

Electricity & Electronics

Scope and Sequence

Re-Created 4/2024 R.Weber

Full Content can be accessed at <http://www.TechEd.rocks>

<i>Course Outline & Expectations</i> <ul style="list-style-type: none">• <i>Classroom Expectations</i>• <i>Regular Bell Schedule</i> • <i>Course Objectives & Requirements</i>• <i>Proposed Scope and Sequence</i>	2 Days
<i>Introduction</i> <ul style="list-style-type: none">• <u>What is Electricity?</u>• <u>Basic Terminology</u>	1 Week
<i>Electrical Energy Fundamentals</i> <ul style="list-style-type: none">• Static Electricity • What is Static Electricity?• The Science of Static Electricity• Bill Nye - Static Electricity Science Demonstration• A static electricity generator - the Van-De-Graaff Generator<ul style="list-style-type: none">○ Why does his hair go crazy when he touches the Van-De-Graaff Generator?• Static Electricity - Review Sheet • Electrical Circuits<ul style="list-style-type: none">○ Basic Electrical Circuit Information Sheet○ Basic Electricity Review Sheet	3 Weeks

<ul style="list-style-type: none"> ○ Basic Electrical Circuit ○ Series & Parallel Circuits <ul style="list-style-type: none"> ▪ Information Sheet ▪ Series & Parallel Circuits ▪ Review Sheet • Ohm's Law <ul style="list-style-type: none"> ○ Ohm's law Explained ○ Information Sheet <ul style="list-style-type: none"> ▪ Ohm's Law Triangle (graphic) ○ Ohm's Law Worksheet <ul style="list-style-type: none"> ▪ Working Ohm's Law Problems ○ Review Sheet • Types of Electrical Currents <ul style="list-style-type: none"> ▪ Information Sheet ▪ What is AC and DC? ▪ Review Sheet ▪ AC vs DC Power? • Energy - Power, Force, Work <ul style="list-style-type: none"> ▪ Volts, Amps, and Watts Explained ▪ Power, Force, Work & Wattage ▪ Power, Force, Work & Wattage Review Sheet <ul style="list-style-type: none"> ▪ Watts & Ohm's Law Wheel ▪ Applying the Power Wheel - Worksheet 	
<p><i>Circuit Components</i></p> <ul style="list-style-type: none"> • Resistors <ul style="list-style-type: none"> ○ <u>What Is a Resistor?</u> ○ <u>Resistor Information Sheet</u> <ul style="list-style-type: none"> ▪ <u>Resistor Information Study Guide</u> ○ <u>How to read a Resistor</u> ○ <u>Color Code Calculator</u> 	<p>6 Weeks</p>

- [Color code chart](#)
- **Capacitors**
 - [What is a Capacitor?](#)
 - [Capacitor Information Sheet](#)
 - [Capacitor Information Study Guide](#)
- **Inductors**
 - [What is an Inductor?](#)
 - [Inductor Information Sheet](#)
 - [Inductor Information Study Guide](#)
 - [Electromagnets- How they work](#)
 - [Electromagnet Information Sheet](#)
 - [Electromagnet Study Guide](#)
 - [Rockin' Paper Plate Speaker](#)
- **Diodes**
 - [How does a Diode work?](#)
 - [LED Circuit Design - How to design LED circuits](#)
 - [Diode Information Sheet](#)
- **Transistors**
 - [How does a Transistor Work?](#)
 - [Transistor Information Sheet](#)
 - **PNP - NPN Transistors**
 - **Impact of Transistors on the Development of Microprocessors**
 - [First digital computer ENIAC](#)
 - **Microprocessors**
 - [How Microchips made?](#)
 - [Layers of a Micro Chip](#)
 - [Building a microchip with regular transistors](#)
 - [How a CPU is made](#)

Lab Activities

- How to Use a Breadboard
- #1 Schematic Symbols
 - How to Read a Schematic
- #2 Basic Electronic Circuit
- #3 Parallel Circuits
- #4 Diode Action
 - What is a diode?
- #5 Light Emitting Diodes
 - How LED's Work
- #6 Electromagnetism
- #7 Capacitance
- #8 Transistor Switch
- #9 Variable Resistor
- #10 DC Motor
- #11 Transistor Oscillator
- #12 7 Segment Display Circuit
- #13 SCR Latching Switch
- #14 Conductor Identifier
- #15 2 Transistor Audio Oscillator
- #16 Continuity Tester
- #17 Multi vibrator LED Blinker
- #18 Insanity Alarm
- #19 Light Controlled Bird
- #20 Code Practice Oscillator

Integrated into
Content

ARDUINO

- **Arduino Tutorials**
 - Introduction to Arduino
 - [Arduino Board \(Graphic\)](#)
 - Hardware Overview: Arduino Course for Absolute Beginners

1 Week

<ul style="list-style-type: none"> ○ Download and install the Arduino IDE ○ Arduino IDE and Sketch Overview ○ Understanding Arduino Syntax ○ Understanding Variables ● Arduino Programming References <ul style="list-style-type: none"> ○ Arduino Notebook ○ Arduino Programming - Language Reference ○ Arduino Programming Language (Sanford University) 	
<h2 style="color: red; text-align: center;">Arduino Programming Activities</h2> <ul style="list-style-type: none"> ● Basic LED Programming <ul style="list-style-type: none"> ○ Basic Structure of an Arduino Sketch ○ Lesson 1 - Blink ○ Lesson 2 - LED's <ul style="list-style-type: none"> ▪ LED Board- Functions and Program Flow <ul style="list-style-type: none"> ▪ Arduino Language Resource ▪ LED Board Function Sketch <ul style="list-style-type: none"> ▪ Function Sketch Listing ▪ LED Board - Function and Counter Sketch ▪ LED Board- Functions and IF ELSE decision structure <ul style="list-style-type: none"> ▪ Adding a Buzzer to your LED Board ▪ Breakout of If Else section of Sketch ● 7 Segment Display <ul style="list-style-type: none"> ○ 7 Segment Display Breadboard Schematic ○ 7 Segment Display connection to the Arduino ○ 7 Segment Display Programming Considerations ○ 7 Segment Display Test Program- <ul style="list-style-type: none"> ▪ Test program running on Arduino and 7 Segment Display- 	<p>8 Weeks</p>

- [7 Segment Display Program Template](#) -
 - [Defining a program Function](#)
 - [Counting program running on Arduino and 7 Segment Display](#)

- **Arduino Music**
 - [The Tone\(\) Command](#)
 - [Connection to a Speaker](#)
 - **Simple Music Composition**
 - [Music template \(sketch\)](#)
 - **Sheet Music**
 - [Twinkel-Twinkl Sheet Music](#)
 - [When the Saints go Marching in](#)
 - [Mary had a Little Lamb](#)
 - [Mary had a Little Lamp PLUS LED'S Template](#)
 - [Simple Note - Frequency Conversion Chart](#)
 - [Advanced Note - Frequency Conversion Chart](#)
 - [Note Length Chart](#)
 - **Example Music Sketches**
 - [Mario Bros](#)
 - [Star Wars](#)
 - **SOS Sound**
 - [Schematic](#)
 - [SOS Sound Code](#)

- **Ultrasonic Sensor**
 - [How does it work?](#)
 - [Ultrasonic Distance Sensor Audio Alert](#)
 - [Ultrasonic Repeater Breadboard \(Image\)](#)
 - [Ultrasonic Repeater Sketch \(code\)](#)
 -
 - **Arduino Roadster Ultrasonic Module**
 - [Roadster Ultrasonic Module \(Image\)](#)
 - [Roadster Ultrasonic Module Sketch](#) -

- **Arduino Motor Control**

- **H Bridge Integration**
 - [What is an H Bridge ?](#)
 - [H-Bridge-Arduino port connections](#)
 - [Connecting the H Bridge to motors and Arduino](#)
 - [Motor Test Code](#) -
 - [Listing of Motor Test Code](#)
 - [Motor and Ultrasonic combination code](#) -
- [The Arduino Roadster](#)
 - [3-D Parts for Roadster](#)
 - **Lego Construction**
 - [Third Wheel Assembly](#)
 - [Third Wheel Assembly](#)
 - [Frame Assembly](#)
 - [Frame Assembly](#)
 - **Component Installation**
 - [Component Installation](#)
 - **Wiring Roadster Components**
 - [Wiring Roadster Components](#)
 - **Software to operate Roadster**
 -
- **Arduino Roadster: Code to Operate the roadster**
 - [Roadster Sketch: Motor and Ultrasonic combination code](#) -
 - **Analyzing the Roadster Code**
 - [Basic Structure of an Arduino Sketch](#)
 - [Structure of the Arduino Roadster Sketch](#)

- [Analysis of the Arduino Roadster Sketch LOOP Actions](#)

- **Arduino Roadster Coding Challenges**

- [Roadster Challenge Template Sketch](#) 

- [Roadster Coding Challenge #1](#) - 90 Degree turn
- [Roadster Coding Challenge #2](#) - Irregular Shape
- [Roadster Coding Challenge #3](#) - Square
- [Roadster Coding Challenge #4](#) - Irregular Shape
- [Roadster Coding Challenge #5](#) - Circle
- [Roadster Coding Challenge #6](#) - Circle- Speed Control