Unit 08: Engineering Exploration

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 4**
Length: **6 Weeks**
Status: **Published**

Summary

Introduction:

Students explore an engineering discipline of personal interest. Students will produce a product that is discipline dependent. Options may also include the timely pursuit of a competition, or expanding upon a previous topic.

Revision Date: July 2022

Standards

9.4.12.CI	Creativity and Innovation
	With a growth mindset, failure is an important part of success.
9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
	Innovative ideas or innovation can lead to career opportunities.
9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
9.4.12.CT	Critical Thinking and Problem-solving
	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.DC	Digital Citizenship
	Laws govern the use of intellectual property and there are legal consequences to utilizing or sharing another's original works without permission or appropriate credit.
9.4.12.DC.1	Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
LA.RST.9-10	Reading Science and Technical Subjects
9.4.12.DC.2	Compare and contrast international differences in copyright laws and ethics.
	Key Ideas and Details
LA.RST.9-10.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.9-10.2	Determine the central ideas, themes, or conclusions of a text; trace the text's explanation

	or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
LA.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
	Integration of Knowledge and Ideas
LA.RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
LA.WHST.9-10	Writing History, Science and Technical Subjects
	Text Types and Purposes
LA.WHST.9-10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.
LA.WHST.9-10.1.A	Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
LA.WHST.9-10.1.D	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.WHST.9-10.1.E	Provide a concluding paragraph or section that supports the argument presented.
9.4.12.TL	Technology Literacy
	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
	Research to Build and Present Knowledge
LA.WHST.9-10.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.WHST.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
LA.WHST.9-10.9	Draw evidence from informational texts to support analysis, reflection, and research.

Essential Questions/Enduring Understandings

Essential Questions:

What do engineers do?

What do engineers produce?

How do engineers solve problems?

What are career paths and work styles for engineers?

Essential Understandings:

There are many career paths for engineers.

Some engineers work in private practice while others work for government, large companies, and mid-sized firms.

Engineers produce a variety of things and have a variety of areas of expertise.

The engineering design loop is used to produce a solution to problems where multiple solutions exist.

Engineers share fundamental knowledge but specialize in areas of interest.

Objectives

Students will know key terms: electric engineer, computer engineer, design loop, iterative, scientific method, design log, alternate solutions, brainstorming, design brief, evaluation, and safety.

Students will know there are many engineering disciplines besides those in the key terms.

Students will know that different engineering careers support different personal lifestyles.

Students will know the steps of the design loop.

Students will know how to apply the design loop to a problem.

Students will know how to methodically document work in a design log.

Students will be skilled at using the design loop.

Students will be skilled at making career choices.

Students will be skilled at defining and developing a project.

Students will be skilled at meeting deadlines.

Students will be skilled at documenting their work.

Students will be skilled at making a presentation of their work.

Students will be skilled at identifying safety and fire concerns when using electronics.

Students will be skilled at applying strategies and rules for maintaining a safe environment.

Students will be skilled at using unit vocabulary.

Learning Plan

Formative assessments will be conducted throughout the design process.

Problem-based learning: Students will develop a solution to an engineering problem they choose. Working in groups or alone, they will apply the design loop to develop a solution. Students may explore a previous unit's work—make another computer game, or other engineering disciplines. Examples: mechanical engineering-a carnival-type ride, robotics-a machine for making pizza, electrical-an electric chafing dish, civil engineering-a bridge. The project may coincide with a competition.

Current Events: identify trends in power production and explain how they relate to engineering and society.

Preview the essential questions and connect them to learning throughout the unit.

Conduct formative assessments throughout the process using class discussion, student writing, and practice quizzes.

Provide lectures and lessons to develop students understanding of the design loop.

Provide guidance and rubrics for the development of a digital portfolio.

Complete summative assessments throughout to evaluate skills acquisition.

Conduct formative assessments throughout the design process.

Problem-based learning: Students will develop a solution to a design problem graded with a rubric.

Students and teacher score summative assessments by using a rubric specific to the design problem.

Complete unit summative assessments.

Assessment

Formative:

Participate in guided question and answer sessions, group and individual discussions, and show an

understanding of the purpose of the unit lesson(s), and their key terms and concepts.

Participate in classroom activities such as class discussion, question and answer sessions, cooperative group projects, and presentation of research.

Develop a digital portfolio that logs student activities throughout the year. The portfolio will be graded using a rubric.

demonstrate the ability to utilize the design loop as a problem-solving tool.

Demonstrate the ability to document work in a design log that is assessed with a rubric.

Summative:

Demonstrate the ability to document work in a design log that is assessed with a rubric.

Demonstrate understanding through written quizzes and tests about subject materials.

Perform a problem-based learning activity focusing on a problem a student identifies. The project will include a prototype, a written report, and an oral presentation that demonstrates the use of digital media. Students will provide handouts of vocabulary. The project will be graded using a rubric specific to the project.

Meaningfully address the essential and guiding questions of this unit of study.

Benchmark:

Develop a digital portfolio that logs student activities throughout the year. The portfolio will be graded using a rubric.

Final exam

Alternative:

Oral exam

Project review

Materials

Textbook: Raymond B. Landis, Studying Engineering: A Road Map to a Rewarding Career (4th ed.). Discovery Press (ISBN-10: 0879348749, ISBN-13: 978-0979348747)

Robotics Lab, including: soldering irons, electric and manual drills/drill press, scroll saw, hand powered saws,

3-D printer and curing machine, safery glasses, hand operated tools like tin snips, wire cutters, electronic multi meters, power supplies, electronic components.

Computer Lab: Windows based computers with Autocad software, Arduino software, LEGO NXT software, CREO software, INTERNET connectivity.

Consumable materials: materials for 3d Printer, paper, wire, electronics components (speakers, transistors,

capacitors, resistors etc).

White Board/LCD Screen

Online references from NJIT