DELAWARE VALLEY SCHOOL DISTRICT

PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Automation and Robotics

Grade Level: 8

Date of Board Approval: _____2017_____

DELAWARE VALLEY SCHOOL DISTRICT

Planned Instruction

Title of Planned Instruction: Automation and Robotics

Subject Area: Technology Education Grade(s): 8

Course Description: In Unit 1 What is Automation and Robotics? Students will understand what robots are used for and the effect they have on our lives. Students will experience how a robot receives information through various sources. In Unit 2 Mechanical Systems, students use VEX components to create various gear mechanisms and determine their real-world uses. They will then apply what they learned to create a VEX pull toy project. In Unit 3 Automated Systems, student will learn RobotC programming. Using their knowledge from the previous units, they will design, build, and program real-world objects such as traffic lights, toll booths, and robotic arms.

Time/Credit for the Course: 9 weeks, daily, 46 minutes = 34.5 hours

Curriculum Writing Committee: Anthony Comunale

Curriculum Map

1. Marking Period One: 45 days

Goals:

Unit #1 What is Automation and Robotics?

- Students will describe the purpose of automation and robotics and its effect on society.
- Students will summarize ways that robots are used in today's world and the impact of their use on society.
- Students will describe positive and negative effects of automation and robotics on humans in terms of safety and economics.
- Students will provide examples of STEM careers and the need for these professionals in our society.

Unit #2 Mechanical Systems

- Students will investigate and understand various mechanisms to determine their purpose and applications.
- Students will be able to apply their knowledge of mechanisms to solve a unique problem.

Unit #3 Automated Systems

- Students will design, build, wire, and program both open and closed loop systems.
- Students will troubleshoot a malfunctioning system using the design process.
- Students will experience fluid power by creating and troubleshooting a pneumatic device.
- Students will design, build, wire and program a system operated by alternative energy.

Understanding of:

- Analyzing the positive and negative affects robots have on humans
- Analyzing how automation and robotics have an influence on society in the past and present and will influence society in the future.
- Investigate how engineers, designers, and engineering technologists are need in high demand for the development of future technology to meet societal needs and wants.
- Knowing how to use mechanisms to transfer energy.
- Designing mechanisms to change energy by transferring direction, speed, type of movement, and force or torque.
- Creating mechanisms that can be used individually, in pairs, or in systems.
- Constructing automated systems that require minimal human interaction.
- Differentiating between an open-loop and closed-loop system.
- Revising and troubleshooting using the design process.

Curriculum Plan

Unit#1: **What is Automation and Robotics?** **Time Range in Days:** **7**

Standard(s):
Science and Technology and Engineering Education
- 3.4.7.A1, 3.4.8.A1, 3.4.7.B1, 3.4.7.B3, 3.4.8.B4, 3.4.7.C1, 3.4.8.C1, 3.4.7.C2
- http://www.pdesas.org/Standard/View#

Anchor(s):
- S7.A.1, S8.A.1, S8.A.2, S8.B.3
- http://www.pdesas.org/Standard/View#

Overview: Robots have a positive and negative role in today's society.

Focus Question(s):
1. What is the greatest concern that should be considered before converting a factory from human workforce to robotic workforce?

Goals:
1. Students will investigate how automation and robotics have had an influence on society in the past and present and will influence society in the future.

Objectives:
1. Students will describe the purpose of automation and robotics and its effect on society. (DOK 2)
2. Students will summarize ways that robots are used in today's world and the impact of their use on society. (DOK 2)
3. Students will describe positive and negative effects of automation and robotics on humans in terms of safety and economics. (DOK 2)
4. Students will provide examples of STEM careers and the need for these professionals in our society. (DOK 1)

Core Activities and Corresponding Instructional Methods:
1. Sandwich algorithm and Vex model build.
    a. Lecture: Teacher will discuss project requirements
    b. Demonstration: Teacher will show proper Vex building techniques
2. Discuss the history of automation and robotics.
    a. Lecture and PowerPoint
3. Students will create a PowerPoint presentation on a type of robot and give a presentation to the class

a. Demonstration: Teacher will give a brief overview of presentation software

Assessments:

Diagnostic:

- Oral response to determine student comprehension

Formative:

- Daily teacher review of engineering notebook.
- Sandwich Algorithm and Vex Build Project
- Robot Presentation

Summative:

- Engineering Notebook

Extensions:

Correctives:

Individual instruction and demonstrations will be given to students having difficulty

Materials and Resources:

SmartBoard, whiteboard, engineering notebooks, worksheets, Vex robotic kits, Google slides/PowerPoint

Unit #2: **Mechanical Systems** **Time Range in Days:** **12**

Standard(s):
Science and Technology and Engineering Education
- 3.4.7.C1, 3.4.7.C2, 3.4.8.C1, 3.4.8.C2, 3.4.7.C3, 3.4.8.D1,
- http://www.pdesas.org/Standard/View#

Anchor(s):
- S7.A.1, S8.A.2
- http://www.pdesas.org/Standard/View#

Overview: Utilizing the Vex robotics kits to create different mechanisms.

Focus Question(s):
1. Which mechanism would be used to increase torque or force?
2. How do you change types of motion using mechanisms?
3. Where are mechanisms used in real-life applications and what is their purpose?

Goals:
1. Engineers and technologists design mechanisms to change energy by transferring direction, speed, type of movement, and force or torque.
2. Mechanisms can be used individually, in pairs, or in systems.

Objectives:
1. Calculate ratios to solve mechanical advantage problems. (DOK 1)
2. Calculate numerical and algebraic expressions and equations to solve real-life problems, such as gear ratios. (DOK 1)
3. Interpret the characteristics of a specific mechanism to evaluate its purpose and applications. (DOK 2)
4. Apply concepts knowledge of mechanisms to solve a unique problem for speed, torque, force, or type of motion. (DOK 4)

Core Activities and Corresponding Instructional Methods:
1. Discuss and present speed, torque, and gear ratios in different mechanisms
    a. Lecture and PowerPoint
    b. Demonstration: Teacher will show different models to reinforce speed, torque, and gear ratios
2. Mechanical Gears Project using Vex robotics kits
    a. Demonstration: Teacher will give a brief overview of proper building techniques using the Vex robotics kits
    b. Hands-on building activity

3. Vex Pull Toy using Vex robotics kits
    a. Lecture: Teacher will review Mechanical Gears Project and discuss how to implement into Pull Toy design
    b. Hand-on building activity

Assessments:

Diagnostic:

- Oral response to determine student comprehension

Formative:

- Daily teacher review of engineering notebook.
- Mechanical Gears Project
- Pull Toy Project

Summative:

- Engineering Notebook

Extensions:

Students that have mastered the mechanical gears project will be given additional, more challenging builds to complete.

Correctives:

Individual instruction and demonstrations will be given to students having difficulty

Materials and Resources:

SmartBoard, whiteboard, engineering notebooks, worksheets, Vex robotic kits

Unit #3: **Automated Systems** **Time Range in Days: 26**

Standard(s):
Science and Technology and Engineering Education

- 3.4.7.C1, 3.4.7.C2, 3.4.8.C1, 3.4.8.C2, 3.4.7.C3, 3.4.7.D1, 3.4.8.D1, 3.4.8.D2, 3.4.7.E4
- http://www.pdesas.org/Standard/View#

Anchor(s):

- S7.A.1, S8.A.2, S7.A.2
- http://www.pdesas.org/Standard/View#

Overview: Learning how to write computer code using the RobotC software. Use the Robotc software to program the automated systems projects.

Focus Question(s):

1. How do you troubleshoot a malfunctioning system efficiently?
2. What is the purpose of comments in a program?
3. Why is good communication and teamwork important when solving technological problems?

Goals:

1. An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback.
2. Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.
3. Invention is a process of turning ideas and imagination into devices and systems.
4. Some technological problems are best solved through experimentation.

Objectives:

1. Recall the seven technological resources and how they are integrated into an open and closed loop system. (DOK 1)
2. Explain the purpose of pseudocode and comments within a computer program. (DOK 3)
3. Assess how to use ratio reasoning to solve mechanical advantage problems. (DOK 3)
4. Design, build, wire, and program both open and closed loop systems. (DOK 4)
5. Apply concepts of motors and sensors appropriately to solve robotic problems. (DOK 4)
6. Analyze a malfunctioning system using the design process. (DOK 4)
7. Design, build, wire and program a system operated by alternative energy. (DOK 4)
8. Summarize the roles and responsibilities of mechanical, electrical, and computer engineers who solve robotic problems. (DOK 2)

Core Activities and Corresponding Instructional Methods:

1. Robotc terminology
    a. Lecture: Discuss Robotc coding terminology
2. Test Bed Project
    a. Demonstration/Hands-on: Teacher will guide students how to use the Robotc software
    b. Demonstration: Teacher will run the Test Bed project so students can see the finished product.
3. Spinning Sign Project
    a. Lecture: Teacher will review Mechanical Gears Project and discuss how to implement into Spinning Sign design. Teacher will discuss the role of the mechanical engineer, electrical engineer, and computer engineer.
    b. Hands-on building activity
4. Toll Booth Project
    a. Lecture: Teacher will review Mechanical Gears Project and discuss how to implement into Toll Booth design. Teacher will discuss the role of the mechanical engineer, electrical engineer, and computer engineer.
    b. Hand-on building activity
5. Tekrocks Bridge Project
    a. Lecture: Teacher will review Mechanical Gears Project and discuss how to implement into Tekrocks Bridge design. Teacher will discuss the role of the mechanical engineer, electrical engineer, and computer engineer.
    b. Hand-on building activity

Assessments:

Diagnostic:

- Oral response to determine student comprehension

Formative:

- Daily teacher review of engineering notebook.
- Test Bed Project
- Spinning Sign Project
- Toll Booth Project
- Tekrocks Bridge Project

Summative:

- Engineering Notebook

Extensions:
Students that have mastered the automated systems project will be given additional, more challenging builds to complete.

Correctives:
Individual instruction and demonstrations will be given to students having difficulty.

Materials and Resources:
SmartBoard, whiteboard, engineering notebooks, worksheets, Vex robotic kits, Robotc software

Primary Textbook(s) Used for this Course of Instruction

Name of Textbook: There are no textbooks used for this course.

Checklist to Complete and Submit:

(Scan and email)

_____ Copy of the curriculum using the template entitled "Planned Instruction," available on the district website.

_____ The primary textbook form(s).

_____ The appropriate payment form, in compliance with the maximum curriculum writing hours noted on the first page of this document.

Each principal and/or department chair has a schedule of "First and Second Reviewers." Each Reviewer must sign & date below.

First Reviewer Printed Name_____Tom Moran_____

First Reviewer Signature_____ Date_____

Second Reviewer Printed Name_____

Second Reviewer Signature _____ Date_____