## **Introduction to Electronic Technology**

Brockton High School course #: 7718

DESE CIP#: 150303

Instructor: Dr. Nosiglia Ph.D.

# Email: [brunonosiglia@bpsma.org](mailto:brunonosiglia@bpsma.org)

**Teacher Web page: nosiglia.weebly.com**

508-580-7666

### Course description:

If you are curious about what “electronics” is and how “electronics” works - come join us for an intellectual adventure that will show any student what electronics is all about.

Maybe you are curious as to how your smartphone or tablet connects to Wi-Fi, or why everything is going electronic – or, want a basic understanding of electricity in your home - or, a better understanding of how to use electronic devices and tools like multi-meters, oscilloscopes and soldering irons, radio controls, while learning how to perform basic troubleshooting and repair on electronic gadgets.

Whether you are a novice or a “pro”, preparing for electrical engineering or learning how to solder electronic circuit boards, all level of students are welcome. Come join us and be part of what the future looks like, while improving your math skills.

Prerequisite:

Successful completion of linear algebra (algebra 1), with a score of 90% or better, and familiarity with imaginary numbers and exponential math.

Course Objectives:

1. Safety
   1. Classroom safety, following OSHA 10
2. Tools & instruments
   1. Multimeter, Soldering iron, power supply, oscilloscope, function generator
3. DC Resistive circuits
   1. Series circuit analysis
      1. Combining resistors
      2. Voltage divider, Ohm’s Law, KVL
   2. Parallel circuit analysis
      1. Voltage divider, Ohm’s Law, KVL, KCL
   3. Series parallel circuit analysis
      1. Voltage divider, Ohm’s Law, KVL, KCL, mesh equations
4. Sinusoidal wave analysis
   1. Oscilloscope operation
      1. Graticule
      2. Settings
      3. operation
   2. Properties of sinusoidal waves
      1. Amplitude (peal & peak to peak)
      2. Calculation & measurement of period and frequency
5. Capacitors
   1. How they look
      1. How to read values
   2. Reacts differently to AC than DC
      1. Current leads the voltage in the capacitor
      2. Current in phase with input current in series circuit
      3. Voltage in phase with input voltage in parallel circuit
6. Inductors
   1. What they look like
      1. How to read values
   2. Reactance in an AC circuit
      1. Current lags the voltage in the inductor
      2. Current in phase with input current in series circuit
      3. Voltage in phase with input voltage in parallel circuit
7. AC RC circuits
   1. Combining reactive components
   2. Calculating reactance of reactive components
      1. Analysis of reactance
   3. Calculating phase angle
      1. Imaginary numbers
         1. Cartesian coordinate representation
         2. Polar coordinate representation
         3. Multiplying and dividing complex numbers
         4. Conversion from Cartesian to polar representation of complex numbers
      2. Calculating Theta using trigonometry
      3. Vector representation on complex plane
         1. Resultant vector calculation
   4. Voltage, Resistance and Current phase calculations on complex planes
      1. Current leads in capacitive circuits
      2. Voltage lags in capacitive circuits
      3. Current lags in inductive circuits
      4. Voltage leads in inductive circuits
8. RLC circuit analysis
   1. Calculating impedance
   2. Complete analysis
   3. Impedance matching
9. Pass filters
   1. Low, band, notch and high pass filters

Your Instructor:

Contact your instructor: [Brunonosiglia@bpsma.org](mailto:Brunonosiglia@bpsma.org)

508-580-7666

After earning his undergraduate degree in Electrical Engineering from Northeastern University in Boston, Dr. Nosiglia worked as an electrical engineer in many high technology companies: Damon Medical Labs, CODEX, Raytheon, GTE, Sperry, RMS, ASEC, Helix, Softline Systems, PTI, Bose, and Lincoln Labs.

Dr. Nosiglia switched professions and started a few companies: Applied Communications Technology; Banneker Systems, Protocol Technologies. After successfully selling these companies, Dr. Nosiglia changed careers again, and became a teacher.

Teaching Engineering classes at Holliston High School and earning his Graduate degree, a Masters in Technology Engineering from Fitchburg State. And, while teaching at Horace Mann Middle school pursued his PhD in Engineering.

After teaching at Blackstone Millville high school, Blackstone Valley Tech and Nashoba Tech, where he earned his certification in Vocational Electronics, while at the same time completing a PhD in Technology Engineering.

Currently Dr. Nosiglia is teaching non-vocational electronics at Brockton High School and working toward completing his Master’s degree in Vocational Education.

### Instructional Philosophy

It is indispensable that a student learn to work in groups. Electronics is a group effort at solving customer requirements while meeting deadlines, so developing the skills needed to work with others is a primary goal of this course.

Students will practice meeting project deadlines while identifying and take advantage of specific skills brought forth by their other team members. Once students develop their own learning styles, and begin meeting deadlines, they will practice working in groups in order to develop team building skills.

Knowing the big picture and where concepts are applied, allows students to understand and develop real world problems and makes our learning more applicable to the skills and experience industry requires. This course will be validating all designs against real problem solving and not experimentation.

### Course Requirements

* Meeting prerequisites, above
* A calculator with trig/engineering notation/ roots
* Access to the Internet in class and at home
* Ability to follow OSHA 10 safety standards

### Course Schedule

* Class meets every day for half the school year
* Teacher after school one-on-one help from the teacher is available on Mondays and Wednesdays from 2:00 to 3:50
* Access to the Internet in class and at home
* Ability to follow OSHA 10 safety standards

### Homework

* Assignments will include work designed to prepare students for their class activities. Homework handed in 1 school day late gets a 70% max grade, no credit 2 days or later.
* Homework must have your last name, grade, and date to get credit
* Summaries are due once a week on Fridays (Thursdays if there is no class on Friday)

Projects

* Will be directly related to the subject being taught and include working in groups so students may learn how to work with others and come up with a best solution to a given problem. Projects: work as teams, solve given problems, solutions do not have to work as long as steps were followed.

Project grading will have two parts: individual grade and team grade. Individual grades are assessed by the instructor’s observation of how an individual contributes and participates in the project, and a team grade is assessed on the completion of paperwork and results of all lab work.

Safety &, Class Participation

Safety grades are assessed for each student being assigned a 100% and then losing any points based on safety violations, identified by either the instructor or the safety monitor. Credit may be earned by successful completion of all safety monitor responsibilities.

Class participation grades are based on a student’s ability to meet responsibilities, maintain focus and participation in the classroom. A respect for classroom rules and fellow students affect these grades. Each day students will be expected to have a pencil; calculator; notebook, and previous class notes.

### Grading

Homework 10%

Projects and Presentation 40%

# Exams 30%

# Safety 10%

# Class participation 10%

### Extra Help/ Extra Credit

Extra help and extra credit work is available to any student who requests such from the instructor. Any extra credit work must receive prior written approval from the instructor.

Class rules

* Read the safety requirements posted on teacher web page
* On a daily basis, check homework assignments on teacher web page
* When entering the classroom, leave binders on the shelves at the door
* Need a pencil, straight edge & a calculator (it’s nice to have w/ trig functions).
* Please don’t talk to other students while teacher or students are addressing the class
* No food or drink in the classroom (If it is visible it will be confiscated)
* It is faster to use signals when you need to use the lav or get a drink
* Always follow the safety rules posted on teacher web page
* Never walk in front of the teacher or students when they are addressing the class
* Cover your mouth when you yawn, sneeze or cough
* Don’t put your feet on the furniture

Career readiness/Electronics field:

Opportunity to be take on-line second party exams for certified in the following vocations:

* Computer service technician
* Electronic laboratory technician
* Installation technician
* Electronics repair technician
* Electronic technician in communications, instrumentation, digital, and computer electronics companies

A solid understanding of:

* Basic AC & DC electrical circuit wiring
* Complex mathematics
* Trigonometry
* Cartesian & polar coordinate system

A head start in the following college majors:

* Electrical Engineering, requires an undergraduate degree, average starting salary $80k\*
* Computer science, requires an undergraduate degree, average starting salary $110k
* Computer engineering, requires an undergraduate degree, average starting salary $90k

Classroom resources provided:

breadboards; wireless lap tops; access to basic fabrication tools; DMM; oscilloscope; function generator; variable power soldering irons; basic electronic and electrical components; collaboration with other departments within the school; and, access to local companies, universities and industry professionals.

**Online resources** used in the “blended classroom”:

Career paths information: <http://www.bls.gov/ooh/>

ETA certification: <http://www.eta-i.org/>

[http://www.onetonline.org/link/summary/25-1194.00](https://owa.bpsma.org/owa/redir.aspx?C=DyyAlT_mrk6-F634nIE8Q6j1S30FQdMIbBG82DRqBjijcVY2d47_75-OqxKvIcpWial5A2T8L_c.&URL=http%3a%2f%2fwww.onetonline.org%2flink%2fsummary%2f25-1194.00) National source for occupational information - SOC 17-3023

Paper on teaching electronics in high school: [http://www.ijetae.com/files/Volume2Issue9/IJETAE\_0912\_01.pdf](https://owa.bpsma.org/owa/redir.aspx?C=DyyAlT_mrk6-F634nIE8Q6j1S30FQdMIbBG82DRqBjijcVY2d47_75-OqxKvIcpWial5A2T8L_c.&URL=http%3a%2f%2fwww.ijetae.com%2ffiles%2fVolume2Issue9%2fIJETAE_0912_01.pdf)

Using Arduinos in Electronics class: [http://falconphysics.blogspot.com/2009/01/arduino-in-high-school-electronics.html](https://owa.bpsma.org/owa/redir.aspx?C=DyyAlT_mrk6-F634nIE8Q6j1S30FQdMIbBG82DRqBjijcVY2d47_75-OqxKvIcpWial5A2T8L_c.&URL=http%3a%2f%2ffalconphysics.blogspot.com%2f2009%2f01%2farduino-in-high-school-electronics.html)

College electronics course: [http://www.ni.com/white-paper/52056/en/](https://owa.bpsma.org/owa/redir.aspx?C=DyyAlT_mrk6-F634nIE8Q6j1S30FQdMIbBG82DRqBjijcVY2d47_75-OqxKvIcpWial5A2T8L_c.&URL=http%3a%2f%2fwww.ni.com%2fwhite-paper%2f52056%2fen%2f)

Circuit simulator: [http://www.falstad.com/circuit/](https://owa.bpsma.org/owa/redir.aspx?C=zdIgg_JPukuho_W7_VCCWuRxj1cXMtMIVXmfLVn1-1_vUKP1zp8XJC2XfsuHwBN444xP9hQ7hAg.&URL=http%3a%2f%2fwww.falstad.com%2fcircuit%2f)

How capacitors work, video: <https://www.youtube.com/watch?v=IvFVu7Jxa2I>

<https://www.youtube.com/watch?v=NInt1Ss3vQ4>

<https://www.youtube.com/watch?v=BcIDRet787k>

How does electricity work, video: <https://www.youtube.com/watch?v=ZInLPe_bezQ>

Connections, James Burke, video: <https://www.youtube.com/watch?v=nZJ9VdX4ewM>

Ancient technology, video: <https://www.youtube.com/watch?v=3NaXj_TbSoM>

Did ancient Egypt have electricity, video: <https://www.youtube.com/watch?v=ygjCaehjIlo>

Misconceptions in electronics: <http://amasci.com/miscon/elect.html>

How cooling a metal makes it a better conductor: <http://teachers.web.cern.ch/teachers/archiv/HST2001/accelerators/superconductivity/superconductivity.htm>

College level electronics: <http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/>

\*<http://www.bls.gov/ooh/>