Electronics Curriculum Outline

Course Information - Shamokin Area School District

Course Title: Electronics I

Course ID Number: 90900

Course Length: 1 Period Per Day, Full Year

Credit Weight: 1 Credit

Credit Category: Elective

Grades Offered: 9-12

Course Description:

This course is designed to allow students to survey electricity and electronics.

Objectives: Learn the basics of electronics and apply their knowledge on the following: Theory & Practice; Properties of Resistance; Electron Flow; Tools & Testing Equipment; Circuits; Direct Current and Alternating Current Applications, Safe Practices, and Technological Impacts.

Experiences will include bread boarding, design and problem solving, use of test equipment, and electronic project assembly/troubleshooting.

Unit 1 – Introduction

Overview:

This unit will take place at the inception of the class. Its purpose is to inform the students of the format of the course with regards to the objectives listed below.

Objectives:

1. To familiarize students with course instructor and locations of lab and lecture areas.
2. To give a brief overview of the content that will be covered during the course.
3. To familiarize students with emergency procedures for both lab and lecture areas.
4. To familiarize students with normal daily class procedures. For example: Completing bell ringers, lavatory policies, lecture and lab practices, etc.
5. To familiarize students with course grading procedures.
6. To have students remember/apply for credentials to logon to the district network.

Suggested Unit Time Frame: Two Full Class Periods

PDE SAS Standards:

N/A

Assessments:

N/A

Unit Two – Basics of Electricity

Overview:

This unit will focus on the foundational knowledge in order to understand electricity. Topics include work, units of energy, efficiency, structure of matter, electrical charge, current, voltage, resistance, polarity, resistance, and power.

Objectives:

1. To introduce the concept of work including typical units of measurement and formulas.
2. To introduce the concept of efficiency.
3. To introduce the concept of energy and its various forms.
4. To introduce the various units of measurement related to electricity including amperage, voltage, and resistance.
5. To have students be able to calculate amperage, voltage, and resistance in a circuit.
6. To have students be able to create basic circuits in a hands on approach.

Suggested Unit Time Frame: 27 Class Periods

PDE SAS Standards:

3.2.10.B2- Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.

3.4.12.A3- Demonstrate how technological progress promotes the advancement of science, **technology**, engineering and mathematics (**STEM**).

**3.4.12.C3:** Apply the concept that many technological problems require a multi-disciplinary approach.

**3.4.10.E3:** Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others.

**3.**4.12.A2: Describe how management is the process of planning, organizing, and controlling work.

**3.**4.10.E4: Evaluate the purpose and effectiveness of information and communication systems.

Assessments:

Worksheets

Exam 1

Labs

Unit Three – Basics Electronic Components

Overview:

This unit will focus on the variety of basic components found in electronic circuits. At the conclusion of the unit, students will be able to identify the variety of components identified in the “Objectives” below, explain how the components contribute to a communication system, and be able to apply theoretical concepts in a kinesthetic situation.

Objectives:

1. Students will be introduced to resistors. Lessons will include material make-up of the component, their role in a circuit, and how to identify their resistive value.
2. Students will be introduced to relays. Lessons will include material make-up of the component, their role in a circuit, and their functionality.
3. Students will be introduced to diodes. Lessons will include material make-up of the component, their role in a circuit, and their functionality.
4. Students will be introduced to capacitors. Lessons will include material make-up of the component, their role in a circuit, and their functionality.
5. To have students learn the workings and functionality of batteries.
6. Students will be introduced to transistors. Lessons will include material make-up of the component, their role in a circuit, and their functionality.
7. Students will be introduced to integrated circuits (IC). Lessons will include material make-up of the component, their role in a circuit, and their functionality.
8. Students will be introduced to the number system “Binary.” Lessons will include formulas and mathematical formulas that allow for the conversion from “Binary” number systems to “Decimal” number systems.
9. Students will be introduced to the concept of “Gate Logics.” Lessons will describe how binary number systems are important to the functionality of IC’s.

Suggested Unit Time Frame: Approx. 40 Class Periods

PDE SAS Standards:

3.2.10.B2: Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.

3.4.12.A3: Demonstrate how technological progress promotes the advancement of science, **technology**, engineering and mathematics (**STEM**).

**3.4.12.C3:** Apply the concept that many technological problems require a multi-disciplinary approach.

**3.4.10.E3:** Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others.

**3.**4.10.E4: Evaluate the purpose and effectiveness of information and communication systems.

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

Assessments:

Worksheets

Labs

Exam 2

Class Participation

Lab Clean-Up

Unit Four – Practical Electronic Applications

Overview:

This unit will have students take the theoretical knowledge they have gained in previous units and apply it in a working practical setting. Students will be creating circuits that will actually “do something.”

Objectives:

1. To have students work with resistors, diodes, transistors, capacitors, and integrated circuit (IC) chips in order to learn their properties and orientation in a kinesthetic manner.
2. To have students develop an AND logic circuit with IC Logic Chips.
3. To have students develop an OR logic circuit with IC Logic Chips.
4. To have students develop a NOT logic circuit with IC Logic Chips.
5. To have students develop a NAND logic circuit with IC Logic Chips.
6. To have students develop a NOR logic circuit with IC Logic Chips.
7. To have students develop a XOR logic circuit with IC Logic Chips.
8. To have students develop a XNOR logic circuit with IC Logic Chips.
9. To have students complete the “Useless Box Activity.”
10. To have students develop the seven gate logics using transistors instead of IC Logic Chips.

Suggested Unit Time Frame: Approx. 40 Class Periods

PDE SAS Standards:

3.2.10.B2: Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.

3.4.12.A3: Demonstrate how technological progress promotes the advancement of science, **technology**, engineering and mathematics (**STEM**).

**3.4.12.C3:** Apply the concept that many technological problems require a multi-disciplinary approach.

**3.4.10.E3:** Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others.

**3.**4.10.E4: Evaluate the purpose and effectiveness of information and communication systems.

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

Assessments:

Logic Circuit Labs

Useless Box Lab

Hands-On Exam

Class Participation

Lab Clean-Up

Unit Five – Take-Home Project

Overview:

Students will have the opportunity to choose their own project kit, which will have the proper circuit board and components included. Students will be given the requirements, which must be taken into consideration when choosing a project. Once the projects have been received and the instructor hands them out, the students will work in a self-directed manner in order to assemble, solder, and test them. If the project does not work the students must work through a trouble shooting process in order to make it function. Students are able to keep their projects once the

Objectives:

1. To teach students how to perform soldering in relation to electronics.
2. To have students research and select a “take-home” electronics project.
3. To have students properly assemble their projects.
4. To have students fully solder their projects.
5. To have students test and trouble shoot their take-home projects.

Suggested Unit Time Frame: Approx. 30 Class Periods

PDE SAS Standards:

3.2.10.B2: Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.

3.4.12.A3: Demonstrate how technological progress promotes the advancement of science, **technology**, engineering and mathematics (**STEM**).

**3.4.12.C3:** Apply the concept that many technological problems require a multi-disciplinary approach.

**3.4.10.E3:** Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others.

**3.**4.10.E4: Evaluate the purpose and effectiveness of information and communication systems.

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

Assessments:

Take-Home Project Phase I

Take-Home Project Hands-On Activity

Class Participation

Lab Clean-Up

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Unit Six – Class Reflection and Microcontrollers

Overview:

Students will be given the opportunity to learn and create working circuits using a programmable microcontroller. Using the “Basic Stamp” editing program, students will face a variety of challenges that their group must program and have their device complete autonomously. Students will also complete their “Final Exam” in the form of a 5-8 page research paper. The paper will have students research current technologies and see how they have both positively and negatively effected society as a whole.

Objectives:

1. To have students learn what a microcontroller is along with its purpose.
2. To have students be able to work with the Basic Stamp Editor program.
3. To have students program a “robot” to complete the “Park the Car” challenge.
4. To have students program a “robot” to complete the “Follow the Line” challenge.
5. To have students be able to identify how electronics has changed society.
6. To have students reflect on their “Take-home” project and be able to explain its full functionality.
7. To have students reflect on the course as a whole and recommend improvements.

Suggested Time Frame: 30 Class Periods

PDE SAS Standards:

3.2.10.B2: Explain how the overall energy flowing through a system remains constant. Describe the work-energy theorem. Explain the relationships between work and power.

3.4.12.A3: Demonstrate how technological progress promotes the advancement of science, **technology**, engineering and mathematics (**STEM**).

3.4.12.B1: Analyze ethical, social, economic, and cultural considerations as related to the development, selection, and use of technologies.

**3.4.12.C3:** Apply the concept that many technological problems require a multi-disciplinary approach.

**3.4.10.E3:** Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others.

**3.**4.10.E4: Evaluate the purpose and effectiveness of information and communication systems.

CC.2.2.HS.D.8: Apply inverse operations to solve equations or formulas for a given variable.

Assessments:

Park the Car Challenge Activity

Follow the Line Challenge Activity

Research Paper

Unit 7 – Writing Prompts

Per the administration, this unit is to be conducted at least one time each marking period.

Overview:

Students are to practice their comprehension and writing skills in order to perform better on state mandated testing. The prompt has been altered in order to fit into the regular curriculum for the class. Students will be finding a current article from a “reliable” online periodical resource which relates to technology.

Objectives:

1. To have students locate an article from a reliable online resource.
2. To have students summarize the article in one paragraph.
3. To have students form an educated opinion on the evolving technology and support their opinion using a resource which is documented with parenthetical notations.
4. To have students complete the assignment using APA formatting guidelines.

Suggested Time Frame: Approx. 2 Class Periods Per Occurrence.

PDE Standards:

CC.1.2.9-10.B -Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on an author’s explicit assumptions and beliefs about a subject.

CC.1.4.9-10.CDevelop and analyze the topic with relevant, well-chosen, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic; include graphics and multimedia when useful to aiding comprehension.

Assessments:

Technology Current Event Assignment