Rumson-Fair Haven Regional High School Curriculum

Course: *Engineering 2*
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Approved: September 2021

Section I: Course Description

Engineering 2 is a full year elective designed to introduce the high school student to elements of CAD design software, Robotics Engineering, Electrical Engineering, Mechanical Engineering, Automotive Engineering, Aerospace Engineering as well as Energy Engineering. Students will continue to apply our Engineering Design Process and use it for their designs. The students will learn through lectures, teacher demonstrations as well as hands on assignments specifically designed for each unit. Throughout the course, students will use CAD design software for all of their final designs and will improve upon their problem solving skills through researching, generating project designs, building projects and redesigning their projects. They will also learn the proper and safe operation of a variety of hand tools and machines.

Section II: NJSLS: New Jersey Student Learning Standards/Learning Objectives

1. **2020 New Jersey Student Learning Standards – Science:**
    - "Scientific and technological advances have proliferated and now permeate most aspects of life in the 21st century. It is increasingly important that all members of our society develop an understanding of scientific and engineering concepts and processes. Learning how to construct scientific explanations and how to design evidence-based solutions provides students with tools to think critically about personal and societal issues and needs. Students can then contribute meaningfully to decision-making processes, such as discussions about climate change, new approaches to health care, and innovative solutions to local and global problems."
2. ***2016 English Language Arts Companions for Grades 9-10:***
    - The ELA Standards were revised in 2016, with the recommendations of teams of teachers, parents, administrators, supervisors and other stakeholders and reflect the strong beliefs that, "...Literacy must be recognized and guided in content areas so that students recognize the academic vocabulary, media representations, and power of language inherent in the work of scholars and experts..."
3. ***Career Ready Practices:***
    - "Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study."
4. ***Standard 8.1 (Computer Science) and 8.2 (Design Thinking) of the 2020 NJSLS:***
    - "The 'Intent and Spirit of the Computer Science and Design Thinking Standards' is to focus on deep understanding of concepts that enable students to think critically and systematically about leveraging technology to solve local and global issues. Authentic learning experiences that enable students to apply content knowledge, integrate concepts across disciplines, develop computational thinking skills, acquire and incorporate varied perspectives, and communicate with diverse audiences about the use and effects of computing prepares New Jersey students for college and careers."
5. ***2020 Career Readiness, Life Literacies, and Key Skills Standards (9.2 and 9.4):***
    - "Rapid advancements in technology and subsequent changes in the economy have created opportunities for individuals to compete and connect on a global scale. In this increasingly diverse and complex world, the successful entrepreneur or employee must not only possess the requisite education for specific industry pathways but also employability skills necessary to collaborate with others and manage resources

effectively in order to establish and maintain stability and independence. This document outlines concepts and skills necessary for New Jersey's students to thrive in an ever-changing world. Intended for integration throughout all K–12 academic and technical content areas, the New Jersey Student Learning Standards- Career Readiness, Life Literacies, and Key Skills (NJSLS-CLKS) provides the framework for students to learn the concepts, skills, and practices essential to the successful navigation of career exploration and preparation, personal finances and digital literacy."

- **Climate Change:** The state of New Jersey has mandated instruction in, "Climate Change across all content areas, leveraging the passion students have shown for this critical issue and providing them opportunities to develop a deep understanding of the science behind the changes and to explore the solutions our world desperately needs."

6. ***LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35*:**
   - A transformative approach to the inclusion of lessons and resources/texts on the contributions and issues concerning the LGBTQ+ population and people with disabilities will be implemented across all core subjects in accordance with state law: "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 (N.J.S.A.18A:35-4.36). A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35."
7. **Acquisition/development/refinement of the higher-order critical thinking skills aligned with the *Revised Bloom's Taxonomy of Cognitive Objectives***

Section III: Curriculum Modifications

The *Engineering 2 Curriculum* is subject to case-by-case modifications to support/advance the needs of all students, including special education students, English language learners, gifted students and those at risk of school failure. These modifications are based on Individualized Learning Programs (IEPs), recommendations made by the district's English Language Learners (ELL) coordinator, feedback from members of the Intervention & Referral Services Team (*I&RS*) for at-risk students, and 504 Plans.

Coursework and assessments will be modified on an individual basis for students when necessary. Modifications may include but are not limited to:

- Small group instruction
- One on one instruction
- Independent work stations
- Use of graphic organizers
- Interest inventories and questionnaires
- Audio resources to complement written texts and concepts
- Visual resources to complement written texts and concepts
- Extra time on assessments and large scale projects
- Reduced length of written assignments
- Large projects broken into smaller tasks and timelines
- Tiered Instruction
- Individual help during practice
- Diagrams and color coding for visual learners
- Verbal and written directions for visual and auditory learners
- Provided class notes
- Preferential seating

- Spelling not penalized
- Varied supplemental activities
- Assessments delivered orally

Section IV: Preparation for Standardized Testing

Instruction in *Engineering 2* is aligned with the requirements of state and national standardized assessments, including the *NJSLA*, the *ACT*, the *PSAT* and the *SAT*. The *End of Marking Period Assessments* for *Engineering 1* also demonstrate alignment with the aforesaid standardized assessments.

Section V: Curriculum Pacing Guide

Curriculum Pacing Guide	
Course Title: *Engineering 2*	**Grade Level:** 10th 11th and 12th
Unit 1: Introduction to CAD	4 Weeks
Unit 2: Robotics Engineering	6 Weeks
Unit 3: Electrical Engineering	6 Weeks
Unit 4: Mechanical Engineering	6 Weeks
Unit 5: Automobile Engineering	6 Weeks
Unit 6: Aerospace Engineering	6 Weeks
Unit 7: Energy Engineering	6 Weeks

Section VI: Primary Texts and Year Long Instructional Resources

The following texts and instructional resources are employed in *Engineering 2*:

- *Google Classroom*
- *internet resources*
- *youtube.com*
- *teachengineering.org*
- *project materials*
- *classroom tools and machines.*

Section VII: Grading Formula and Assessment Modes

Marking period grades in *Engineering 2* are determined via a percentage weighting model. The specific grading categories and weightings of each will be determined prior to the start of each academic year and will be published in the posted/distributed course syllabi.

Section VIII: Unit Templates

The following unit templates have been established for the *Engineering 2* Curriculum by the *Industrial Arts* Instructional Team:

Unit 1: Introduction to CAD

Unit Summary

In this unit, students will become familiar with Computer Aided Design Software. They will learn how to create sketches in different views and formats in order to properly represent their project design. This software enables engineers to produce a digital rendering of their drawings and ideas, leading to a more defined design process. Through the completion of this unit they will begin to understand how to properly use the program and be able to create geometric models accurately.

Standards/Core Ideas/Performance Expectations

The state standards outlined below, and established by New Jersey Department of Education, will guide instruction throughout this unit in Engineering 2*:*

- *2020 New Jersey Student Learning Standards: Science*
  - HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4
- *2016 New Jersey Student Learning Standards: English Language Arts Companions for Grades 9-10*
  - NJSLSA.R7, RST.9-10.3, RST.9-10.4, NJSLSA.W4, NJSLSA.W7, WHST.9-10.6, WHST.9-10.7, WHST.9-10.10
- *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*
  - 8.1.12.CS.2, 8.1.12.DA.1, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.4, 8.2.12.ED.5, 8.2.12.NT.1, 8.2.12.NT.2
- *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies and Key Skills*
  - 9.2.12.CAP.6, 9.2.12.CAP.8, 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.DC.7, 9.4.12.TL.1, 9.4.12.TL.3,9.4.12.TL.4
  - CRP1, CRP2, CRP3, CRP4, CRP5, CRP6, CRP7, CRP8, CRP9, CRP10, CRP11, CRP12

Unit Essential Questions	Unit Enduring Understandings
● How do you use CAD? ● How can it help to improve the quality of the designs? ● How can it increase the productivity of the designer? ● How can it improve communication through documentation?	● Students will be able to operate the CAD design program ● Students will be able to identify ways in which designs can be improved ● Students will be able to identify how CAD can increase the productivity of the designer. ● Students will be able to identify how CAD can improve communication through documentation

Evidence of Learning

Formative Assessment:	Summative Assessment:	Resources Needed:
● Introduction to CAD	● CAD design assignments	● *google classroom* ● *internet resources* ● *youtube.com* ● *teachengineering.org*

		● *project materials* ● *classroom tools and machines*

Unit 2: **Robotics**		
Unit Summary		
In this unit, students will become familiar with Robotics. They will learn about how Robotics Engineers help society and in what ways. A heavy focus for robotics is on developing a system to increase the efficiency, output and safety of all sorts of tasks, including manufacturing and production. They often are faced with a problem and must work towards a solution with given robotic parts, systems and information. The major component of this unit will be the design, construction and programming of both VEX and GoPiGo robotic kits. Through the completion of this unit they will understand some of the challenges faced by Robotics Engineers and become familiar with both programming languages. All final sketches in this unit will be completed using CAD.		
Standards/Core Ideas/Performance Expectations		
The state standards outlined below, and established by New Jersey Department of Education, will guide instruction throughout this unit in Engineering 2*:* ● *2020 New Jersey Student Learning Standards: Science* ○ HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4 ● *2016 New Jersey Student Learning Standards: English Language Arts Companions for Grades 9-10* ○ NJSLSA.R7, RST.9-10.3, RST.9-10.4, NJSLSA.W4, NJSLSA.W7, WHST.9-10.6, WHST.9-10.7, WHST.9-10.10 ● *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking* ○ 8.1.12.CS.2, 8.1.12.DA.1, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.4, 8.2.12.ED.5, 8.2.12.NT.1, 8.2.12.NT.2 ● *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies and Key Skills* ○ 9.2.12.CAP.6, 9.2.12.CAP.8, 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.DC.7, 9.4.12.TL.1, 9.4.12.TL.3,9.4.12.TL.4 ○ CRP1, CRP2, CRP3, CRP4, CRP5, CRP6, CRP7, CRP8, CRP9, CRP10, CRP11, CRP12		
Unit Essential Questions	**Unit Enduring Understandings**	
● What does a Robotics Engineer do? ● How does a VEX robot get built? ● How does a GoPiGo robot get built? ● How does a VEX robot get programmed? ● How does a GoPiGo robot get programmed?	● Students will be able to list three elements of a Robotics Engineer job ● VEX robots will be built using a set kit, with some user-created changes and choices ● GoPiGo robots will be built by student groups to particular parameters. ● Programming for the VEX robots will take place after the build and depend on the user's experience--it can be as simple as a controller or a coded program of movements. ● GoPiGo robots function with a RaspberryPi and a wireless connection to a laptop.	
Evidence of Learning		
Formative Assessment:	**Summative Assessment:** ● VEX robot ● GoPiGo robot	**Resources Needed:** ● *google classroom* ● *internet resources*

• Each Step of the Engineering Design Process will be turned in: • Ask to identify the need and Constraints • Research the problem • Imagine possible solutions • Plan by selecting a promising solution • Create a prototype • Test and evaluate the prototype • Improve and redesign as needed		• *youtube.com* • *teachengineering.org* • *project materials* • *classroom tools and machines*

Unit 3: **Electrical Engineering**	
Unit Summary	
In this unit, students will become familiar with Electrical Engineering. They will learn about how Electrical Engineers help society and in what ways. Electrical Engineers are concerned with the study, design and application of all equipment, devices, and systems that use electricity, electronics or electromagnetism. The major component of this unit will be the design, construction and testing of two different, small circuit systems. Here they will work with and learn about many electrical components. Through the completion of this unit they will understand some of the challenges faced by Electrical Engineers and be proficient at soldering. All final sketches in this unit will be completed using CAD.	
Standards/Core Ideas/Performance Expectations	
The state standards outlined below, and established by New Jersey Department of Education, will guide instruction throughout this unit in Engineering 2*:* • *2020 New Jersey Student Learning Standards: Science* ○ HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4 • *2016 New Jersey Student Learning Standards: English Language Arts Companions for Grades 9-10* ○ NJSLSA.R7, RST.9-10.3, RST.9-10.4, NJSLSA.W4, NJSLSA.W7, WHST.9-10.6, WHST.9-10.7, WHST.9-10.10 • *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking* ○ 8.1.12.CS.2, 8.1.12.DA.1, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.4, 8.2.12.ED.5, 8.2.12.NT.1, 8.2.12.NT.2 • *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies and Key Skills* ○ 9.2.12.CAP.6, 9.2.12.CAP.8, 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.DC.7, 9.4.12.TL.1, 9.4.12.TL.3,9.4.12.TL.4 ○ CRP1, CRP2, CRP3, CRP4, CRP5, CRP6, CRP7, CRP8, CRP9, CRP10, CRP11, CRP12	
Unit Essential Questions	**Unit Enduring Understandings**
• What does an Electrical Engineer do? • What role does a capacitor play in a circuit?	• Students will be able to list three elements of an Electrical Engineers job • A capacitor stores electrical energy in an elective field, to be used at another point in time either slowly or quickly.

● What role does a transistor play in a circuit? ● What role does a semiconductor play in a circuit? ● What role does a transformer play in a circuit?	● A transistor is a device that can amplify or switch electronic signals and power. It is a semiconductor. ● Semiconductors are important in all electronics as they have a conductivity between conductors and insulators, making them useful to send current in only one direction or show variable resistance. Silicon is a common semiconductor ● A transformer is a device that can change the voltage of an electric circuit.

Evidence of Learning

Formative Assessment:	**Summative Assessment:**	**Resources Needed:**
● Each Step of the Engineering Design Process will be turned in: ● Ask to identify the need and Constraints ● Research the problem ● Imagine possible solutions ● Plan by selecting a promising solution ● Create a prototype ● Test and evaluate the prototype ● Improve and redesign as needed	● Sound Activated Circuit Project ● Light Activated Circuit Project	● *google classroom* ● *internet resources* ● *youtube.com* ● *teachengineering.org* ● *project materials* ● *classroom tools and machines*

Unit 4:
Mechanical Engineering

Unit Summary

In this unit, students will become familiar with Mechanical Engineering. They will learn about how Mechanical Engineers help society and in what ways. A mechanical engineer is concerned with combining physics and mathematical principles to design, build and maintain mechanical systems. Though broad in scope, mechanical engineers deal with industrial equipment, engine systems and other aspects of machinery. The major component of this unit will be the design, construction and testing of a simple vehicle that utilizes a worm gear. Through the completion of this unit they will understand some of the challenges faced by Mechanical Engineers and be able to identify worm gear ratios. All final sketches in this unit will be completed using CAD.

Standards/Core Ideas/Performance Expectations

The state standards outlined below, and established by New Jersey Department of Education, will guide instruction throughout this unit in Engineering 2*:*

- *2020 New Jersey Student Learning Standards: Science*
  - HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4
- *2016 New Jersey Student Learning Standards: English Language Arts Companions for Grades 9-10*
  - NJSLSA.R7, RST.9-10.3, RST.9-10.4, NJSLSA.W4, NJSLSA.W7, WHST.9-10.6, WHST.9-10.7, WHST.9-10.10
- *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*

- 8.1.12.CS.2, 8.1.12.DA.1, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.4, 8.2.12.ED.5, 8.2.12.NT.1, 8.2.12.NT.2
- *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies and Key Skills*
  - 9.2.12.CAP.6, 9.2.12.CAP.8, 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.DC.7, 9.4.12.TL.1, 9.4.12.TL.3,9.4.12.TL.4
  - CRP1, CRP2, CRP3, CRP4, CRP5, CRP6, CRP7, CRP8, CRP9, CRP10, CRP11, CRP12

Unit Essential Questions	Unit Enduring Understandings
● What does a Mechanical Engineer do? ● What does a gear do? ● What does a worm gear do? ● How does a worm gear engage with a DC motor? ● What role does friction play in power loss?	● Students will be able to list three elements of an Mechanical Engineers job ● A gear is a rotating circular machine that has teeth (or cogs) which can work in gearboxes with other different sized gears to create a gear ratio and mechanical advantage. ● A worm gear has a rod (worm) with grooves cut into it which works with a gear to create a mechanical advantage. ● A DC motor provides the mechanical motion to spin the component of the worm gear. ● Friction is one of the main components that reduces efficiency of motors as it turns useful mechanical energy into heat or sound.

Evidence of Learning

Formative Assessment:	Summative Assessment:	Resources Needed:
● Each Step of the Engineering Design Process will be turned in: ● Ask to identify the need and Constraints ● Research the problem ● Imagine possible solutions ● Plan by selecting a promising solution ● Create a prototype ● Test and evaluate the prototype ● Improve and redesign as needed	● Worm gear Project	● *google classroom* ● *internet resources* ● *youtube.com* ● *teachengineering.org* ● *project materials* ● *classroom tools and machines*

Unit 5:
Automobile Engineering

Unit Summary

In this unit, students will become familiar with Automobile Engineering. They will learn about how Automobile Engineers help society and in what ways. Automobile engineers are a part of a subset of mechanical engineering that focus specifically on the manufacture of vehicles along with the components that make up the vehicle including energy and propulsion systems. The major component of this unit will be the design, construction and testing of a Magnetic Levitation Car and a Compressed Air car. Through

the completion of this unit they will understand some of the challenges faced by Automobile Engineers and have the opportunity to test their designs in a wind tunnel before they race them. All final sketches in this unit will be completed using CAD.

Standards/Core Ideas/Performance Expectations

The state standards outlined below, and established by New Jersey Department of Education, will guide instruction throughout this unit in Engineering 2*:*

- *2020 New Jersey Student Learning Standards: Science*
  - HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4
- *2016 New Jersey Student Learning Standards: English Language Arts Companions for Grades 9-10*
  - NJSLSA.R7, RST.9-10.3, RST.9-10.4, NJSLSA.W4, NJSLSA.W7, WHST.9-10.6, WHST.9-10.7, WHST.9-10.10
- *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*
  - 8.1.12.CS.2, 8.1.12.DA.1, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.4, 8.2.12.ED.5, 8.2.12.NT.1, 8.2.12.NT.2
- *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies and Key Skills*
  - 9.2.12.CAP.6, 9.2.12.CAP.8, 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.DC.7, 9.4.12.TL.1, 9.4.12.TL.3,9.4.12.TL.4
  - CRP1, CRP2, CRP3, CRP4, CRP5, CRP6, CRP7, CRP8, CRP9, CRP10, CRP11, CRP12

Unit Essential Questions	Unit Enduring Understandings
● What does an Automobile Engineer do? ● What does a DC motor do? ● How can a DC motor power a small vehicle? ● What are some challenges that face a Magnetic Levitation vehicle? ● What is drag and what impact does it have on speed ● How is a wind tunnel used and what information does it provide?	● Students will be able to list three elements of an Automobile Engineers job ● A DC motor is an electric motor that converts direct current electrical energy into mechanical energy. (Electricity → Motion) ● Students will be able to get a DC motor to power a small vehicle ● Magnetic Levitation eliminates friction, but the challenges include choosing a proper propulsion system, a means of levitation and aerodynamic design. ● Drag is a frictional force that is caused by air resistance over a body moving through a fluid. More drag causes lower speeds ● Students will be able to properly use a wind tunnel and analyze the data it provides to better their design.

Evidence of Learning

Formative Assessment:	Summative Assessment:	Resources Needed:
● Each Step of the Engineering Design Process will be turned in: ● Ask to identify the need and Constraints ● Research the problem ● Imagine possible solutions ● Plan by selecting a promising solution ● Create a prototype ● Test and evaluate the prototype	● MagLev Project ● Compressed Air Car Project	● *google classroom* ● *internet resources* ● *youtube.com* ● *teachengineering.org* ● *project materials* ● *classroom tools and machines*

• Improve and redesign as needed		

Unit 6:
Aerospace Engineering

Unit Summary

In this unit, students will become familiar with Aerospace Engineering. They will learn about how Aerospace Engineers help society and in what ways. With a focus on industries including designing or building aircraft, projectiles, spacecraft and other areas of research and development for Aerodynamically fit materials sent flying through the air (or space!) The major component of this unit will be the design, construction and testing of a glider and that of a trebuchet. Through the completion of this unit they will understand some of the challenges faced by Aerospace Engineers and be able to understand the terminology used in this industry. All final sketches in this unit will be completed using CAD.

Standards/Core Ideas/Performance Expectations

The state standards outlined below, and established by New Jersey Department of Education, will guide instruction throughout this unit in Engineering 2*:*

- *2020 New Jersey Student Learning Standards: Science*
  - HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4
- *2016 New Jersey Student Learning Standards: English Language Arts Companions for Grades 9-10*
  - NJSLSA.R7, RST.9-10.3, RST.9-10.4, NJSLSA.W4, NJSLSA.W7, WHST.9-10.6, WHST.9-10.7, WHST.9-10.10
- *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*
  - 8.1.12.CS.2, 8.1.12.DA.1, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.4, 8.2.12.ED.5, 8.2.12.NT.1, 8.2.12.NT.2
- *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies and Key Skills*
  - 9.2.12.CAP.6, 9.2.12.CAP.8, 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.DC.7, 9.4.12.TL.1, 9.4.12.TL.3,9.4.12.TL.4
  - CRP1, CRP2, CRP3, CRP4, CRP5, CRP6, CRP7, CRP8, CRP9, CRP10, CRP11, CRP12

Unit Essential Questions	Unit Enduring Understandings
• What does an Aerospace Engineer do? • What is roll? • What is lift? • What is yaw? • What is the optimal firing angle for a glider and how is that different from that of a trebuchet?	• Students will be able to list three elements of an Aerospace Engineers job • Roll is the up and down movement of the wings of an aircraft • Lift is a force that is produced by the dynamic effect of the air acting on the airfoil and acts perpendicular to the flight path. • Yaw is the left or right turning of a plane caused by the rudder on the tail. • Students will be able to compare and contrast the optimal firing angles for both.

Evidence of Learning

Formative Assessment:	Summative Assessment:	Resources Needed:
• Each Step of the Engineering Design Process will be turned in: • Ask to identify the need and Constraints	• Glider Project • Trebuchet Project	• *google classroom* • *internet resources* • *youtube.com* • *teachengineering.org* • *project materials*

• Research the problem • Imagine possible solutions • Plan by selecting a promising solution • Create a prototype • Test and evaluate the prototype • Improve and redesign as needed		• *classroom tools and machines*

Unit 7: **Energy Engineering**
Unit Summary
In this unit, students will become familiar with Energy Engineering. They will learn about how Energy Engineers help society and in what ways. The focus of Energy Engineers is to combine scientific fields of study with environmental engineering processes to increase efficiency, sustainability and development of renewable sources of energy. The major component of this unit will be the design, construction and testing of a solar panel vehicle. Through the completion of this unit they will understand some of the challenges faced by Energy Engineers and be able to describe how a solar panel functions. They will also know the differences between traditional energy sources and alternative energy sources such as; Solar, Wind, Tidal, Hydroelectric and Biomass Energy. All final sketches will be completed using CAD.
Standards/Core Ideas/Performance Expectations

The state standards outlined below, and established by New Jersey Department of Education, will guide instruction throughout this unit in Engineering 2*:*
• *2020 New Jersey Student Learning Standards: Science*
  ○ HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4
• *2016 New Jersey Student Learning Standards: English Language Arts Companions for Grades 9-10*
  ○ NJSLSA.R7, RST.9-10.3, RST.9-10.4, NJSLSA.W4, NJSLSA.W7, WHST.9-10.6, WHST.9-10.7, WHST.9-10.10
• *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*
  ○ 8.1.12.CS.2, 8.1.12.DA.1, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.4, 8.2.12.ED.5, 8.2.12.NT.1, 8.2.12.NT.2
• *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies and Key Skills*
  ○ 9.2.12.CAP.6, 9.2.12.CAP.8, 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.DC.7, 9.4.12.TL.1, 9.4.12.TL.3,9.4.12.TL.4
  ○ CRP1, CRP2, CRP3, CRP4, CRP5, CRP6, CRP7, CRP8, CRP9, CRP10, CRP11, CRP12

Unit Essential Questions	Unit Enduring Understandings
• What does an Energy Engineer do? • How does a solar panel function? • How does Wind Energy work? • How does Tidal Energy work? • How does Hydroelectric Energy work? • How does Biomass Energy work?	• Students will be able to list three elements of an Energy Engineers job • Students will be able to describe parts of a Solar panel and how they help to produce energy. • Wind Energy is energy captured from wind turning a turbine to generate electricity. • Tidal energy is energy capture from the movement of the tides in waterways which turns a turbine to generate electricity.

	● Hydroelectric Energy relies on the movement of water from a higher height to a lower one, turning a turbine in the process. ● Biomass energy relates to a cycle of renewable organic material coming from plants and animals--chemical energy stored from the sun.

Evidence of Learning		
Formative Assessment: ● Each Step of the Engineering Design Process will be turned in: ● Ask to identify the need and Constraints ● Research the problem ● Imagine possible solutions ● Plan by selecting a promising solution ● Create a prototype ● Test and evaluate the prototype ● Improve and redesign as needed	**Summative Assessment:** ● Solar Panel Project ● Generator Project/ Presentation	**Resources Needed:** ● *google classroom* ● *internet resources* ● *youtube.com* ● *teachengineering.org* ● *project materials* ● *classroom tools and machines*

Section IX: Unit Reflection

The *Industrial Arts* Instructional Team must confer upon the completion of each instructional unit in the *Engineering 2 curriculum* and rate the degrees to which the instructional units meet performance criteria established by the New Jersey Department of Education using the *Unit Reflection Form*. Completed unit reflection forms must be submitted to the Department Supervisor for approval upon completion of curriculum implementation with a complementing list of suggested modifications to the *Engineering 1* Curriculum.

Lesson Activities:	**Strongly**	**Moderately**	**Weakly**
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills;			
Are challenging and require higher order thinking and problem solving skills;			
Allow for student choice;			
Provide scaffolding for acquiring targeted knowledge/skills;			
Integrate global perspectives;			

Integrate 21st century skills;			
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills;			
Are varied to address different student learning styles and preferences;			
Are differentiated based on student needs;			
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process;			
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives;			
Provide opportunities for student reflection and self-assessment;			
Provide data to inform and adjust instruction to better meet the varying needs of learners;			