West Windsor-Plainsboro Regional School District
8th Grade STEM

Unit 0: Technology Education

Content Area: Technology Education

Course & Grade Level: Technology Education – Grade 8

Summary and Rationale

The West Windsor-Plainsboro Regional School District recognizes the importance of the study 21st Century Life and Careers standards. Additionally, it is also believed this learning should not be taught in isolation and cross curricular and career ready practices are embedded in every unit of study. Unit 0 is incorporated into each unit of study of this curricular document.

Recommended Pacing:

ELA Companion Standards and Career Ready Practices will be integrated throughout all units of study.

Interdisciplinary Connections

Grades 6-8

Progress Indicators Reading Science and Technical Subjects

Key Ideas and Details

RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Craft and Structure

RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

RST.6-8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

RST.6-8.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

Integration of Knowledge and Ideas

RST.6-8.7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

RST.6-8.8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Range of Reading and Level of Text Complexity

RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

Career Ready Practices

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP9. Model integrity, ethical leadership and effective management.

CRP10. Plan education and career paths aligned to personal goals.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

Competencies for 21st Century Learners			
X	Collaborative Team Member	X	Effective Communicator
X	Globally Aware, Active, & Responsible Student/Citizen	X	Information Literate Researcher
X	Innovative & Practical Problem Solver	X	Self-Directed Learner

Unit 1: Introduction to STEM

Content Area: Technology

Course & Grade Level: 8th Grade STEM

Summary and Rationale

Introduce STEM education as an interdisciplinary approach to learning, where academic concepts of science, technology, engineering, and math are coupled with real-world, problem-based, and performance-based lessons. Students will have experiences in which they will critically think and solve problems by asking, imagining, planning, creating, experimenting, and improving.

Recommended Pacing

6 days

State Standards

Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

STRAND C. Design: The design process is a systematic approach to solving problems.

STRAND E. Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.E.3	Develop an algorithm to solve an assigned problem using a specified set of commands and use peer review to critique the solution.

Instructional Focus

Unit Enduring Understandings

- Problem-based learning is interdisciplinary.
- Problems can be broken down into smaller, simpler tasks.
- Failure should be viewed as an opportunity for learning.
- The Design Loop is an essential process in problem solving.

Unit Essential Questions

- What is STEM?
- What is the interdependency between science, technology, engineering, and math?
- What are the steps in the Design Loop?

Objectives

Students will be able to:

- define what is meant by STEM and the relationship between these disciplines.
- identify the steps in the design process.

● demonstrate lab safety and procedures.			
Evidence of Learning			
Assessment			
End of Unit Common Assessment			
Competencies for 21st Century Learners			
X	Collaborative Team Member	X	Effective Communicator
	Globally Aware, Active, & Responsible Student/Citizen		Information Literate Researcher
X	Innovative & Practical Problem Solver	X	Self-Directed Learner
Resources			
Suggested Resources: **www.tryengineering.org**			

Unit 2: Electronics/Circuits

Content Area: Technology

Course & Grade Level: 8th Grade STEM

Summary and Rationale

The study of electronic systems including sensors, control of input and output devices, and utilization of these systems will be included in this section of the course. Introduction to switching, timing and other control devices and systems will be addressed along with the analysis of circuits and use of instrumentation.

Recommended Pacing

14 days

State Standards

Standard 8.2 Technology Education, Engineering, and Design: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Strand C. Design: The design process is a systematic approach to solving problems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate, and test options to repair the product, presenting the better solution.
8.2.8.D.1	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

Instructional Focus

Unit Enduring Understandings

- Understand how simple circuits work and the fundamentals of electricity and magnetism.
- The attributes and application of engineering design.
- The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
- All electrical circuits must be comprised of a power source, a load and a path for electricity to flow.
- Advancements in the field of electronics have led to a number of great inventions throughout history which have helped to shape the way we live our lives.

- Electrical signals can be manipulated and changed to perform a number of useful tasks in our daily lives.

Unit Essential Questions

Why is it important to solder connections?

How can a multimeter be used to diagnose problems with electrical systems?

Why is it important to use resistors to control current flow?

What are some methods used to produce electrical power?

How can movement, temperature, sound, and infrared heat control an electronic circuit?

How can we detect a fire using electronic devices and circuits in the real world?

Why must all circuits power something (light, motor, etc.) to be considered a complete circuit?

How do we direct the flow of electricity to go where we want it to go?

How do we measure electricity?

Why must all circuits power something (light, motor, etc.) to be considered a complete circuit?

How do we direct the flow of electricity to go where we want it to go?

What is the relationship between voltage, current and resistance?

What are some different types of circuits which change electrical signals?

Objectives

Students will be able to:

- identify and implement proper safety in a work environment.
- understand the importance of collaboration and effective teamwork skills.
- utilize technological tools and equipment safely to create products and systems.
- explain how electricity flows and how it can be directed using conductors.
- explain the various types of electrical power sources.
- identify and utilize a variety of electrical components in circuits.
- explain how the flow of electrical current can be manipulated by the designer of a circuit.
- use a multimeter to test for continuity.
- use a soldering iron to solder connections.
- read resistor codes.
- demonstrate proper use of tools and design concepts while completing design challenges.
- properly and safely use the following power tools:
    - Scroll Saw
    - Cordless Drill
    - Drill Press
    - Various Hand Tools

Students will know:

Electrical Components and Electronic Measurement

- How to Read Resistor Codes
- Ohm's Law
- Power Supplies – Battery and Line Power - Alternating/Direct Current
- Relative Resistances of Materials
- Use of Digital Multimeter
- Electric Circuits

- Basic Sensor Circuits
- Solderless Breadboard

Evidence of Learning

Assessment

Common Assessment 1.1 End of Unit Common Assessment

Competencies for 21st Century Learners

x	Collaborative Team Member	x	Effective Communicator
	Globally Aware, Active, & Responsible Student/Citizen	x	Information Literate Researcher
x	Innovative & Practical Problem Solver	x	Self-Directed Learner

Unit 3: Computer Programming

Content Area: Technology

Course & Grade Level: 8th Grade STEM

Summary and Rationale

Students are expected to learn and have a strong working knowledge of computer programming basics and concepts. Students will utilize this knowledge to control, problem solve, and critically think.

Recommended Pacing

14 days

State Standards

Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

STRAND C. Design: The design process is a systematic approach to solving problems.

STRAND E. Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.E.2	Demonstrate an understanding of the relationship between hardware and software.
8.2.8.E.3	Develop an algorithm to solve an assigned problem using a specified set of commands and use peer review to critique the solution.
8.2.8.E.4	Use appropriate terms in conversation (e.g., programming, language, data, RAM, ROM, Boolean logic terms).
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).

Instructional Focus

Unit Enduring Understandings

- Appreciate the ability of programming to create solutions to problems.
- Programming languages have specific syntax which must be followed.
- Computer programs are made up of precise instructions.

Unit Essential Questions

- What is computer programming?
- What are the programming methods to solving problems?
- What are the components of the design process in computer programming?
- What is the relationship between a programming instruction and a resulting outcome?
- What is the cause and effect relationship between software and hardware?

- What is meant by OUTPUT?

Objectives

Students will be able to:

- analyze and design logical solutions to programming problems.
- code, debug, and refine solutions to programming problems.
- work in groups to solve a problem.
- implement basic programming concepts of output, variables and data types, assignment, operators, library functions, and parameters.
- understand the relationship between programming instruction and resulting outcome.
- control hardware behaviors (e.g., LEDs, servos) by programming software.
- articulate the difference between hardware and software and the relationship between them.

Evidence of Learning

Assessment

End of Unit Common Assessment

Competencies for 21st Century Learners

X	Collaborative Team Member	X	Effective Communicator
	Globally Aware, Active, & Responsible Student/Citizen		Information Literate Researcher
X	Innovative & Practical Problem Solver	X	Self-Directed Learner

Resources

Suggested Resources:

http://www.tutorialspoint.com/cprogramming/cprogramming_tutorial.pdf
http://profesores.fi-b.unam.mx/cintia/cc.pdf
www.arduino.cc
Make: Getting Started With Arduino (Massimo Banzi & Michael Shiloh)
learn.sparkfun.com

Unit 4: Fabrication & Prototyping

Content Area: Technology

Course & Grade Level: 8th Grade STEM

Summary and Rationale

This section of the course is intended to develop knowledge and capability to build prototypes and implement design solutions with the use of the proper tools, machinery, and materials.

Recommended Pacing

25 Days

State Standards

Standard 8.2 Technology Education, Engineering, and Design: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Strand C. Design: The design process is a systematic approach to solving problems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate, and test options to repair the product, presenting the better solution.
8.2.8.D.1	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution

Instructional Focus

Unit Enduring Understandings

- Following safety procedures and using personal protection equipment will reduce the risk of injury.
- Planning is an essential component to design, construction, material usage, and efficiency.
- Tools and machinery have specific functions and methods for usage.
- Methods of construction and assembly determine the difference in strength and quality.
- Identify and use various types of hand tools, gages, and measuring tools.
- Identify and use various types of portable power tools and stationary power tools. The proper implementation of personal protective equipment.
- Understanding of machine/tool safety and instruction regarding correct shop procedure is crucial in a fabrication lab.

Unit Essential Questions

- What are the safety concerns to be considered when working in a lab setting in school or on the job?
- What protection can be used in a laboratory environment?
- What should be part of an effective safety program?

- What characteristics are essential to a functional team?
- What are the benefits of working in a team environment as opposed to individually?
- Why is planning an important aspect to project work?
- How does planning influence efficiency?
- Why is planning vital to material usage and construction?
- How is the design of a product influenced by planning?
- What hand tools and machines are used for cutting?
- What hand tools and machines are used for drilling and boring?
- What hand tools and machines are used for planing and jointing?
- What hand tools and machines are used for measuring and drawing?
- What hand tools and machines are used for sanding?
- What are joinery techniques?
- What types of mechanical fasteners are used in wood product construction?
- What types of glues and adhesives are used in wood product construction?

Objectives

Students will be able to:

- follow safety procedures and use personal protective equipment to reduce the risk of injury.
- identify and implement proper safety in a work environment, including working as a team.
- use planning as an essential component to design, construction, material usage, and efficiency.
- successfully complete a bill of materials, a plan of procedure and select appropriate materials for each of their projects.
- understand that tools and machinery have specific functions and methods for usage.
- properly select and utilize the appropriate hand tools for the necessary task.
- utilize different methods of construction and assembly and determine the difference in strength and quality.
- properly assemble their pieces into a project using appropriate methodology.
- understand how materials are processed using tools and machines.
- properly and safely use the following power tools:
    - Bench Grinder
    - Cordless Drill
    - Sanding Processes
    - Drill Press
    - Various Hand Tools
    - Soldering Iron

Students will know:

- Electrical Components and Electronic Measurement
- Relays
- Motors
- Potentiameter
- RGB

Evidence of Learning			
Assessment			
Common Assessment 1.1			
Competencies for 21st Century Learners			
x	Collaborative Team Member	x	Effective Communicator
	Globally Aware, Active, & Responsible Student/Citizen		Information Literate Researcher
x	Innovative & Practical Problem Solver	x	Self-Directed Learner

Unit 5: Programming for the Physical World

Content Area: Technology

Course & Grade Level: 8th Grade STEM

Summary and Rationale

Programming for the physical world involves using control and programming fundamentals associated with circuitry and programmable manipulators. With the use of a hands-on, collaborative approach, students will prototype electronically controlled devices, using software to control input and manipulate output behaviors.

Recommended Pacing

25 Days

State Standards

Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

STRAND C. Design: The design process is a systematic approach to solving problems.

STRAND E. Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.E.2	Demonstrate an understanding of the relationship between hardware and software.
8.2.8.E.3	Develop an algorithm to solve an assigned problem using a specified set of commands and use peer review to critique the solution.
8.2.8.E.4	Use appropriate terms in conversation (e.g., programming, language, data, RAM, ROM, Boolean logic terms).
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.

8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
8.2.8.D.1	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

NGSS Standards

MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Instructional Focus

Unit Enduring Understandings

- Technology is a process by which humans use scientific knowledge for practical purposes.
- The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
- Appreciate the ability of programming to create solutions to problems.
- Programming languages have specific syntax which must be followed.
- Computer programs are made up of precise instructions.
- There is not always one 'right answer' when dealing with creative problem solving.
- Failure should be viewed as an opportunity for learning.
- The Design Loop is an essential process in problem solving.

Unit Essential Questions

- What is programming for the physical world?
- How can the design process be implemented to solve a problem?
- What is the inter-relationship between hardware and software in the development process?
- How can a system be thoroughly tested?

Objectives

Students will be able to:

- use the design process to solve a problem by developing a system of hardware and software.
- implement additional programming concepts of: input, conditional logic, iterative loops.

- receive and respond to input from hardware (for example, buttons and/or switches, potentiometer).
- control additional hardware behaviors (for example, RGB, motor, buzzer) by programming software.
- write programs to control hardware, test their systems, and adapt them for variations.
- work collaboratively to build and program a system of hardware and software.
- construct and control basic electrical circuits using a breadboard.

Evidence of Learning

Assessment

End of Unit Common Assessment

Competencies for 21st Century Learners

X	Collaborative Team Member	X	Effective Communicator
	Globally Aware, Active, & Responsible Student/Citizen		Information Literate Researcher
X	Innovative & Practical Problem Solver	X	Self-Directed Learner

Resources

Suggested Resources:

National TSA Conference Competitive Events Guide

www.arduino.cc

Make: Getting Started With Arduino (Massimo Banzi & Michael Shiloh)

learn.sparkfun.com

Unit 6: Automated Systems

Content Area: Technology

Course & Grade Level: 8th Grade STEM

Summary and Rationale

Students will apply programming, circuitry and engineering concepts in which they will critically think and solve problems by creating, experimenting and improving. With the use of a hands-on, collaborative approach, students will build, engineer, and program robotically controlled devices, using software to control input and manipulate output behaviors.

Recommended Pacing

50 days

State Standards

Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

STRAND C. Design: The design process is a systematic approach to solving problems.

STRAND E. Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.E.2	Demonstrate an understanding of the relationship between hardware and software.
8.2.8.E.3	Develop an algorithm to solve an assigned problem using a specified set of commands and use peer review to critique the solution.
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
8.2.8.D.1	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.

8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

Instructional Focus

Unit Enduring Understandings

- Technology is a process by which humans use scientific knowledge for practical purposes.
- The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
- Appreciate the ability of programming to create solutions to problems.
- Programming languages have specific syntax which must be followed.
- Computer programs are made up of precise instructions.
- There is not always one 'right answer' when dealing with creative problem solving.
- Failure should be viewed as an opportunity for learning.
- The Design Loop is an essential process in problem solving.

Unit Essential Questions

- How can the design process be implemented to solve a real world problem?
- What is the interrelationship between hardware and software in the development process?
- How can programming and circuitry be applied to build and control a robot?

Objectives

Students will be able to:

- understand the relationship between programming instruction and resulting outcome.
- recognize input/output cause and effect.
- articulate the difference between hardware and software and the relationship between them.
- demonstrate proper use of tools and design concepts while completing design challenges.
- use the design process to solve a problem by developing a system of hardware and software.
- write programs to control hardware, test their systems, and adapt them for variations.
- work collaboratively to build and program a system of hardware and software.

Evidence of Learning

Assessment

End of Unit Common Assessment

Competencies for 21st Century Learners

X	Collaborative Team Member	X	Effective Communicator
	Globally Aware, Active, & Responsible Student/Citizen		Information Literate Researcher
X	Innovative & Practical Problem Solver	X	Self-Directed Learner

Resources

Suggested Resources:

www.tryengineering.org

Unit 7: Design Challenge

Content Area: Technology

Course & Grade Level: 8th Grade STEM Elective

Summary and Rationale

The STEM Design Challenge is intended to help students develop more expertise in a chosen area of investigation and development. During this experience, students follow the design process to develop a solution to a technological problem, including research, brainstorming, modeling, prototyping, testing and evaluation. Of particular importance is quantitative analysis throughout the project. Students will provide an in-depth technological experience from conception to completion through the design, development, construction, and testing of a product that solves a specific problem.

Recommended Pacing

46 days

State Standards

Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

STRAND C. Design: The design process is a systematic approach to solving problems.

STRAND D. Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

STRAND E. Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
8.2.8.E.2	Demonstrate an understanding of the relationship between hardware and software.
8.2.8.E.3	Develop an algorithm to solve an assigned problem using a specified set of commands and use peer review to critique the solution.
8.2.8.E.4	Use appropriate terms in conversation (e.g., programming, language, data, RAM, ROM, Boolean logic terms).
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).

NGSS Standards	
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Instructional Focus

Unit Enduring Understandings

- Technology is a process by which humans use scientific knowledge for practical purposes.
- The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
- Appreciate the ability of programming to create solutions to problems.
- Programming languages have specific syntax which must be followed.
- Computer programs are made up of precise instructions.
- There is not always one 'right answer' when dealing with creative problem solving.
- Failure should be viewed as an opportunity for learning.
- The Design Loop is an essential process in problem solving.
- Circuit design is made of three primary stages: prototyping, testing and final production.
- Design plays an important role in the creation of electrical based products and prototype.

Unit Essential Questions

- How can a real world problem be identified?
- How can the design process be implemented to solve a real world problem?
- What is the inter-relationship between hardware and software in the development process?
- How are electrical circuits tested to insure proper operation?
- How can a system be thoroughly tested?
- Why must all circuits power something (light, motor, etc.) to be considered a complete circuit?
- How do we direct the flow of electricity to go where we want it to go?

Objectives

Students will be able to:

- research, identify, and evaluate a design challenge to solve a real-world problem.
- use the design process to solve a problem by developing a system of hardware and software.
- implement additional programming concepts of arrays and user-defined functions.
- control additional hardware behaviors (for example, LCD) by programming software.
- write programs to control hardware, test their systems, and adapt them for variations.
- work collaboratively to build and program a system of hardware and software.
- explain how the flow of electrical current can be manipulated by the designer of a circuit.

- utilize a variety of power sources in electrical circuits.
- utilize a variety of loads in an electrical circuit.
- design and construct working circuits on a variety of platforms.

Evidence of Learning

Assessment

End of Unit Common Assessment

Competencies for 21st Century Learners

X	Collaborative Team Member	X	Effective Communicator
X	Globally Aware, Active, & Responsible Student/Citizen	X	Information Literate Researcher
X	Innovative & Practical Problem Solver	X	Self-Directed Learner

Resources

Suggested Resources:

National TSA Conference Competitive Events Guide

www.arduino.cc

Make: Getting Started With Arduino (Massimo Banzi & Michael Shiloh)

learn.sparkfun.com