Unit 02: Engineering Study and Practice

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **3 Weeks**
Status: **Published**

Summary

Introduction: Students will explore topics in engineering including how to be a successful student, disciplines in engineering, key elements of engineering practice, and choosing an engineering major. This unit will run concurrently with other units.

Revision Date: July 2022

Standards

CS.9-12.8.2.12.ETW.1	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
CS.9-12.EC	Ethics & Culture
CS.9-12.NT	Nature of Technology
TECH.9.4.12.CI	Creativity and Innovation
TECH.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).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
TECH.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).
TECH.9.4.12.TL	Technology Literacy
	Engineers use science, mathematics, and other disciplines to improve technology. Increased collaboration among engineers, scientists, and mathematicians can improve their work and designs. Technology, product, or system redesign can be more difficult than the original design.
	With a growth mindset, failure is an important part of success.
	Innovative ideas or innovation can lead to career opportunities.
	Cultivating online reputations for employers and academia requires separating private and professional digital identities.
	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.
	Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization.

Essential Questions/Enduring Understandings

Essential Questions:

What are ethical and professional concerns for an engineer?

What are the attributes of a successful engineering student?

What are engineering career paths?

Essential Understandings:

Engineers exercise discretion and judgment and often make decisions that impact life and safety.

Engineers are (often) state-licensed professionals.

Engineering students can expect to spend 60 hours a week on their studies and require a strong mathematics and science background.

Engineering has many disciplines. Through exploration, students can develop a career path.

Objectives

Students will know the most common engineering disciplines: mechanical engineering, civil engineering, electrical engineering, computer engineering, chemical engineering, bioengineering and biomedical engineering, industrial engineering, and aerospace engineering.

Students will know what the time commitments are for engineering education.

Students will know the ethical expectations of engineers.

Students will know what high school coursework most impacts success in college.

Learning Plan

Note: the timeline for completing this unit will extend to all four marking periods.

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.

Assess to determine the students' background knowledge in the design loop and electrical engineering.

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

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.

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 understanding through written quizzes and tests about subject materials.

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

Write a reflection paper at the conclusion of the final project to be assessed with a rubric.

Benchmark:

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

Final exam

Alternative:

Oral exam

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, safety glasses, hand-operated tools like tin snips, wire cutters, electronic multimeters, power supplies, and electronic components.

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

Consumable materials: materials for 3d Printer, paper, wire, and electronics components (speakers, transistors, capacitors, resistors, etc).

White Board/LCD Screen

Online references from NJIT