Board Approved
August 2018

Wilson Area School District
Planned Course Guide

Title of planned course: Electricity and Electronics

Subject Area: Technology Education

Grade Level: 9-12

Course Description: This introductory course will explore the concepts of electronics technology. Students will be provided instruction on safety, introduction to the Electronics industry, tool and equipment use, soldering techniques, and employability skills and habits. Students will be involved in activities which will reinforce teamwork, problem solving, application of Language Arts, Science, and Mathematics through real-life industry examples and procedures. The course will focus on current and voltage fundamentals, series circuits, parallel circuits, resistors and other basic components, and circuit design and recognition. The course will provide students the opportunity to study devices that use DC to Series-Parallel circuits and AC concepts.

Time/Credit for this Course: Half Year / 0.5 credit

Curriculum Writing Committee: Erik Everett & Brian Meckley

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Curriculum Map

First Semester-

August:
- Introduction, Safety, Basic Concepts

September:
- Notation techniques, Electrical Quantities & units, Resistance
- Alternating & Direct Current, Soldering
- Basic Circuits, Laws, & Measurements, Circuit Components
- Series, Parallel, and Series-Parallel Circuits

October:
- Series, Parallel, and Series-Parallel Circuits
- Magnetism, Electromagnetism, Inductance
- Residential wiring & Circuit Protection Devices
- Mechatronics Activity- planning, material processing

November:
- Mechatronics Activity- electronics PCB, wiring, arduino coding

December/January:
- Mechatronics Activity- assembly, testing, finalizing
- Final Exam

Second Semester-

January:
- Introduction, Safety, Basic Concepts
- Notation techniques, Electrical Quantities & units, Resistance
- Alternating & Direct Current, Soldering
- Basic Circuits, Laws, & Measurements, Circuit Components

February:
- Series, Parallel, and Series-Parallel Circuits
- Magnetism, Electromagnetism, Inductance
- Residential wiring & Circuit Protection Devices

March:
- Residential wiring & Circuit Protection Devices
- Mechatronics Activity- planning, material processing

April:
- Mechatronics Activity- electronics PCB, wiring, arduino coding

May:
- Mechatronics Activity- assembly, testing, finalizing

June:
- Final Exam

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Wilson Area School District
Planned Course Materials

Course Title: Electricity and Electronics

Textbook: Electricity and Basic Electronics

Supplemental Books:

- Electricity and Basic Electronics Workbook
- Arduino Projects Book

Teacher Resources:

- ITEC 261 Electronic Activities Manual
- ITEC 261 Lecture Note-Taking Handouts
- Pennsylvania State Standards

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Curriculum Scope & Sequence

Planned Course: Electricity and Electronics

Unit: Introduction, Safety, Basic Concepts

Time frame: 1 week

State Standards: 3.2.10.B2; 3.4.12.B2

Essential content/objectives: At end of the unit, students will be able to:

- List and describe electronics lab safety rules
- Explain common electronics procedures that ensure a safe working environment
- Develop safety awareness in the home, outdoors, and school
- Define energy and work
- List and explain the characteristics of the major particles of an atom, particularly the electron
- Describe how an electric charge occurs

Core Activities: Students will complete/participate in the following:

- Lecture and class discussion
- Note taking handouts
- Observe situations and note safety concerns
- Hands on lab experiments
- Introduction and setup in arduino project book

Extensions:

- Write a one page lab report on one or more electronics concepts covered
- Weekly progress portfolio write up

Remediation:

- Review
- Homework
- Unit Quiz

Instructional Methods:

- Demonstration
- Lecture
- Observation

Materials & Resources:

- Textbook
- Internet
- Video / Projector
- Digital Multimeter
- Electronic Components
- Arduino Kit

Assessments:

- Follow up Quiz
- Lab Report

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Curriculum Scope & Sequence

Planned Course: Electricity and Electronics

Unit: Notation Techniques, Electrical Quantities & Units, Resistance

Time frame: 1 week

State Standards: 3.2.10.B4; 3.4.12.B2; 3.4.10.C2; 3.4.10.D2

Essential content/objectives: At end of the unit, students will be able to:

- Write numbers using scientific notation and engineering notation
- Accurately convert numbers from one notation form to another
- Express numbers in the best notation form
- Define and differentiate between current, voltage, and resistance
- Describe and correctly use units of charge, current, voltage, resistance, and power.
- Describe current in solids, liquids, and gases
- Explain four factors affecting resistance
- List and explain five ways of producing voltage
- Define resistance and explain the purpose of resistors
- Identify and describe types of resistors, including their schematic symbols
- Accurately determine the value of a resistor and its tolerance based on its color code

Core Activities: Students will complete/participate in the following:

- Lecture and class discussion
- Note taking handouts
- Hands on lab experiments
- Project 1 in arduino project book

Extensions:

- Write a one page lab report on one or more electronics concepts covered
- Weekly progress portfolio write up

Remediation:

- Review
- Homework
- Unit Quiz

Instructional Methods:

- Demonstration
- Lecture
- Observation

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Materials & Resources:

- Textbook
- Internet
- Video / Projector
- Digital Multimeter
- Electronic Components
- Arduino Kit

Assessments:

- Follow up Quiz
- Lab Report

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Curriculum Scope & Sequence

Planned Course: Electricity and Electronics

Unit: Alternating & Direct Current, Soldering

Time frame: 1 week

State Standards: 3.2.10.B4; 3.4.12.B2; 3.4.10.C2; 3.4.10.D2

Essential content/objectives: At end of the unit, students will be able to:

- Differentiate between alternating current and direct current
- Explain ways to quantify and describe alternating current
- Understand uses and benefits of AC & DC in different applications
- Explain what soldering is and why it is done
- Describe solder and flux characteristics and purposes
- Describe the safe procedures for soldering and desoldering in an electronics lab
- Identify and describe good and poor solder joints

Core Activities: Students will complete/participate in the following:

- Lecture and class discussion
- Note taking handouts
- Hands on lab experiments
    - Measuring and identifying types current in different applications
    - circuit soldering practice
- Project 2 in arduino project book

Extensions:

- Write a one page lab report on one or more electronics concepts covered
- Weekly progress portfolio write up

Remediation:

- Review
- Homework
- Unit Quiz

Instructional Methods:

- Demonstration
- Lecture
- Observation

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Materials & Resources:

- Textbook
- Internet
- Video / Projector
- Digital Multimeter
- Electronic Components
- Arduino Kit

Assessments:

- Follow up Quiz
- Lab Report

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Curriculum Scope & Sequence

Planned Course: Electricity and Electronics

Unit: Basic Circuits, Laws, & Measurements, Circuit Components

Time frame: 1 week

State Standards: 3.2.12.A4; 3.2.10.B4; 3.4.12.B2; 3.4.10.C2; 3.4.10.D2

Essential content/objectives: At end of the unit, students will be able to:

- List and describe the parts of basic circuits
- Define schematics and recognize the importance of symbols
- Use Ohms law to calculate the current, voltage, and resistance in simple electric circuits
- Safely and accurately measure resistance, voltage, and current using a digital Multimeter
- Safely perform continuity checks with a digital multimeter
- Identify and explain common electronic components, their ratings, and their schematic symbols
- Describe the characteristics and operating principles of basic electronic components such as cells, batteries, LED's, lamps, and switches
- Identify and classify common types of cells, batteries, switches, and wire
- Diagram electron flow and conventional current flow

Core Activities: Students will complete/participate in the following:

- Lecture and class discussion
- Note taking handouts
- Hands on lab experiments
    - Measuring and identifying types current in different applications
- Project 3 in arduino project book

Extensions:

- Write a one page lab report on one or more electronics concepts covered
- Weekly progress portfolio write up

Remediation:

- Review
- Homework
- Unit Quiz

Instructional Methods:

- Demonstration
- Lecture
- Observation

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Materials & Resources:

- Textbook
- Internet
- Video / Projector
- Digital Multimeter
- Electronic Components
- Arduino Kit

Assessments:

- Follow up Quiz
- Lab Report

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Curriculum Scope & Sequence

Planned Course: Electricity and Electronics

Unit: Series, Parallel, and Series-Parallel Circuits

Time frame: 2 weeks

State Standards: 3.2.10.B4; 3.4.12.B2; 3.4.10.C2; 3.4.10.D2

Essential content/objectives: At end of the unit, students will be able to:

- Name and classify the three major types of multiple-load circuits
- Identify and describe the characteristics of a series circuit
- Use ohms law and watts law to calculate power, current, voltage, and/or resistance for the total circuit or any load in a series circuit
- Evaluate how a short or open affects a series circuit
- Identify and describe the characteristics of a parallel circuit
- Use ohms law and watts law to calculate power, current, voltage, and/or resistance for the total circuit or any load in a parallel circuit
- Evaluate how a short or open affects a parallel circuit
- Identify and describe the characteristics of a combination (series-parallel) circuit
- Use ohms law and watts law to calculate power, current, voltage, and/or resistance for the total circuit or any load in a combination (series-parallel) circuit
- Evaluate how a short or open affects a combination (series-parallel) circuit

Core Activities: Students will complete/participate in the following:

- Lecture and class discussion
- Note taking handouts
- Hands on lab experiments
    - Creation of series, parallel, and series-parallel circuits using schematic diagrams on a breadboard
    - Troubleshoot series and parallel circuits
- Project 4 in arduino project book

Extensions:

- Write a one page lab report on one or more electronics concepts covered
- Weekly progress portfolio write up
- Construct simulated circuits
- Use a home appliance and produce a schematic drawing

Remediation:

- Review
- Homework
- Unit Quiz

Instructional Methods:

- Demonstration
- Lecture
- Observation

Materials & Resources:

- Textbook
- Internet
- Video / Projector
- Digital Multimeter
- Electronic Components
- Arduino Kit

Assessments:

- Follow up Quiz
- Lab Report

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Curriculum Scope & Sequence

Planned Course: Electricity and Electronics

Unit: Magnetism, Electromagnetism, Inductance

Time frame: 1 week

State Standards: 3.2.10.B4; 3.4.12.B2; 3.4.10.C2; 3.4.10.D2

Essential content/objectives: At end of the unit, students will be able to:

- Define magnetism and electromagnetism and explain how they work
- Explain the basic principles and properties of magnetism and magnetic circuits
- Appreciate the importance of magnetism to the study of electricity/electronics
- Describe the basic principle of operation of a motor, generator, transformer, solenoid, and relay
- Explain what inductance is and how it is useful
- Describe how inductance influences current and voltage in an RL circuit
- Describe the relationship between inductance, frequency, and reactance

Core Activities: Students will complete/participate in the following:

- Lecture and class discussion
- Note taking handouts
- Hands on lab experiments
    - Produce a static charge using magnets
    - Produce an electromagnetic field using magnets
    - Generate an electromagnetic field using heat
    - Construct a simple motor using magnets and wire coil
    - Identify magnetic and non-magnetic materials
    - Induce temporary magnetism
    - Test the transfer electricity through inductors
- Project 5 in arduino project book

Extensions:

- Write a one page lab report on one or more electronics concepts covered
- Weekly progress portfolio write up
- Design a magnetism demonstration showing magnetic poles and lines of force

Remediation:

- Review
- Homework
- Unit Quiz

Instructional Methods:

- Demonstration
- Lecture
- Observation

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Materials & Resources:

- Textbook
- Internet
- Video / Projector
- Digital Multimeter
- Electronic Components
- Arduino Kit
- Magnets
- Coils

Assessments:

- Follow up Quiz
- Lab Report

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Curriculum Scope & Sequence

Planned Course: Electricity and Electronics

Unit: Residential wiring & Circuit Protection Devices

Time frame: 1 - 2 weeks

State Standards: 3.2.10.B4; 3.4.12.B2; 3.4.10.C2; 3.4.10.D2

Essential content/objectives: At end of the unit, students will be able to:

- Identify and define fuses and circuit breakers utilized in residential applications
- Understand thermal overload protectors and their purpose in an electrical system
- Describe how one, two, and three way switching works in homes to effectively light spaces of occupancy
- Develop an understanding of lighting rods and arrestors
- Understand undesirable circuit conditions and how they can result in dangerous conditions

Core Activities: Students will complete/participate in the following:

- Lecture and class discussion
- Note taking handouts
- Hands on lab experiments
    - Calculate fuse size requirements for different circuits
    - Construct circuits using fuses and breakers
    - Explain factors pertaining to wire size
    - Creation of common house wiring circuits
        - 1 way switching
        - 2 way switching
        - 3 way switching
        - Outlets
- Project 6 in arduino project book

Extensions:

- Write a one page lab report on one or more electronics concepts covered
- Weekly progress portfolio write up
- Design a magnetism demonstration showing magnetic poles and lines of force

Remediation:

- Review
- Homework
- Unit Quiz

Instructional Methods:

- Demonstration
- Lecture
- Observation

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Materials & Resources:

- Textbook
- Internet
- Video / Projector
- Digital Multimeter
- Electronic Components
- Arduino Kit
- fuses
- circuit breakers

Assessments:

- Follow up Quiz
- Lab Report

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Curriculum Scope & Sequence

Planned Course: Electricity and Electronics

Unit: Mechatronics Activity

Time frame: 6 weeks

State Standards: 3.2.10.B4; 3.4.10.A2; 3.4.12.A2; 3.4.12.B2; 3.4.10.C1; 3.4.10.C2; 3.4.12.C2; 3.4.10.D2; 3.4.12.E7

Essential content/objectives: At end of the unit, students will be able to:

- Develop simple mechatronics systems via programming of an embedded system.
- Develop creative and innovative mechatronic solutions for simple problems, anticipating financial and social consequences of any intended action.
- Design and analysis of electric circuits, applying relevant theories.
- Simulate a simple electric circuit using basic mathematical skills.
- Design experiments to evaluate the performance of a mechatronic system or component with respect to specifications
- Conduct experiments, as well as analyze and interpret data
- Design a mechatronic system, component, or process to meet desired needs within realistic constraints
- Function effectively as member of multidisciplinary teams
- Define and solve engineering problems
- Implement the Engineering design Process to develop a solution to a mechatronic system
- Utilize a variety of forms of presentation techniques.
- Apply acquired knowledge into the development of a working prototype.
- Implement the teamwork performance model to maximize group efficiency.
- Introduce a variety of different materials for usage and processing.

Core Activities: Students will complete/participate in the following:

- Lecture and class discussion
- Note taking handouts
- Hands on lab experiments
    - Construct a working electronic device using soldering skills and acquired knowledge from the course
    - Program an arduino microcontroller to monitor multiple inputs and control given outputs
    - Creation of a drone using an arduino as the programmed flight controller

Extensions:

- Write a one page lab report on one or more electronics concepts covered
- Weekly progress portfolio write up

Remediation:

- Review
- Homework
- Unit Quiz
- Review of course materials

Instructional Methods:

- Demonstration
- Lecture
- Observation
- Experimentation

Materials & Resources:

- Textbook
- Internet
- Video / Projector
- Digital Multimeter
- Electronic Components
- Arduino Kit
- Mechatronics Kit
- Soldering Materials

Assessments:

- Course Final Exam
- Lab Report