SCHOOL DISTRICT OF THE CHATHAMS
CURRICULUM PROFILE

CONTENT AREA(S): Design & Technology **GRADE LEVEL(S):** 9-12

COURSE: Robotics & Controls **TIME FRAME:** Half Year (2.5 Credits)

I. Course Overview

In this course, students will explore the field of robotics and control systems through a variety of hands-on, experiential learning experiences. Students will work individually and in teams to design, build, program, and test digital controls and robotics systems, as well as microprocessors and electromechanical components, such as sensors, actuators, motors, and servos. Students will utilize the Engineering Design Process to design and build real-world robotic systems that solve problems present in our day-to-day lives.

II. Units of Study

Unit 1: Introduction to Electronics
Unit 2: Introduction to Programming Electronics
Unit 3: Using motors and servo motors to create movement
Unit 4: Robotic Design Challenge
Unit 5: Research and Prototype a Robotic Design Challenge

III. Essential Questions *(The open-ended, provocative questions that help frame inquiry)*

Unit 1: Introduction to Electronics
- Electricity & Ohms Law
- Circuit Boards
- Soldering
- Electronic Components

Unit 2: Introduction to Programming Electronics
- What are methods?
- What are comments?
- How do you initialize a program?
- What are the parts of a simple program and correct syntax?
- How does the Arduino software communicate with the boards?
- How can you make an LED blink or a speaker make a note?

Unit 3: Using Motors and Servos to Create Movement
- How can a motor be connected to the breadboard?
- How do you define a motor in Arduino?
- How can a shield be used with the Arduino board?

Unit 4: Robotic Design Challenges
- How can materials be joined together to allow movement?
- What are different types of power?

- How can hydraulic power be used in robotics?
- How can you create a robot using hydraulic power?

Unit 5: Research and Prototype a Robotic Design Challenge
- What problems can robots solve?
- How can robotics and controls be used in the real world?
- Can you determine, design and prototype a solution?

IV. Learning Objectives

8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
8.2.12.C.6	Research an existing product, reverse engineer and redesign it to improve form and function.
8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
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.
8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
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).
CRP12.	Work productively in teams while using cultural global competence
9.3.ST.3	Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-ET.4	Apply the elements of the design process.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
9.3.12.AC-DES.1	Justify design solutions through the use of research documentation and analysis of data.
9.3.12.AC-DES.7	Employ appropriate representational media to communicate concepts and project design.

9.3.12.AC-DES.8	Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.

V. Instructional Materials

- Textbook – None
- Teacher prepared handouts
- Use of videos, DVD's, Lego computer software, online resources, posters, and other audio-visual materials as appropriate
- Arduino Starter kits
- Breadboards, electronic components, soldering irons, and building materials such as foam core.
- Google Drive
- Schoology

VI. Key Performance and Benchmark Tasks

- Apply workshop rules and safety regulations inside a materials processing lab.
- Applying measurement and geometry to calculate robot navigation
- Identify, utilize, and maintain appropriate materials in the design of a robotic system.
- Identify use and application of robotics with manufacturing systems.
- Build, test and evaluate electronics and programming.
- Test, verify, and maintain robotic inventions.
- Measure torque with various gear ratios.
- Students are challenged to develop solutions through a systematic process that identifies the problem and refines ideas for solutions within the stated requirements
- Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate technology tools.
- Students use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others.

Student Outcomes and Methods of Assessment:

- Attendance as per school policy
- Tests
- Design Projects
    - Design & Rationale
    - Performance
    - Rubrics
- Digital Portfolio