Board Approval Date: 8/23/22
Course Title: Engineering Design 1
Course Description: This course exposes students to the various fields of engineering and what it means to be an engineer. Math and science principles and concepts will be applied in a practical format. Areas of study include but are not limited to structures and mechanisms, control systems and product design. Students will utilize mechanical drawing techniques, as well as Computer Aided Design (CAD) software. Students will work collaboratively on real world engineering design problems requiring the application of valuable skills such as: hands-on problem solving, creative thinking, working within a team, creating engineering reports and presentations.

Course Sequence & Pacing			
Estimated Number of Blocks	**Marking Period 1**	**Estimated Number of Blocks**	**Marking Period 3**
8	Unit 1: Engineering Communication	10	Unit 5: Structures & Forces
12	Unit 2: Computer-Aided Design	10	Unit 6: Mechanical Systems
Estimated Number of Blocks	**Marking Period 2**	**Estimated Number of Blocks**	**Marking Period 4**
8	Unit 3: Prototyping	10	Unit 7: Electronics
12	Unit 4: Engineering Design Process	10	Unit 8: Mechatronics

Stage 1 Desired Results

Unit Title #1: Engineering Communication

Unit Summary: Engineering communication follows basic rules so that information can be effectively and efficiently communicated and interpreted by anyone. The ability to express ideas and concepts through drawings, diagrams, and written words is an important skill set in the field of engineering.

Unit Learning Targets

NJSLS Standards:

8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

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.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)***:**

9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

Computer Science & Design Thinking *(CS & DT)***:**

8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

Interdisciplinary Connections ELA, Math, VPA, etc:

RI.CR.9–10.1
Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.CI.9–10.2
Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

RI.MF.9–10.6
Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9–10.4
Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Unit Essential Questions:	**Unit Enduring Understandings:**
What does it require to fabricate, manufacture or build something? How do lines, measurements, basic shapes, and geometric construction relate to developing mechanical drawings? How are measurement and accuracy important in life? How can learning how to create engineering drawings help you for the rest of your life? Why is it important to communicate ideas in the field of engineering efficiently and effectively? How can various techniques be used to describe a complex technological product through engineering drawings? What is required to completely communicate an idea?	Drawings and diagrams are a communication of physical objects, ideas, and descriptions. Engineering drawings follow basic rules so that all drawings are consistent and can be interpreted by anyone. An orthographic projection is a means of representing a 3D object in 2D. The ability to represent an object using different types of drawings is essential to communicating your ideas in the best possible manner. Working drawings in engineering require information in addition to the drawing(s) including notes, annotations, and descriptions. Annotations can be a written paragraph or just a few words that describe a specific part of an idea.

What makes a set of plans or a diagram easy to understand?	Even complex designs can be broken down and communicated as simple individual parts.
Students will know: Object line, Center line, Hidden line, Lead hardness, T-square, Drawing Triangle, Compass, Erasing shield, Circle template, Single-view drawing, Orthographic projection, Scale, Auxiliary view, Diameter, Radius, Annotation, Tangent, Perpendicular, Pictorial drawing, Isometric, Oblique, Perspective, Thumbnail sketch, Exploded view, Sectional view, Call-out drawing, Scale	**Students will be able to:** Apply geometric construction techniques in the creation of engineering drawings. Evaluate an engineering drawing scenario to determine the appropriate tools and techniques to achieve the specified degree of precision and error needed in a situation. Create single & multi-view engineering drawings of physical objects. Demonstrate proper freehand sketching techniques when communicating ideas and designs. Apply a combination of engineering drawings and techniques to describe a physical object.

Stage 2 Assessment Evidence

Summative Assessments:
Engineering drawing common assessment

Formative Assessments:
Engineering drawing vocabulary quiz
Spatial visualization quiz

Common Benchmark Assessments:
Engineering drawing common assessment

Alternative Assessments:
Multimedia presentation showing engineering drawing skills/techniques

Stage 3 Learning Plan

Standard	***Skill***	***Learning Activities & Differentiation*** *(Asian American & Pacific Islanders, LGBTQ and People with Disabilites, Diversity, Equity & Inclusion [DEI],)*	***Timeframe*** *(Days or Weeks)*
8.2.12.ETW.1 8.2.12.ITH.1 8.2.12.EC.2	Apply geometric construction techniques in the creation of engineering drawings.	• Creation of engineering drawings • Analyze/compare and contrast engineering drawing tools	2 blocks
8.2.12.ITH.1 RH.11-12.7 8.2.12.EC.2 8.2.12.ETW.4	Evaluate an engineering drawing scenario to determine the appropriate tools and techniques to achieve the specified degree of precision and error needed in a situation.	• Creation of engineering drawings • Discussion of engineering drawing techniques • Identifying good practice in engineering drawing	1 block
8.2.12.ITH.1 8.2.12.EC.1 9.3.ST-SM.2	Create single & multi-view engineering drawings of physical objects.	• Creation of engineering drawings • Spatial visualization activities	2 blocks
RH.11-12.7	Demonstrate proper freehand sketching techniques when communicating ideas and designs.	• Hand drawing with and without the use of tools • Shading engineering drawing exercises	2 blocks
8.2.12.ITH.1 SL.11-12.5 W.11-12.7	Apply a combination of engineering drawings and techniques to describe a physical object.	• Creation of engineering drawings • Creating a multimedia presentation of engineering drawings	2 blocks

Core Instructional & Supplemental Materials (including various levels of texts)	
Texts	*Notes*
Access to level libraries diverse titles and representation	
Material and supplies	
Create a digital reading folder for staff only.	
Must have leveled texts for students	

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Specific examples applied to the unit

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Specific Strategies and Practices that Support Gifted & Talented Students:
Specific examples applied to the unit

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study

- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Specific Strategies and Practices that Support English Language Learners:
Specific examples applied to the unit

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Stage 1 Desired Results

Unit Title #2: Computer Aided Design

Unit Summary: 2D and 3D CAD systems are used in conjunction with rapid prototyping equipment to aid in the design, creation and production of products.

Unit Learning Targets

NJSLS Standards:

8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

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

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)***:**

9.3.ST-ET.1: Use STEM concepts and processes to solve problems involving design and/or production.

Computer Science & Design Thinking *(CS & DT)***:**

8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

Interdisciplinary Connections ELA, Math, VPA, etc:

RI.CR.9–10.1
Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.CI.9–10.2
Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

RI.MF.9–10.6
Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9–10.4
Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Unit Essential Questions:	**Unit Enduring Understandings:**

What are the applications of 2D and 3D CAD? How has rapid prototyping influenced the design of products? What is the future of CAD and rapid prototyping? What are the limitations of CAD systems? How can CAD systems be used to identify potential issues with the design of a product? How is engineering drawing interrelated with CAD systems?	The use of computer aided design (CAD) has revolutionized the design of products. There are different types of CAD systems, each with different uses and purposes. There are multiple career paths, across a wide range of disciplines, that utilize CAD systems. Rapid prototyping allows for an increased iterative process in the design of products.
Students will know: Profile, Extrude, Feature, Revolve, Model Tree, View Cube, Geometric Constraint, Assembly, Shell, Work Plane, Hole, Drawing, Sweep, Coil, Part, Construction Lines, Axis, Sketch, Loft, Origin	**Students will be able to:** Apply the properties of geometric shapes to construct two-dimensional sketches in a CAD system and manipulate them to create a 3D part. Apply and edit constraints to a sketch/object leveraging parametric modeling techniques Design and output a 2D part using a CAD system to be laser cut as part of a design product. Design and output a 3D part using a CAD system to be 3D printed.

Stage 2 Assessment Evidence

Summative Assessments:
End of unit assessment

Formative Assessments:
Parametric modeling extrusion assessment
CAD terms quiz
CAD object creation common assessment

Common Benchmark Assessments:
End of unit assessment

Alternative Assessments:
Multimedia presentation showing CAD skills/techniques
CAD modeling design challenge rubric

Stage 3 Learning Plan

Standard	***Skill***	***Learning Activities & Differentiation*** *(Asian American & Pacific Islanders, LGBTQ and People with Disabilites, Diversity, Equity & Inclusion [DEI],)*	***Timeframe*** *(Days or Weeks)*
8.2.12.ED.2	Apply the properties of geometric shapes to construct two-dimensional sketches in a CAD system and manipulate them to create a 3D part.	• Analyze/compare and contrast the various CAD systems. • Creating 2D sketches using geometric construction techniques.	2 blocks
8.2.12.ED.2	Apply and edit constraints to a sketch/object leveraging parametric modeling techniques	• Creating and editing objects using geometric constraints and dimensions. • Analyze a designed part to determine the more effective and efficient techniques to create it in a CAD system.	3 blocks

		• Discuss best practices in parametric modeling	
8.2.12.ETW.1 8.2.12.EC.1 8.2.12.EC.2 9.3.ST-ET.1	Design and output a 2D part using a CAD system to be laser cut as part of a designed product.	• Analyze/compare and contrast the various CAD rapid prototyping tools and techniques. • Design and output a product for laser cutting using CAD modeling	3 blocks
8.2.12.ETW.1 8.2.12.EC.1 8.2.12.EC.2 8.2.12.ETW.4 9.3.ST-ET.1	Design and output a 3D part using a CAD system to be 3D printed.	• Analyze/compare and contrast 3D printing technologies and materials. • Design and output a product for 3D print using CAD modeling	4 blocks

Core Instructional & Supplemental Materials (including various levels of texts)	
Texts	*Notes*
Access to level libraries diverse titles and representation	
Material and supplies	
Create a digital reading folder for staff only.	
Must have leveled texts for students	

Accommodations and Modifications:
Students with Disabilities, English Language Learners,
Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Specific examples applied to the unit

- Use of visual and multisensory formats

- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Specific Strategies and Practices that Support Gifted & Talented Students:
Specific examples applied to the unit

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Specific Strategies and Practices that Support English Language Learners:
Specific examples applied to the unit

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Stage 1 Desired Results

Unit Title #3: Prototyping

Unit Summary: The ability to leverage hands-on prototyping techniques and methods in a safe and efficient manner is an effective way to create solutions to engineering problems.

Unit Learning Targets

NJSLS Standards:

8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

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.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).

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)***:**

9.3.MN-HSE.1: Demonstrate the safe use of manufacturing equipment.

Computer Science & Design Thinking *(CS & DT)***:**

8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

Interdisciplinary Connections ELA, Math, VPA, etc:

RI.CR.9–10.1
Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.CI.9–10.2
Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

RI.MF.9–10.6
Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9–10.4
Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Unit Essential Questions:	**Unit Enduring Understandings:**
How can hands-on prototyping be used alongside rapid prototyping techniques? How does safety play a role in the prototyping process? How does material selection influence the design process?	Materials science is an important part of the engineering design process and can be used to create new products that solve problems. Hands-on prototyping can be used in conjunction with 2D and 3D rapid prototyping to create products. Hands-on prototyping can be used to quickly produce a mockup of a design considerably quicker than even rapid prototyping equipment.
Students will know:	**Students will be able to:**
Materials processing, Band saw, Drill press, Scroll saw, Spindle sander, Workflow, Sanding grit, Mockup, Prototype, Developmental work	Demonstrate the safe and effective use of prototyping equipment. Create functional prototypes by safely utilizing materials processing equipment.

	Reproduce a part to set criteria of standards using a diagram and/or engineering drawing(s) as a guide. Create a presentation documenting the prototyping process.

Stage 2 Assessment Evidence

Summative Assessments:
End of unit assessment

Formative Assessments:
Demonstrating safe operation of tools
Safety tests

Common Benchmark Assessments:
End of unit assessment rubric

Alternative Assessments:
Presentation(s), documentation portfolio

Stage 3 Learning Plan

Standard	***Skill***	***Learning Activities & Differentiation*** *(Asian American & Pacific Islanders, LGBTQ and People with Disabilites, Diversity, Equity & Inclusion [DEI],)*	***Timeframe*** *(Days or Weeks)*
8.2.12.EC.1 8.2.12.EC.2	Demonstrate the safe and effective use of prototyping equipment.	• Demonstration of prototyping equipment	2 blocks

9.3.MN-HSE.1		• Presenting prototyping scenarios and developing a work plan to safely and effectively create desired product	
8.2.12.EC.1 8.2.12.EC.2 8.2.12.ITH.1 8.2.12.ETW.4	Create functional prototypes by safely utilizing materials processing equipment.	• Prototyping design challenges • Creation of mockups and prototypes to model a design solution	2 blocks
8.2.12.ED.5 8.2.12.ETW.1	Reproduce a part to set criteria of standards using a diagram and/or engineering drawing(s) as a guide.	• Exercises in reading diagrams/plans • Discussion of work plan	2 blocks
SL.11-12.5 RH.11-12.7	Create a presentation documenting the prototyping process.	• Multimedia presentation highlighting design work on a project	2 blocks

Core Instructional & Supplemental Materials (including various levels of texts)	
Texts	*Notes*
Access to level libraries diverse titles and representation	
Material and supplies	
Create a digital reading folder for staff only.	
Must have leveled texts for students	

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students
Specific Strategies and Practices that Support Students with Disabilities:

Specific examples applied to the unit

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Specific Strategies and Practices that Support Gifted & Talented Students:
Specific examples applied to the unit

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Specific Strategies and Practices that Support English Language Learners:
Specific examples applied to the unit

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Stage 1 Desired Results

Unit Title #4: Engineering Design Process

Unit Summary: Engineering design is a creative and iterative process for identifying and solving problems in the face of various constraints.

Unit Learning Targets

NJSLS Standards:

8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

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.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.NT.2: Redesign an existing product to improve form or function.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)***:**

9.3.ST.1: Apply engineering skills in a project that requires project management, process control and

quality assurance.

Computer Science & Design Thinking *(CS & DT)***:**

8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

Interdisciplinary Connections ELA, Math, VPA, etc:

RI.CR.9–10.1
Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.CI.9–10.2
Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

RI.MF.9–10.6
Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9–10.4
Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Unit Essential Questions:	**Unit Enduring Understandings:**
What is technology? How are science, technology and engineering interrelated? How does society influence technology and vice versa? Why is the design process used in engineering?	Society can shape technology, and technology can shape society. Engineering design is a creative and iterative process for identifying and solving problems in the face of various constraints. There are often many possible solutions to a problem.

Why does a technological product change over time? What role does prototype testing play in the design process? What information is needed to make a proper evaluation of a design? What kind of safety considerations are there during the prototyping process? How does rapid prototyping influence engineering design?	The design process is often called the “design loop” because there is no beginning, middle or end but an iterative process of design, testing, and redesign. There are many different fields/disciplines of engineering. Being an effective engineer requires the application of technical, communication and interpersonal skills. Safety is an important part of the prototyping process in an engineering lab.
Students will know: Design brief, Testing, Thumbnail sketch, Iteration, Mockup, Analysis, Technology, Design process, End user, Proof of concept, Computer Aided Design, Engineering, Innovation, Project map, Brainstorming, Specifications, Possible solution, Prototype, Call-out drawing, Evaluation, Invention, Rapid prototyping, Empathic design	**Students will be able to:** Formulate a design brief for an engineering problem and identify project specifications given background information. Create brainstorming sketches of solutions to an engineering problem. Develop possible solutions to an engineering problem. Design and build a solution to an engineering design problem. Document the design process through the use of an engineering portfolio. Present a design to peers for review.

	Incorporate the use of a 2D and/or 3D CAD system and rapid prototyping to develop a solution to an engineering design problem.

Stage 2 Assessment Evidence

Summative Assessments:
End of unit documentation rubric

Formative Assessments:
Informal presentation of design solutions
Documentation portfolio
Terms quiz

Common Benchmark Assessments:
End of unit documentation rubric

Alternative Assessments:
Multimedia presentation presenting design solution(s)
Short-term design challenge solution rubric

Stage 3 Learning Plan

Standard	***Skill***	***Learning Activities & Differentiation*** *(Asian American & Pacific Islanders, LGBTQ and People with Disabilites, Diversity, Equity & Inclusion [DEI],)*	***Timeframe*** *(Days or Weeks)*
8.2.12.EC.1 8.2.12.EC.2 8.2.12.ETW.4	Formulate a design brief to an engineering problem and identify project	• Creation of design brief(s) • Class discussion on design briefs	1 block

	specifications given background information.		
8.2.12.ED.2 8.2.12.ETW.1 RH.11-12.7	Create brainstorming sketches of solutions to an engineering problem.	• Sketches exercises • Discussion of sketching techniques	2 blocks
8.2.12.ETW.1 8.2.12.ED.1 9.3.ST.1	Design and build a solution to an engineering design problem.	• Engineering design challenges leading to student produced solutions and prototypes	4 blocks
8.2.12.ED.2 SL.11-12.5	Document the design process through the use of an engineering portfolio.	• Engineering design challenges • Creation of documentation portfolio	2 blocks
8.2.12.ITH.1 SL.11-12.5	Present a design to peers for review.	• Student presentations and/or project poster(s)	1 block
8.2.12.ED.2	Incorporate the use of a 2D and/or 3D CAD system and rapid prototyping to develop a solution to an engineering design problem.	• Effective utilization of rapid prototyping equipment in the creation of a product	2 blocks

Core Instructional & Supplemental Materials (including various levels of texts)	
Texts	*Notes*
Access to level libraries diverse titles and representation	
Material and supplies	
Create a digital reading folder for staff only.	
Must have leveled texts for students	

Accommodations and Modifications:

Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Specific examples applied to the unit

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Specific Strategies and Practices that Support Gifted & Talented Students:
Specific examples applied to the unit

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Specific Strategies and Practices that Support English Language Learners:
Specific examples applied to the unit

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding

- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Stage 1 Desired Results

Unit Title #5: Structures & Forces

Unit Summary: Structures are always under stress from forces whether it is from gravity, the environment, or people. These structures are used in mechanical systems to resist the loads these devices encounter.

Unit Learning Targets

NJSLS Standards:

8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

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.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.

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).

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)***:**

9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

Computer Science & Design Thinking *(CS & DT)***:**

8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

Interdisciplinary Connections ELA, Math, VPA, etc:

RI.CR.9–10.1
Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.CI.9–10.2
Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

RI.MF.9–10.6
Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9–10.4
Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Unit Essential Questions:	**Unit Enduring Understandings:**
How can materials be combined together to create stronger structures? How does materials science influence the design of a structure?	Structures are always under stress from forces whether it is from gravity, the environment, or people. A material's properties will determine how it reacts to particular forces. It may perform well under one type of force and/or stress but poorly under another type.

What is the difference between designing structures effectively vs efficiently? How does a combination of forces affect a structure? Why is the actual mechanical advantage of a system more important than ideal mechanical advantage? What factors can limit the efficiency of a mechanical system? How can simple machines be grouped together to form mechanisms? How are forces, motion and energy concepts connected? How does friction affect the design of a mechanical system?	Materials science is an important factor to consider when deciding which products to use in a structure. The efficiency of a mechanical system is calculated by comparing the ideal mechanical advantage of the system and comparing it to the actual mechanical advantage. Incorporating mechanical advantage into a system allows for a relatively small input force to be converted to a large output force. Many mechanical systems require structures to be built that can withstand the mechanical force exerted by the system.
Students will know: Structural integrity, Stress point, Destructive testing, Non-destructive testing, Dead load, Live load, Compression, Tension, Bending, Torsion, Shear, Stress, Strain, Elastic deformation, Modulus of elasticity, Plastic deformation, Cantilever, Force, Static load, Dynamic load, Beam, Arch, Girder, Truss, Gusset, Bending moment, Newton, Tensile strength, Hooke's law, Structure, Materials science, Deflection, Composite material	**Students will be able to:** Evaluate a scenario to determine which forces are affecting a structure. Calculate forces acting on a structure including stress, strain, bending moment, torque, and vertical load. Apply the design process to design and build a structure and document work completed in an engineering portfolio. Conduct an analysis of structural engineering data and present the findings in a multimedia presentation.

Stage 2 Assessment Evidence

Summative Assessments:
End of unit assessment

Formative Assessments:
Terms quiz
Stress/strain quiz
Simply supported beams quiz

Common Benchmark Assessments:
End of unit assessment

Alternative Assessments:
Structural performance assessments rubric
Research report/presentation on famous structures

Stage 3 Learning Plan

Standard	***Skill***	***Learning Activities & Differentiation*** *(Asian American & Pacific Islanders, LGBTQ and People with Disabilites, Diversity, Equity & Inclusion [DEI],)*	***Timeframe*** *(Days or Weeks)*
8.2.12.ETW.1	Evaluate a scenario to determine which forces are affecting a structure.	• Analyzation of force diagrams	2 blocks
8.2.12.EC.2 9.3.ST-SM.2	Calculate forces acting on a structure including stress, strain, bending moment, torque, and vertical load.	• Stress/strain calculations • Simply supported beam calculations	2 blocks

8.2.12.ETW.1 8.2.12.EC.1 SL.11-12.5 RH.11-12.7	Apply the design process to design and build a structure and document work completed in an engineering portfolio.	• Formulation of design brief(s) • Creation of a solution to a structural engineering design challenge	4 blocks
SL.11-12.5	Conduct an analysis of structural engineering data and present the findings in a multimedia presentation.	• Creation of structural engineering data presentation • Presentations for peer review and feedback	2 blocks

Core Instructional & Supplemental Materials (including various levels of texts)	
Texts	*Notes*
Access to level libraries diverse titles and representation	
Material and supplies	
Create a digital reading folder for staff only.	
Must have leveled texts for students	

Accommodations and Modifications:
Students with Disabilities, English Language Learners,
Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Specific examples applied to the unit

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations

- Authentic assessments

Specific Strategies and Practices that Support Gifted & Talented Students:
Specific examples applied to the unit

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Specific Strategies and Practices that Support English Language Learners:
Specific examples applied to the unit

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Stage 1 Desired Results

Unit Title #6: Mechanical Systems

Unit Summary: Even complex mechanical devices are made up of simple mechanisms and these simple mechanisms are made up of simple machines such as levers and pulleys.

Unit Learning Targets

NJSLS Standards:

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

Computer Science & Design Thinking *(CS & DT)*:

8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

Interdisciplinary Connections ELA, Math, VPA, etc:

RI.CR.9–10.1
Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.CI.9–10.2
Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

RI.MF.9–10.6
Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9–10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.	
Unit Essential Questions: Why is the actual mechanical advantage of a system more important than ideal mechanical advantage? What factors can limit the efficiency of a mechanical system? How can simple machines be grouped together to form mechanisms? How can mechanisms be grouped together to change the type of motion produced from input to output?	**Unit Enduring Understandings:** Even complex mechanical devices are made up of simple mechanisms and these simple mechanisms are made up of simple machines such as levers and pulleys. The efficiency of a mechanical system is calculated by comparing the ideal mechanical advantage of the system and comparing it to the actual mechanical advantage. The concept of having mechanical systems transmit motion has been used for thousands of years. Incorporating mechanical advantage into a system allows for a relatively small input force to be converted to a large output force. There are a series of classical mechanisms that make up just about every mechanical system.
Students will know: Dynamics, Wedge, Momentum, Screw, Mechanism, Class 3 lever, Links, Inclined plane, Rotary motion, Torque, Cam & follower, Linear motion, Work, Crown gear, Mechanical advantage, Oscillating motion, Rack & pinion, Gear, Kinematics, Machine, Reciprocal motion, Wheel & axle, Pulley, Class 2 lever, Crank & slider, Worm gear, Lever, Power, Force, Class 1 lever, Statics, Bevel gear, Intermittent motion	**Students will be able to:** Evaluate a mechanism to determine the types of simple machines and types of motion located within it. Calculate the mechanical advantage, input/out speed, and input/output torque of a mechanism. Generate brainstorming ideas for a mechanical system that changes the type of output motion.

	Create complete possible solutions for a mechanical system that changes the type of output motion.

Stage 2 Assessment Evidence

Summative Assessments:
End of unit assessment

Formative Assessments:
Mechanical advantage quiz
Terms quiz

Common Benchmark Assessments:
End of unit assessment

Alternative Assessments:
Multimedia presentation showing CAD skills/techniques

Stage 3 Learning Plan

Standard	***Skill***	***Learning Activities & Differentiation*** *(Asian American & Pacific Islanders, LGBTQ and People with Disabilites, Diversity, Equity & Inclusion [DEI],)*	***Timeframe*** *(Days or Weeks)*
9.3.ST-SM.2	Evaluate a mechanism to determine the types of simple machines and types of motion located within it.	• Creation and evaluation of mechanisms • Presentation of mechanisms types of motion observed	2 blocks

9.3.ST-SM.2	Calculate the mechanical advantage, input/out speed, and input/output torque of a mechanism.	• Creation and evaluation of mechanisms • Redesign of mechanisms to fulfill design requirements • Design challenges to create mechanisms that fulfill design requirements	3 blocks
9.3.ST-SM.2	Calculate mechanical advantage, input/output RPMs, and input/output forces of a mechanical system.	• Creation of mechanical systems • Calculations of mechanical forces given inputs and outputs	2 blocks
8.2.12.ETW.4 8.2.12.EC.1 8.2.12.EC.2	Apply the design process to design a mechanism that performs specific tasks.	• Open-ended design challenge(s) • Student-produced portfolio of work • Documentation of design development, prototyping, and testing/evaluation	3 blocks

Core Instructional & Supplemental Materials (including various levels of texts)	
Texts	*Notes*
Access to level libraries diverse titles and representation	
Material and supplies	
Create a digital reading folder for staff only.	
Must have leveled texts for students	

Accommodations and Modifications:
Students with Disabilities, English Language Learners,
Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Specific examples applied to the unit

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Specific Strategies and Practices that Support Gifted & Talented Students:
Specific examples applied to the unit

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Specific Strategies and Practices that Support English Language Learners:
Specific examples applied to the unit

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Stage 1 Desired Results

Unit Title #7: Electronics

Unit Summary: Electricity is a form of energy that can be transformed by moving electric charges doing work in various devices.

Unit Learning Targets

NJSLS Standards:

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

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.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)***:**

9.3.ST-ET.1: Use STEM concepts and processes to solve problems involving design and/or production.

Computer Science & Design Thinking *(CS & DT)***:**

8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

Interdisciplinary Connections ELA, Math, VPA, etc:

RI.CR.9–10.1
Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.CI.9–10.2
Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

RI.MF.9–10.6
Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9–10.4
Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Unit Essential Questions:	**Unit Enduring Understandings:**
How is an electrical circuit similar to a water pipe? How can an electrical circuit be controlled? How are electrical circuits a part of everyday life? How are voltage, resistance and current related in an electrical circuit? What are the safety issues that need to be taken into consideration when creating electrical circuits? What are the applications of digital and analog circuits?	A circuit consists of a power source, a load and a conductor. Voltage, current and resistance are related and their values in a circuit are reliant on one another. Electricity is a form of energy that can be transformed by moving electric charges doing work in various devices. A potential difference has to be maintained in order to move charges between two points. Even simple circuits using simple components can perform complex tasks. Safety must be considered when designing and creating electrical systems.

	Digital and analog circuits perform very different tasks and each has applications in electrical engineering.
Students will know: Capacitor, Voltage, Farad, Series Circuit, Digital, Load, Resistor, Mechatronics, Ampere, Diode, Alternating Current (AC), Potentiometer, Servo Motor, Coulomb, Direct Current (DC), Analog, Resistance, Schematic Diagram, Current, Light Emitting Diode (LED), Polarity, Parallel Circuit, Battery, Watt	**Students will be able to:** Calculate voltage, current and resistance in an electrical circuit. Operate a multimeter to record electrical measurements in a circuit. Create an electrical circuit given a written description of it. Create schematic diagrams of electrical circuits. Create a physical electrical circuit using a schematic diagram as a guide.

Stage 2 Assessment Evidence

Summative Assessments:
End of unit assessment

Formative Assessments:
Creation of circuits
Creation of schematic diagrams

Common Benchmark Assessments:
End of unit assessment

Alternative Assessments:
Presentation(s)
Documentation portfolio

Stage 3 Learning Plan

Standard	***Skill***	***Learning Activities & Differentiation*** *(Asian American & Pacific Islanders, LGBTQ and People with Disabilites, Diversity, Equity & Inclusion [DEI],)*	***Timeframe*** *(Days or Weeks)*
9.3.ST-ET.1	Calculate voltage, current and resistance in an electrical circuit.	• Ohm's law calculations • Creation of circuits applying ohm's law	2 blocks
8.2.12.EC.2 8.2.12.ITH.1	Operate a multimeter to record electrical measurements in a circuit.	• Multmeter lab(s)	2 blocks
9.3.ST-ET.1 8.2.12.EC.1	Create an electrical circuit given a written description of it.	• Demonstration of simple circuits • Creation of circuits using a breadboard	2 blocks
9.3.ST-ET.1	Create schematic diagrams of electrical circuits.	• Creation of schematic diagrams using a written description • Creation of schematic diagrams using a physical circuit	2 blocks
9.3.ST-ET.1 SL.11-12.5 RH.11-12.7	Create a physical electrical circuit using a schematic diagram as a guide.	• Circuits lab(s) • Open-ended design challenge • Presentation of circuit design solutions	2 blocks

Core Instructional & Supplemental Materials (including various levels of texts)

Texts	*Notes*
Access to level libraries diverse titles and representation	
Material and supplies	

Create a digital reading folder for staff only.	
Must have leveled texts for students	

Accommodations and Modifications:
Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Specific examples applied to the unit

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Specific Strategies and Practices that Support Gifted & Talented Students:
Specific examples applied to the unit

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study
- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Specific Strategies and Practices that Support English Language Learners:
Specific examples applied to the unit

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups

Stage 1 Desired Results

Unit Title #: Mechatronics

Unit Summary: Mechatronics is the combination and integration of multiple fields of engineering and technology in the design and creation of electrical systems that control movement.

Unit Learning Targets

NJSLS Standards:

8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.

8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

8.2.12.EC.2: Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

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.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)***:**

9.3.ST-ET.1: Use STEM concepts and processes to solve problems involving design and/or production.

Computer Science & Design Thinking *(CS & DT)***:**

8.2.12.ETW.4: Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.

Interdisciplinary Connections ELA, Math, VPA, etc:

RI.CR.9–10.1
Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.CI.9–10.2
Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

RI.MF.9–10.6
Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9–10.4
Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Unit Essential Questions:	**Unit Enduring Understandings:**
How are mechanical systems integrated into electrical systems? How can electricity be turned into motion?	Building an electrical system requires combining multiple engineering disciplines.

What are some of the dangers associated with the design of electrical systems? How does mechatronics incorporate several areas of engineering? What are the difficulties in combining multiple disciplines into a single project? How is project management incorporated into a large-scale engineering project?	Physical electrical systems can look very different from their schematic diagrams. Electrical safety considerations are an integral part of every electronic related activity. Mechatronics requires a combination of several areas of engineering to create electrical devices that move. Mechatronics requires effective project management skills.
Students will know: Alternating Current (AC), Ampere, Capacitor, Coulomb, Current, Direct Current (DC), Diode, Electric Motor, Farad, Light Emitting Diode (LED), Load, Polarity, Potentiometer, Resistance, Resistor, Voltage, Mechatronics, Servo Motor, Digital, Analog, Circuit, Schematic Diagram, Battery, Mechatronics	**Students will be able to:** Formulate a design brief and identify specifications for an electrical engineering problem. Apply and document the design process to create a physical electrical circuit that is a solution to an electrical engineering problem. Work within a team to develop a design solution to a real world problem. Integrate the concepts of structural, mechanical, electrical and engineering into the design of a product.

Stage 2 Assessment Evidence

Summative Assessments:
End of unit assessment.

Formative Assessments:
Informal presentations.
Documentation portfolio.

Common Benchmark Assessments:
End of unit assessment.

Alternative Assessments:
Multimedia presentation showing CAD skills/techniques

Stage 3 Learning Plan

Standard	***Skill***	***Learning Activities & Differentiation*** *(Asian American & Pacific Islanders, LGBTQ and People with Disabilites, Diversity, Equity & Inclusion [DEI],)*	***Timeframe*** *(Days or Weeks)*
8.2.12.ETW.1 8.2.12.EC.1	Formulate a design brief and identify specifications for an electrical engineering problem.	• Discussion of possible design briefs for a mechatronic design challenge • Discussion of mechatronics in society and how the field has impacted STEM areas	1 block
9.3.ST-ET.1 RH.11-12.7 SL.11-12.5	Apply and document the design process to create a physical electrical circuit that is a solution to an electrical engineering problem.	• Formulation of design briefs • Discussion of design specifications and how they will relate to the engineering design process • Student created mockup and prototypes utilizing CAD and rapid prototyping as needed	4 blocks
8.2.12.EC.2 8.2.12.ITH.1	Work within a team to develop a design solution to a real world problem.	• Structured group meetings with desired outcomes and discussion • Assigning roles and responsibilities within a group	3 blocks
9.3.ST-ET.1	Integrate the concepts of structural, mechanical, electrical and engineering into the design of a product.	• Design and creation of a mechatronic system • Documentation in an engineering technical report • Presentation of design solution	2 blocks

Core Instructional & Supplemental Materials (including various levels of texts)	
Texts	*Notes*
Access to level libraries diverse titles and representation	
Material and supplies	
Create a digital reading folder for staff only.	
Must have leveled texts for students	

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Specific examples applied to the unit

- Use of visual and multisensory formats
- Use of assisted technology
- Use of prompts
- Modification of content and student products
- Testing accommodations
- Authentic assessments

Specific Strategies and Practices that Support Gifted & Talented Students:
Specific examples applied to the unit

- Adjusting the pace of lessons
- Curriculum compacting
- Inquiry-based instruction
- Independent study

- Higher-order thinking skills
- Interest-based content
- Student-driven instruction
- Real-world problems and scenarios

Specific Strategies and Practices that Support English Language Learners:
Specific examples applied to the unit

- Pre-teaching of vocabulary and concepts
- Visual learning, including graphic organizers
- Use of cognates to increase comprehension
- Teacher modeling
- Pairing students with beginning English language skills with students who have more advanced English language skills
- Scaffolding
- Word walls
- Sentence frames
- Think-pair-share
- Cooperative learning groups