Unit 05: Electrical Engineering and Circuits

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 2**
Length: **6 Weeks**
Status: **Published**

Summary

Introduction: Students will investigate Atomic structure, electricity, charge, direct current, alternating current, power, voltage, Ohm's & Kirchoff's law. Students will use different components and model circuits using a breadboard and with computer modeling software.

Revision Date: July 2022

Essential Questions/Enduring Understandings

Essential Questions:

What is the science that relates to electricity?

What engineering laws are used to solve electrical engineering problems?

How do we model circuits?

How do electrical components work?

Essential Understandings:

Understanding atomic structure and models of electricity can explain how circuits behave.

The mathematical relationships expressed by Ohm's Law and Kirchoff's law are used to solve circuit problems.

Components are selected to produce a desired function.

Schematic diagrams graphically describe circuits.

Circuits can be modeled on breadboards and using software.

Engineers use discipline-specific vocabulary.

Objectives

Students will know key terms: valence electron, proton electron, neutron, direct current, alternating current, resistor, conductor, voltage, ohms, amperage, series, parallel. solutions, brainstorming, design brief, evaluation, safety.

Students will know: atomic structure as described in the Bohr model of the atom.

Students will know: the plumbing model of electricity.

Students will know: charge, current voltage, and power are properties of electricity.

Students will know: the characteristics of direct and alternating current.

Students will know: the characteristics of conductors and insulators.

Students will know: Ohm's law and Kirchoff's law

Students will know: the resistor color coding system

Students will know: how to calculate voltage, current, resistance and power in a circuit.

Students will know: how a photo-resistor, potentiometer, LED, capacitor, resistor, SCR, and a transistor function.

Students will be skilled at using a soldering iron.

Students will be skilled at prototyping circuits on a breadboard

Students will be skilled at prototyping circuits using a computer software program.

Students will be skilled at using a multimeter to measure resistance, voltage and continuity.

Students will be skilled at identifying safety and fire are 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

Preview the essential questions and connect 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.

Lab/Hands-on activities: Students will make circuits using electrical components on a breadboard. Each of the activities will focus on how a particular component works and or how it works with other components. Students will model a circuit for an oscillator.

Students will model circuits using computer software.

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

Provide lectures and lessons to develop student 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 will score summative assessment by using a rubric specific to the design problem. Suggested activity: flying device.

Complete unit summative assessments.

Assessment

Formative:

Participate in guided question and answer sessions, and 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

Maintain a design log that documents hands-on and virtual activities in circuit modeling that are assessed with a rubric.

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.

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, 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