



**G-E-T High School Curriculum**  
**Align, Explore, Empower**  
Scope and Sequence  
Robotics with Electronics

Unit 1 - (Electricity Basics and Terminology)

(Length of Unit - 1 week)

Students will start the class with learning the basics of electricity and many common terms. Students need to familiarize themselves with common vocabulary like - volts, current, resistance, load, consumer, conductor, insulator, magnetism, law of charges, ohm's law, circuitry, schematics, electrical symbols, etc. In addition, understand what electricity is, the various measurements of electricity and we can use it. Students will have multiple note taking guides, work in small groups on several formative assessments and have hands-on lab activities to reinforce the content.

In this unit, students will ...

**Understand and explain the basics of electricity.**

Students will be able to identify all the major terms and concepts tied to electricity: Atom, electrons, protons, neutrons, voltage, amperage, current, resistance, ohms, Ohm's Law, Law of Charges, magnetism, conductors, insulators, and more.

Students will be able to apply electrical schematic drawings to communicate and design potential circuits.

Standards for (Robotics with Electronics)

**EL1.a:** Apply electronic and electrical theory to practice.

**EL1.a.18.h:** Explain the difference between conventional current theory and electron current theory.

**EL7.a.6.h:** Demonstrate the safe usage of appropriate tools, procedures and operation of equipment.

Unit 2 - (Robots and Programming)

(Length of Unit - 1 week/ongoing)

Students will partner up and receive a robot and computer for programming. Students need to get some basic training on the robot. How to power up, down, where to hook up the servos and how to wire various circuits on the breadboard. Students will check their robot over and begin using it for learning different information like decoding resistors, measuring voltage, wiring things in series and parallel, hooking up small electronic components like LED's, capacitors, infrareds, photocells, etc. Furthermore, students will get training and assigned activities to build on their programming skills. Students will need to learn how to maneuver their bots - continuously, certain distances, certain speeds, turning left, right, going in reverse, having speakers make

noise, lights turn on etc.

In this unit, students will ...

**Create programs for robots to maneuver and complete various obstacles.**

Students will illustrate common commands using Basic Stamp 2 software: DO, LOOP, PAUSE, NEXT, END, HI, LOW, FOR, COUNTER, DEBUG, PULSOUT, GOSUB, ELSEIF, VAR BYTE, etc.

Students will implement the use of IR (infrared detection) photocells, whiskers continuity, piezo speakers, capacitors, transistors, and more within the robot programming.

Students will wire and program the various circuits provided in the Robotics Boe-Bot book.

### Standards for (Robotics with Electronics)

**EL2.a.9.h:** Recognize the following electronic components by constructing simple circuits: capacitors, resistors, diodes, transistors, insulators, conductors, fuses, switches, batteries, etc.

**EL3.a.5.h:** Identify and describe the operation of common electronic components.

**EL4.a.12.h:** Design a combinational logic circuit using programmable logic device.

**EL6.a.3.h:** Program and test an autonomous robot.

**EL6.a.5.h:** Program a microcontroller to maneuver a robot.

### Unit 3 - (Digital Multimeters)

(Length of Unit - 1 week/ongoing)

Students will be required to use a multimeter throughout the course. They will apply the use of a multimeter weekly and sometimes daily. They will use the meter for checking their bots, circuits they have wired, electronic components that have failed, batteries, coils, outlets, and anything that needs diagnostics. Students need to understand the value of using a multimeter in robotics, electronics, and electricity occupations. Students will work in groups and independently throughout the course on multiple assessments and activities to enhance their skill-set.

In this unit, students will ...

**Identify and properly apply digital multimeters.**

Students will evaluate measured voltage, amperage and resistance.

Students will distinguish the differences with various values on multimeters: m, k, M, Hz, AC or ~, DC or --, and more.

### Standards for (Robotics with Electronics)

**EL2.a.10.h:** Demonstrate multimeter and usage.

**EL2.b.10.h:** Explain multimeter construction, components and usage and distinguish between digital and analog meters.

**ENG5.a.6.h:** Diagnose a system that is malfunctioning and use tools, materials or machines to repair it.

**BB1.d.6.h:** Perform a voltage drop test and describe the relationship between voltage, current and resistance with a multimeter.

**BB1.d.7.h:** Inspect and test components such as switches, connectors, relays, solid state devices and conductors and take appropriate action.

#### Unit 4 - (Ohm's Law and Circuit Calculations)

(Length of Unit - 2 weeks)

Students will need to make connections of Ohm's Law and wiring things in series, parallel and complex in order to better understand the measurements of electricity. You need to have 1 volt of pressure to push 1 amp of electrons through 1 ohm of resistance. Ohm's Law states and allows for you to solve for the missing measurement of electricity (volts, current and resistance). Students will practice using ohm's law on multiple activities and assignments. Some assessments are group based and others are individual.

In this unit, students will ...

Calculate E,I,R (Volts, Amps/Current, Ohms).

Students will be able to explain that 1 volt is required to push 1 amp through 1ohm of resistance and that if you identify 2 of the 3 measurements of electricity; you can solve for the 3<sup>rd</sup>.

Students will know how to identify and use the following Ohm's Law formulas:  $V = A * R$      $A = V / R$      $R = V / A$

Students will recognize that E = voltage, I = amperage, and R = Ohms

#### Standards for (Robotics with Electronics)

**EL1.a.13.h:** Calculate current, voltage or resistance using Ohm's Law and Kirchhoff's Voltage Law.

**EL2.b.6.h:** Calculate unknown current, voltage or resistance in series circuits, using Ohm's Law.

**EL2.b.8.h:** Calculate unknown current, voltage or resistance in parallel circuits, using Ohm's Law.

#### Unit 5 - (Wiring Circuits)

(Length of Unit - 1 week)

Students will get plenty of hands-on experience wiring circuits. Students will need to identify the differences between each circuit and read schematics in order to build their beginning level circuits. Students will practice drawing circuits, wiring circuits and testing/measuring the differences between circuits throughout the course. Students will work in small groups wiring their circuit boards and robot circuits. However, the students will work by themselves wiring the "33 in1" breadboard circuits and soldering circuits.

In this unit, students will ...

Identify and illustrate wiring of four types of circuits.

Students will be able to demonstrate and assemble 4 types of circuits: series, parallel, combination, and single wire.

Students will wire many circuits tied to breadboards and printed boards - both types require an understanding of schematic reading.

#### Standards for (Robotics with Electronics)

**EL4.a.8.h:** Simulate and prototype a logic circuit.

**ENG5.a.6.h:** Diagnose a system that is malfunctioning and use tools, materials or machines to repair it.

#### Unit 6 - (Soldering and Board Type)

(Length of Unit - 1 week)

Students will get trained on soldering small electronic components and build several permanent circuits to test their level of soldering and schematic reading. Students will use different soldering pencils and techniques to illustrate the challenges and differences and to help the students determine what they like. Students will get multiple opportunities to recognize the difference between breadboards and printed boards. Students will be required to solder on their own, but can get help from a partner to hold electronic components in place and wire many breadboard circuits.

In this unit, students will ...

**Compare printed boards and breadboards.**

Students will be able to explain the difference between permanent circuitry and removable circuitry, identify soldered joints and clipped joints and critique shorts and loose connections.

Students will be able to list the advantages and disadvantages of board type and recognize the difference between anode and cathode.

#### Standards for (Robotics with Electronics)

**EL2.a.13.h:** Describe and demonstrate the difference between good and bad mechanical and electrical solder connections.

**EL3.a.6.h:** Perform basic soldering techniques and printed circuit board construction.

**ENG5.a.6.h:** Diagnose a system that is malfunctioning and use tools, materials or machines to repair it.

**BB1.d.7.h:** Inspect and test components such as switches, connectors, relays, solid state devices and conductors and take appropriate action.

Unit 7 - (Residential Wiring)

(Length of Unit - 1 week)

Students will get exposed to common residential wiring options. Students will get hands-on experience wiring a doorbell, outlets, switches, lights, fan, etc. Students will have residential wiring schematics to follow along with on their activities. Students will be required to use boxes, proper wire gauge, secured wire nuts, etc. when wiring their circuits. Students will work independently on their residential wiring activities.

In this unit, students will ...

**Create residential wiring circuits and implement proper wire gauge.**

Students will distinguish proper wire selection 12-2, 12-3, 14-2 or 14-3 and create various circuits with single pole, 3-way, 4-way switches, receptacles, boxes, fans and more.

Students will convert wattage into amperage, identify wire gauge to amperage, recognize breaker functions and loading circuits.

Standards for (Robotics with Electronics)

**EL7.a.6.h:** Demonstrate the safe usage of appropriate tools, procedures and operation of equipment.

**EL7.a.7.h:** Describe personal safety precautions for working with electric and electronic devices electrical shock.

**AC1.f.5.h:** Demonstrate the safe use of electrical connection methods and electrical wiring procedures.