Unit 14: How Things Work

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 1**
Length: **2 Weeks**
Status: **Published**

Brief Summary of Unit

Students will explore careers and prepare a technical report and presentation about an electrical device.

Standards

MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
LA.RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.RI.11-12.10b	By the end of grade 12, read and comprehend literary nonfiction at grade level text-complexity or above.
SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
TECH.8.1.12.D.1	Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
TECH.8.1.12.D.3	Compare and contrast policies on filtering and censorship both locally and globally.
TECH.8.2.12.A.2	Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
TECH.8.2.12.B.4	Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.
TECH.8.2.12.C.4	Explain and identify interdependent systems and their functions.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.6	Research an existing product, reverse engineer and redesign it to improve form and

	function.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
TECH.8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

Transfer

Essential Questions

- How do things work?
- What do electrical engineers do?
- What is engineering?

Essential Understandings

- communication skills are an important part of engineering.
- electrical engineering is a broad field and there are many areas of concentration.
- engineering by definition concerns the application of science.
- vocabulary associated with engineering is discipline specific.

Students Will Know

- how complicated devices or processes work. i.e.: a servo motor in a robot, a hard drive, CD burner, power station, power grid, communication through the World Wide Web, IC (Integrated Circuit) manufacturing, etc.
- how to communicate their work to others.
- key terms: engineering, system, subsystem, assembly, subassembly and student driven vocabulary dependent on their area of research
- special areas of concentration for electrical engineers.

Students Will Be Skilled At

Evidence/Performance Tasks

- • complete writing prompt. Example: Compare the educational background of an electrical engineer who designs IC with one who designs the power grid…
- • demonstrate the ability to utilize the design loop as a problem solving tool.
- • demonstrate understanding on written quizzes and tests about subject materials.
- • develop a digital portfolio that logs student activities throughout the year. The portfolio will be graded using a rubric
- • meaningfully address the essential and guiding questions of this unit of study.
- • meaningfully participate in guided question and answer sessions, group and individual discussions, show an understanding of the purpose of the unit lesson(s), and their key terms and concepts.
- • perform a research project of an invention or process related to electrical engineering. The presentation will include an oral element and a vocabulary list. The research project and presentation will be evaluated using teacher and student designed rubrics.

Learning Plan

- • Complete quizzes on students' research projects and vocabulary.
- • Complete unit test.
- • Conduct formative assessment thorough out the process with class discussion, student writing, practice quiz, review of student work.
- • Conduct formative assessments throughout the research problem using class discussion, student writing and practice quizzes.
- • Pre-assessment to determine the direction of work.
- • Preview the essential questions and connect to learning throughout the unit.
- • Provide guidance and rubrics for the development of a digital portfolio.
- • Provide lecture and opportunities for discussion about the guiding questions.
- • Solve research problem(s): Students will choose a topic to research based on their personal motivation and interest. The report will focus on the technical aspects of the invention, the subassemblies, etc. A written and oral presentation with a vocabulary list will be made by the student.
- • Students and teachers score summative assessment by using a rubric specific to the problem which may include student driven goals.
- Suggested Supplemental manual and reference for experiments: • FED 101 – Fundamentals of Engineering Design, Electrical and Computer Engineering Module, Laboratory Manual and Supplementary Notes, John D. Carpinelli, Department of Electrical and Computer Engineering. NJIT. Copyright 2004, updated 2010.

Materials

- • CAD and other software programs
- • DVDs
- • Email and e-board
- • Robotics lab equipped with MATLAB, PSpice, power supplies, logic testers, various electrical components, drill press and tools.

- SmartBoard use for presentation and interactive lessons
- Virtual Field Trips
- Web sites

Suggested Strategies for Modifications

- additional time on task
- alternative outcome options
- assessment based on individual development in the area of study
- audio tape of instruction
- cooperative learning groups
- handouts of notes, procedures, processes, diagrams, etc.
- images and visual aids
- one-to-one instruction and assistance
- preferential seating
- reading material modified to student level
- revised techniques, use of tools and media in hands-on activity
- study partners
- testing materials appropriate to student level