Unit 12: Prototypical Circuits

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

Brief Summary of Unit

Students will explore the 555 timer, decimal counter, a stable multivibrator, 4-bit binary counter, LED protection and LED protection

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.
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.8.2.12.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.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

- Are there common circuits that are used in electronics ?
- How do engineers solve problem?

Essential Understandings

- circuits are modified with other electrical components to meet specific needs.
- components require protection so that they are less likely to become destroyed.
- most circuits can be classified into functional categories.

Students Will Know

- A 4-bit binary counter counts electrical pulses.
- electrical components require protection so they do not burn out.
- electronics symbols and what they mean in a schematic or circuit diagram.
- how to use an integrated circuit to perform a function.
- integrated circuits are used with other components that modify their functions.
- key terms: pulse train, a stable, 4-bit counter, decimal counter
- the 555 Timer integrated circuit can be used to make a mono or a stable (free-running) multivibrator.
- where to find information about an IC and be able to interpret the data provided.

Students Will Be Skilled At

Evidence/Performance Tasks

- demonstrate the ability to utilize the design loop as a problem solving tool.
- demonstrate understanding on written quizzes and tests about subject materials.

- demonstrate using prototypes and describe how circuits using the 555 Timer, and a counter work.
- 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.
- use unit vocabulary in written and oral communication.

Learning Plan

- *Experiment 7-Boardwalk Wheel, application of digital logic, the 555 timer integrated circuit, and 4-bit counter.
- Complete quizzes on other students' research and vocabulary.
- Complete summative assessment by the student and teacher using a rubric specific to the problem which may include student driven goals.
- Complete unit test.
- Conduct formative assessment throughout the process with class discussion, student writing, practice quiz and review of student work.
- Conduct formative assessments throughout the research problem.
- Explore Integrated Circuit problem(s): Students or teacher will choose an application and integrated circuit to explore. Students will make the circuit and an oral and written presentation that would include schematic diagrams.
- 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.
- 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