Software Engineering – Arduino – Electronic Music

Almost all types of engineers use programming in the course of their work. This exploration teaches standard computer programming skills in two different development environments as students work in teams to build and program an electronic instrument to play a song of their choice. This prepares students for essential programming tasks in the following unit, *Systems Engineering: Aerial Imaging.* The exploration also introduces students to the field of electrical engineering.

Time Allotted: Approximately 2-3 Weeks

New Jersey Student Learning Standards (NJSLS)

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 modification to increase optimization based on feedback.
8.2.12.ED.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
9.3.12.AC.1 Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.2 Use architecture and construction skills to create and manage a project.
9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
9.3.12.AC.4 Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
9.3.12.AC.5 Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.
9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC.7 Describe career opportunities and means to achieve those opportunities in each of the Architecture & Construction Career Pathways.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• How do engineers develop and implement programming code to accomplish projects and tasks?	• Students demonstrate understanding of electronic component diagrams by creating a circuit using a piezoelectric speaker	• Develop algorithms to automate processes. • Develop well-documented and commented code to communicate effectively with others.	• Physical Device / Artifact • Digital Presentation • Prototype Development • Class Participation • Research Documentation

• What are some best practices for programming and why are they important? • What do electrical engineers do in their profession?	• Students demonstrate understanding of the purpose and use of an integrated development environment (IDE) by implementing an IDE, including coding functions, comments, variables, and loops, to program the speaker to play a selected song. • Students demonstrate knowledge about professions in electrical engineering by conducting research and presenting findings to the class. • Engineers develop algorithms to automate processes. • Engineers develop well-documented and commented code to communicate effectively with others. • Within various industries, electrical engineers rely on their knowledge of mathematics and their problem-solving abilities to solve design challenges in a range of fields.	• Build a simple circuit with a speaker. • Program the speaker to play a simple song of your choice • Modify the speaker to make it push-button-operated • Program using a visual IDE (integrated development Environment) • Program using text- based IDE • Describe AND create a 'flowchart' using various shapes in the diagram • Start with pseudo code • Use Block code to start • Advance to line code	• Extent To Which Prototype Satisfies 'The Design Brief' • Quizzes • Unit Deliverable: UNIT 06 DELIVERABLE
Resources/Materials	• Desktop and/or Laptop Computer with Arduino Software, Arduino Uno, Jumper wires, M-M, 6", Piezo buzzer, Pushbutton/switch (EG1325-ND), Wire strippers - 5", Wire, spool, 22AWG, solid, black, 25' OR wire kit (22 AWG), Multi-Meter, Breadboard, USB Cable		
Interdisciplinary Connections	NJSLSA.SL1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.		

	NJSLSA.SL2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. NJSLSA.SL3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.
Life Literacies & Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
Information and Media Literacy & Technology Literacy	9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified 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. 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 9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Career Readiness, Life Literacies & Key Skills Practices	Act as a responsible and contributing community member and employee Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● When possible, modify the project so ELL students have simpler questions to answer, fewer spelling words, etc. ● Provide a variety of texts and resources on curriculum topics at a range of reading levels. ● Provide models of completed homework assignments, projects, etc. ● Assign a native language partner.	● Receive large projects as smaller tasks with individual deadlines. ● Work with a partner. ● Only do one portion, instead of the entire model home.	● Incorporate student choice. ● Provide peer mentoring. ● Allow students multiple opportunities for practice and learning ● Use scaffolding for complex tasks.	● Offer choices, once finished with basic tasks, with personal interest being the key. ● Make a 3D model of "dream home". Defend its features in terms of flow, design type, and the other objectives of this unit. ● Include the 3D model of another floor or level of your home

HONORS ENGINEERING DESIGN – *Engineer Your World I*

Unit 7: Systems & Aerospace Engineering – Aerial Imaging / Descent

With the advancement of technology, engineers find themselves designing, inventing, and creating increasingly complex products. Often dividing a large task into smaller, more manageable objectives is not only helpful, but necessary. In this unit, students will decompose a system challenge (*i.e.*, to design and build an aerial imaging system) into its subsystem components (*i.e.*, the payload, structure, and descent mechanism). Students will divide into subsystem teams to analyze, design, and create each subsystem before coming together to integrate these into the final product (system).

Engineers have an inherent interaction with society and thus a responsibility to the people that are affected by their work. The unit project offers students the opportunity to investigate a publicly known failure case study (Space Shuttle Challenger), create written position statements explaining the actions from one viewpoint, and debate responsibility with peers.

Time Allotted: Approximately 7-8 weeks

New Jersey Student Learning Standards (NJSLS)

8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
8.1.12.CS.2: Model interactions between application software, system software, and hardware.

8.1.12.CS.3: Compare the functions of application software, system software, and hardware.
8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
8.1.12.IC.2: Test and refine computational artifacts to reduce bias and equity deficits.
8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena
8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
8.1.12.AP.2: Create generalized computational solutions using collections instead of repeatedly using simple variables.
8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue
8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.
9.3.12.AC.3 Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
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).

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• Why do engineers use data when solving problems? • How does understanding the system context aid the engineer in understanding the challenge? • Why does a systems challenge require complex teaming?	The primary goal of the unit is that students work in teams to solve a complex engineering design challenge involving a system. Supporting goals are that students will: • Examine and discuss the design challenge, and through guided questioning, conclude that the system must be decomposed into subsystems that will be designed in parallel and integrated to form a	• Develop a launch system • Identify the functions necessary to capture aerial images • Teams to select/vote have each of three members that represent each of the following (Subsystem interdependence); Payload, Descent, and Structure.	• Physical Device / Artifact • Digital Presentation • Prototype Development • Class Participation • Research Documentation • Extent To Which Prototype Satisfies 'The Design Brief' • Quizzes • Unit Deliverable: UNIT 07 AERIAL IMAGING DELIVERABLE

• What are the ethical obligations of engineers?	functioning system Identify the parts (subsystems) of the larger system; • Demonstrate understanding of application of the design process within subsystem teams • Demonstrate an understanding of subsystem integration • Demonstrate an understanding of the ethical obligations of engineers • Demonstrate an understanding of the engineering relevant to a control system (such as the aerial imaging system)		
Resources/Materials	• Sandpaper, White Poster Board, Cardboard, Chipboard, Plastic, Fabric, Cylindrical Tubes, Index Cards, Manila Folder, Markers, Colored Pencils, Tape, String, Paint, Pop sickle sticks / Tongue Depressors, Rubber Bands, Scissors, X-Acto Knife, Ruler, Arduino, USB Cable, Breadboard, Piezo Buzzer/Speaker, Compass, 9Volt Battery, 9Volt Battery Holder, BMP180 SPI barometric pressure & altitude sensor OR Altimeter, Carabiner / Spring snap, HC-SR04 ultrasonic/sonar distance sensor module OR Range-finder sensor, microSD card (16GB or 32GB) with adaptor for microSD to SD, Various Color LED's, 10K Ohm Resistor, 330 Ohm Resistor, Capacitor, 470 uF, through-hole, Servomotor, 4.8-6V, 180 degrees, Bluetooth Sensor/Receiver, Small digital camera (SQ11), Drone Release ++, Release supplies (depends on launch method) ++, Hard hat, Safety glasses, work gloves, Helium, Latex Balloons, Balloon Conditioner, Cushioning Material, Spools of String that Wind on a Core, Android Phone with App to Activate Bluetooth Sensor on Release Mechanism • Computers, Internet access, Resource Texts • Machinery: Drill Press, Band Saw, Power Sander, Lathe, Laser Cutter, 3D Printer, Handheld Power Tools • OSHA Safety Guidelines: https://www.osap.org/page/GuideOSHAh		
Interdisciplinary Connections	NJSLSA.SL1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. NJSLSA.SL2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed. NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.		

Life Literacies & Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
Information and Media Literacy & Technology Literacy	9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified 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. 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 9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Career Readiness, Life Literacies & Key Skills Practices	Act as a responsible and contributing community member and employee Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership, and effective management. Use technology to enhance productivity, increase collaboration, and communicate effectively. Work productively in teams while using cultural/global competence.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Add written labels to equipment and explain the purpose of each component. ● Assign a native language partner. ● Provide extended time for written responses and reports.	● Provide an outline of lessons. ● Receive large project as smaller tasks with individual deadlines. ● Work or take a test in a different setting, such as a quiet room with few distractions.	● Allow students many opportunities for practice and learning. ● Use scaffolding for complex tasks.	● Offer choices, once finished with basic task, with personal interest being the key. ● Investigate how our military employs 'drop' technologies and how it works ● Investigate the ways in which companies like Amazon use drones for delivery safely and efficiently.