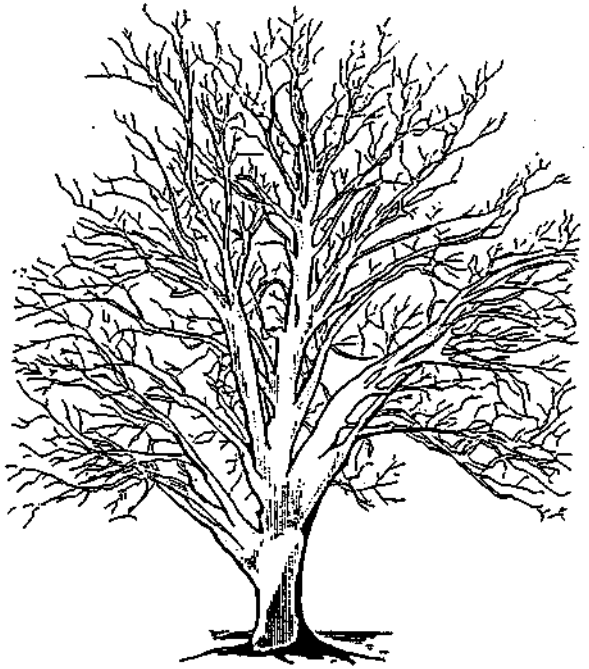
Monroe Township Schools



Curriculum Management System

Electronics & Robotics Technology

Grade 10-12

2007

*** For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy # 2220.**

Board Approved: August 2008

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MONROE TOWNSHIP SCHOOL DISTRICT

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Acknowledgments

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Monroe Township Schools

Mission and Goals

Mission

The mission of the Monroe Township School District, a unique multi-generational community, is to collaboratively develop and facilitate programs that pursue educational excellence and foster character, responsibility, and life-long learning in a safe, stimulating, and challenging environment to empower all individuals to become productive citizens of a dynamic, global society.

Goals

To have an environment that is conducive to learning for all individuals.

To have learning opportunities that are challenging and comprehensive in order to stimulate the intellectual, physical, social and emotional development of the learner.

To procure and manage a variety of resources to meet the needs of all learners.

To have inviting up-to-date, multifunctional facilities that both accommodate the community and are utilized to maximum potential.

To have a system of communication that will effectively connect all facets of the community with the Monroe Township School District.

To have a staff that is highly qualified, motivated, and stable and that is held accountable to deliver a safe, outstanding, and superior education to all individuals.

INTRODUCTION, PHILOSOPHY OF EDUCATION, AND EDUCATIONAL GOALS

Philosophy

The philosophy of the Industrial Technology program is to provide students with the necessary experiences needed to develop basic life skills for their present and future roles. In its attempt to develop the individual, interpersonal skills, management skills and communication skills are addressed. Industrial Technology is a systematic approach to developing the individual as a whole. This program emphasizes preparation for employment in occupations related to Industrial Technology. Skills transferable to the workplace and development of positive attitudes toward work are stressed, as well as enriching the family experience, which contributes greatly to the health of our society.

Educational Goals

The students will be able to:

To transfer Arts and Careers skills to the work setting, as well as the home and community.
To foster the growth of self-esteem and responsible citizenship, which enables the student to contribute to the community.
To emphasize the value of working toward good health and safety practices.
To develop tolerance for, acceptance of and respect for other people and cultures.
To manage resources by analyzing and weighing alternatives.
To cultivate and promote student growth in self-expression and creativity.
To develop a knowledge of economic contributions of the family to society.

New Jersey State Department of Education
Core Curriculum Content Standards

A note about Arts & Careers Standards and Cumulative Progress Indicators.

The New Jersey Core Curriculum Content Standards were revised in 2002. The Cumulative Progress Indicators (CPI's) referenced in this curriculum guide refer to these new standards and may be found in the Curriculum folder on the district servers. A complete copy of the new Core Curriculum Content Standards for Mathematics may also be found at:
http://www.nu.gov/njded/ccs/s9_career.htm

Electronics & Robotics Technology I

Scope and Sequence

Quarter I

I. Introduction to Electricity & Electronics
   a) Careers
   b) Safety
   c) Atoms, Electrons and Electric Charges
   d) Cells
   e) Generators
   f) Circuit Diagrams & Symbols

II. Electric Circuits & Devices
   a) Measuring Electrical Quantities (basic)
   b) Circuits, Voltage & Current
   c) Conductance & Resistance
   d) Ohm's Law & Power Formulas

Quarter II

III. Electric Circuits & Devices Continued
   a) Series Circuits
   b) Parallel Circuits
   c) Series-Parallel Circuits
   d) Capacitors

IV. Electric Circuits & Devices Continued
   a) Magnetism
   b) Electric Induction & Inductance

Quarter III

V. Semiconductors & Integrated Circuits
   a) Semiconductors & Diodes
   b) Integrated Circuits & Special Devices

VI. Semiconductors & Integrated Circuits
   a) Digital Electronic Circuits
   b) Fundamentals of Computers

Quarter IV

VII. Electricity & Electronics at Work
   a) Computerized Controls & Robotics Technology
   b) Communications Systems
   c) Lasers & Fiber Optics

VIII. Testing & Troubleshooting
   a) Measuring Electrical Quantities (advanced)
   b) Troubleshooting & Repair (advanced)

Suggested days of Instruction	Curriculum Management System **Grade Level/Subject:** **Grade 10-12/Electronics & Robotics I**	**Topic: Introduction to Electricity & Electronics** **Goal 1: The student will be able to discuss the benefits of electricity and electronics career paths and understand important safety considerations in the field.**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
6	Describe a variety of careers available and education and training requirements for careers in the field of electricity and electronics. (CPI 9.1, 9.2, 8.2) Explain the dangers of Electrical Shock. (CPI 9.1, 9.2, 8.2) List seven general safety rules and practices. (CPI 9.1, 9.2, 8.2) Explain the differences between open and short circuits. (CPI 9.1, 9.2, 8.2) Identify the follow fuses: plug, tamperproof, dual element and cartridge. (CPI 9.1, 9.2, 8.2) Compare the operation of circuit breakers and ground fault current interrupters. (CPI 9.1, 9.2, 8.2)	• Does the field of electricity and electronics offer few or many career opportunities? • When is the best time to begin researching what career you may wish to pursue? • What are the best sources of information regarding careers in the electricity and electronics field? • Hazards represent what type of risks? • What are two primary electrical hazards? • What factors affect the amount of physical damage to humans caused by electrical current? • What federal legislation promotes workplace safety? • What document was produced by the National Fire Protection Association to recommend safe electrical practices? • Safe wiring practices include what two basic considerations?	• Text: Burban, Peter, Electricity and Electronics Technology, Chap 1 Careers • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 2 Safety • Lecture notes • OH Masters • Samples: fuses, breakers, GFCI, polarized/non-polarized plugs, examples of faulty insulation & grounding • In School Field Trip to parking lot: Examine the power supply system to the facility to discuss grounding and over-current protection • Lacey, Electronics Safety Handout • GPU Energy, Electrical Safety Pamphlet • Review Main Ideas Homework Chap 1 • Review Main Ideas Homework Chap 2 • Workbook Activities 1 thru 5 • Workbook Experiment 4-5 • Test: Chapter 1 • Test: Chapter 2 • **Communications Skills Activity** – Students select 5 occupations in electricity and electronics, use resources from guidance, media center and Internet to identify employment requirements and create and present a PowerPoint presentation of findings ***(Knowledge)***

Suggested days of Instruction	Curriculum Management System Grade Level/Subject: Grade 10-12/Electronics & Robotics I	Topic: Introduction to Electricity & Electronics Goal 1: The student will be able to discuss the benefits of electricity and electronics career paths and understand important safety considerations in the field.	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Essential Questions Sample Conceptual Understandings	Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model
			• **Mathematics Activity** – Students will examine food preparation appliances at home, calculate total wattage and current for ach, identify those appliances that can safely be operated on one 15 amp circuit at one time, prepare and present a PowerPoint presentation of finding ***(Synthesis)*** • **Technology Activity** – Students will bring in a small appliance form home with a damaged power cord, repair the cord in class, test for grounds & shorts ***(Synthesis)***

Suggested days of Instruction	Curriculum Management System **Grade Level/Subject:** **Grade 10-12/Electronics & Robotics I**	**Topic: Introduction to Electricity & Electronics** **Goal 2: The student will be able to demonstrate understanding of atomic theory, chemistry of cells, design of generators and use of circuit diagrams & symbols**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
10	Differentiate between elements & compounds. (CPI 5.6, 5.7) 2.2 Define terms atom, electron & proton. (CPI 5.6, 5.7) 2.3 Sketch hydrogen atom and label parts. (CPI 5.6, 5.7) 2.4 Specify charge types on electrons, protons & Neutrons. (CPI 5.6, 5.7) 2.5 Identify industrial applications of static charges. (CPI 5.6, 5.7) 2.6 Define terms Cell & Battery. (CPI 5.4, 5.6, 5.7, 8.2) 2.7 Describe chemical action of a cell. . (CPI 5.4, 5.6, 5.7, 8.2) 2.8 Describe chemical action during discharge and charge of a lead-acid battery. . (CPI 5.4, 5.6, 5.7, 8.2) 2.9 Explain three factors that produce voltage via generator action. . (CPI 5.4, 5.6, 5.7, 8.2) 2.10 Describe differences between ac & dc generators. . (CPI 5.4, 5.6, 5.7, 8.2) 2.11 Compare and contrast slip rings, commutators, rotating armatures, & rotating field designs. . (CPI 5.4, 5.6, 5.7, 8.2) 2.12 Draw a graph depicting how single-phase & three-phase voltages are produced in	• What are two fundamental characteristics of matter? • What are the three particles that make up an atom? • What atomic participles have a negative charge, positive charge or no charge? • Energy, or the potential of matter to do work, results form the motion of what particles with atoms? • What types of changes occur within a cell to create a voltage? • What are the three essential components of a chemical cell? • What type of charges must exist at a cells anode and cathode to present a voltage? • What is the most common wet cell, what are four common types of dry cells, and what types of cells are rechargeable? • What three fundamental parts of a generator must exist to generate a voltage and current? • How do the terms rotation, sine wave, cycle, frequency, hertz and phase relate to the voltage and current output of generators? • What are the defining characteristics of pictorial, schematic, block, wiring, architectural and computer generated diagrams and what are the advantages of each?	• Text: Burban, Peter, Electricity and Electronics Technology, Chap 3 Atoms, Electrons & Charges • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 14 Chemical Cells & Batteries • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 15 Generators • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 13 Circuit Diagrams & Symbols • Lecture notes • OH Masters • **Samples & Demos**: 3d atom model, static balloon, static generator , abrasive papers, potato cell, sectioned car battery, sectioned D cell, AA/AAA/C/D cells, sectioned 9V Battery, NiMH/ NiCad charger & Cells, hydrometer, magnets, dc & ac generators, induction coil OH demo, dc motors/Inventa "generators", ac supply & pictorial • In School Field Trip to parking lot: Examine the power supply & storage systems of an automobile • Review Main Ideas Homework Chap 3 • Review Main Ideas Homework Chap 14 • Review Main Ideas Homework Chap 15 • Review Main Ideas Homework Chap 13

Suggested days of Instruction	Curriculum Management System Grade Level/Subject: **Grade 10-12/Electronics & Robotics I**	Topic: Introduction to Electricity & Electronics Goal 2: The student will be able to demonstrate understanding of atomic theory, chemistry of cells, design of generators and use of circuit diagrams & symbols	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	an ac generator. . (CPI 5.4, 5.6, 5.7, 8.2) 2.13 Define & Identify pictorial, schematic, block & architectural diagrams. . (CPI 5.4, 5.6, 5.7, 8.2) 2.14 Draw a schematic wiring daigram, from a pictorial diagram. . (CPI 5.4, 5.6, 5.7, 8.2) 2.15 Draw from memory seven graphic sysmbols used in electroncis diagrams and label each sysmbol with proper class designator. . (CPI 5.4, 5.6, 5.7, 8.2)		• Workbook Experiments 1-1, 1-2, 1-3, 8-4 • Test: Chapter 3 • Test: Chapter 14 • Test: Chapter 15 • Test: Chapter 13 • **Science & Mathematics Skills Activity** – Students will calculate their distance away from a lightning strike based on a 4 second delay between the lightning strike and the resultant thunderclap. ***(Synthesis)*** • **Mathematics Activity** – Students will charge a rechargeable NiCad battery, connect the battery to a safe load, periodically record current and voltage until 10% capacity, enter data into Excel spreadsheet, compare results to manufacturers' specifications, prepare and present findings in a PowerPoint presentation. ***(Synthesis)*** • **Science Skills Activity** – Students will develop an experiment showing the effect that an induced electromotive force has on the current in a circuit, prepare a PowerPoint presentation of their experimental design. ***(Synthesis)*** • **Workplace Skills Activity** – Students will draw a circuit that individually controls a front door bell and back door buzzer, utilizing a 120v to 12 v step-down transformer. The hand drawn diagram will include all proper

Suggested days of Instruction	Curriculum Management System Grade Level/Subject: Grade 10-12/Electronics & Robotics I	Topic: Introduction to Electricity & Electronics Goal 2: The student will be able to demonstrate understanding of atomic theory, chemistry of cells, design of generators and use of circuit diagrams & symbols	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Essential Questions Sample Conceptual Understandings	Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model
			component labels and designations. Hand drawn sketches will be scanned into a PowerPoint presentation. ***(Synthesis)*** • **Technology Activity** – Students will recreate their door bell circuit design in a computerized circuit design program. ***(Synthesis)***

Suggested days of Instruction	**Curriculum Management System** **Grade Level/Subject:** **Grade 10-12/Electronics & Robotics I**	**Topic: Electric Circuits & Devices** **Goal 3: The student will be able to demonstrate understanding of electric circuits including circuit basics, voltage, current, conductance, resistance and Ohm's Law**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
6 and on-going	2.16 Identify common volt, ohm & amp meters. . (CPI 5.4, 5.6, 5.7, 8.2) 2.17 Demonstrate how to operate a multi-meter. . (CPI 5.4, 5.6, 5.7, 8.2) 2.18 Demonstrate how a voltmeter is connected into a circuit. . (CPI 5.4, 5.6, 5.7, 8.2) 2.19 Demonstrate how an ammeter is connected into a circuit. . (CPI 5.4, 5.6, 5.7, 8.2) 2.20 Demonstrate how an ohmmeter is connected into a circuit. . (CPI 5.4, 5.6, 5.7, 8.2) 2.21 Explain how an oscilloscope displays a sine or non-sine wave. . (CPI 5.4, 5.6, 5.7, 8.2) 2.22 Sketch a basic circuit and identify its four parts. . (CPI 5.4, 5.6, 5.7, 8.2) 2.23 Understand differences between series, parallel and series-parallel circuits. . (CPI 5.4, 5.6, 5.7, 8.2) 2.24 Differentiate between direct and alternating current. . (CPI 5.4, 5.6, 5.7, 8.2) 2.25 Explain what sine waves represent. . (CPI 5.4, 5.6, 5.7, 8.2) 2.26 Define the terms conductor and insulator. . (CPI 5.4, 5.6, 5.7, 8.2)	• What are the different uses of electrical instruments or meters? • What are the three classes of meters and instrumentation available to electronics technicians? • Safe and correct use of instrumentation requires what type of preparation? • What are the four basic parts of a circuit? • What do the terms current, electromotive force and voltage represent? • What is required to carry a current between a source and a load? • What circuit part changes electrical energy into other energy forms? • What is the function of control devices? • What are the tree basics circuit configurations? • What are the differences between alternating current and direct current? • What atomic characteristics make a material a good electrical conductor? • What is the definition of resistance? • Insulators have high or low resistance? • What are resistors used to control in electrical circuits? • Ohm's Law expresses the relationship between what three electrical characteristics? • Power Formula shows the relationship	Text: • Test: Text: Burban, Peter, Electricity and Electronics Technology, Chap 22 Basic Electrical Measurement • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 4 Circuits. Voltage & Current • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 5 Conductance & Resistance • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 6 Ohm's Law & Power Formulas • Lecture notes • OH Masters • **Samples & Demos**: analog and digital volt, amp & ohm meters, multi-meter, clamp ammeter, Crocodile Technology Virtual Instrumentation, source/load/conductor/control circuit demo, wire samples, circuit board sample, breadboard, switch samples, s/p/s&p circuits demos, oscilloscope sine & non-sine wave demo, fixed & variable resistor samples, porcelain insulator sample, resistor code handouts , Ohm & Power Formula handouts • In School Field Trip to parking lot: Examine the power supply & storage systems of an automobile ***(Analysis)***

Suggested days of Instruction	Curriculum Management System Grade Level/Subject: **Grade 10-12/Electronics & Robotics I**	**Topic: Electric Circuits & Devices** **Goal 3: The student will be able to demonstrate understanding of electric circuits including circuit basics, voltage, current, conductance, resistance and Ohm's Law**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	Describe carbon-composition, film, wire-wound and precision resistors. (CPI 5.4, 5.6, 5.7, 8.2) Determine the resistance value of carbon-composition resistors by color code. (CPI 5.4, 5.6, 5.7, 8.2) Use letter symbols for voltage, current and resistance to show the relationship between them. (CPI 5.4, 5.6, 5.7, 8.2) Calculate the current, voltage and resistance a circuit when any two are known quantities. (CPI 5.4, 5.6, 5.7, 8.2)	between what three values? • What does a kilowatt-hour represent?	• Review Main Ideas Homework Chap 22 • Review Main Ideas Homework Chap 4 • Review Main Ideas Homework Chap 5 • Review Main Ideas Homework Chap 6 • Workbook Experiments 2-1, 3-2, 3-4, 3-6, 3-7, 3-1, 3-2, 3-2, 3-4, 3-5, 3-6, 3-7, 3-8 • Test: Chapter 22 • Test: Chapter 4 • Test: Chapter 5 • Test: Chapter 6 • **Communications Skills Activity** – Students will prepare a PowerPoint presentation describing series, parallel and series parallel circuits including definitions and circuit diagrams. ***(Applications)*** • **Workplace Skills Activity** - Students will design a test to determine the conductance of 28, 22 & 18 awg wire samples using a power supply and amp meter, and collect data in an Excel spread sheet to illustrate the results. ***(Synthesis)*** • **Mathematics Skills Activity** – Students will identify 10 electrical appliances in their homes , determine the wattage of each, estimate the time usage of for one months, calculate the cost to operate each based on their families actual electric utility bill. ***(Synthesis)***

Suggested days of Instruction	Curriculum Management System **Grade Level/Subject** **Grade 10-12/Electronics & Robotics**	**Topic: Electric Circuits & Devices** **Goal 4: The student will be able to demonstrate understanding of electric circuits & devices including series, parallel, series-parallel and capacitive circuits**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
7 and on-going	Draw a series circuit, label each part and identify each parts polarity. (CPI 5.4, 5.6, 5.7, 8.2) Determine voltage drops in a series circuit. (CPI 5.4, 5.6, 5.7, 8.2) Calculate the voltages across a voltage divider circuit. (CPI 5.4, 5.6, 5.7, 8.2) Determine the total source voltage of aiding direct current cells in series. (CPI 5.4, 5.6, 5.7, 8.2) Determine the total source voltage of two opposing direct current cells in series. (CPI 5.4, 5.6, 5.7, 8.2) Connect batteries in series to increase supply voltage. (CPI 5.4, 5.6, 5.7, 8.2) Draw and label a parallel circuit and indicate the polarity at each resistor. (CPI 5.4, 5.6, 5.7, 8.2) Define term overloaded circuit. (CPI 5.4, 5.6, 5.7, 8.2) Use the three parallel-resistance formulas. Calculate the equivalent resistance of a parallel circuit. (CPI 5.4, 5.6, 5.7, 8.2) Calculate the total resistance, total current and the branch currents in a parallel circuit. (CPI 5.4, 5.6, 5.7, 8.2) Connect batteries in parallel to increase current capacity. (CPI 5.4, 5.6, 5.7, 8.2) Define the term network. (CPI 5.4, 5.6, 5.7, 8.2)	• What type of circuit has only one path for electron flow? • What are the four basic parts of a series circuit? • When the resistance in a series circuit increases, what happens to current flow? • When you lower the voltage in a series circuit, what happens to current flow? • Is current flow steady throughout a series circuit, or does it changes? • What happens to voltage as current moves through the different loads in a series circuit? • What does the sum of voltage drops across all loads in a series circuit equal? • What does Kirchhoff Voltage Law state about series circuits? • What type of circuit has more than one path for electron flow? • Are currents through the different branches of a parallel circuit necessarily the same? • Is the current the necessarily the same in each branch of a parallel circuit? • Series and parallel circuits can be combined to form series-parallel circuits sometimes referred to as what type of circuit? • Kirchhoff's voltage and current laws can be used to analyze series-parallel circuits after reducing the circuits into what type of circuits?	Text: • Test: Text: Burban, Peter, Electricity and Electronics Technology, Chap 7 Series Circuits • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 8 Parallel Circuits • Text: Burban, Peter, Electricity ands Electronics Technology, Chap Series-Parallel Circuits • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 10 Capacitors • Lecture notes • OH Masters • **Samples & Demos**: Tronix series, parallel, series-parallel circuit boards, aiding and opposing voltage demo, residential wiring demo showing series & series –parallel circuits, spark capacitor demo, capacitor samples, dc capacitor circuit with voltage meter, ac capacitor circuit with voltage meter, old school radio capacitor example, capacitor code handout, Z meter demo • Review Main Ideas Homework Chap 7 • Review Main Ideas Homework Chap 8 • Review Main Ideas Homework Chap 9 • Review Main Ideas Homework Chap 10

Suggested days of Instruction	**Curriculum Management System** **Grade Level/Subject** **Grade 10-12/Electronics & Robotics**	**Topic: Electric Circuits & Devices** **Goal 4: The student will be able to demonstrate understanding of electric circuits & devices including series, parallel, series-parallel and capacitive circuits**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	Calculate the total resistance of two loads in series with a parallel circuit of two unequal loads. (CPI 5.4, 5.6, 5.7, 8.2) Determine the total resistance of a network. (CPI 5.4, 5.6, 5.7, 8.2) Calculate the total current of a series-parallel circuit, the voltage drop across each load and the current flow in each. (CPI 5.4, 5.6, 5.7, 8.2) Differentiate between the terms capacitor and capacitance. (CPI 5.4, 5.6, 5.7, 8.2) Specify the values of fixed and variable capacitors. (CPI 5.4, 5.6, 5.7, 8.2) Calculate the time constant in a circuit that has resistance and capacitive reactance. (CPI 5.4, 5.6, 5.7, 8.2) Explain how to connect capacitors in series and parallel. (CPI 5.4, 5.6, 5.7, 8.2)	• Why must the total series-parallel impedance or total resistance be calculated before one can analyze its equivalent circuits? • The ability of a device or circuit to store electric energy is called? • What type of charge develops between pates of a capacitor when a voltage is applied? • When the supply voltage is disconnected from a capacitor what happens to its charge?	• Workbook Experiments 5-1, 13-1, 13-2, 5-2, 5-3, 13-3, 13-5, 7-1, 7-2, 7-3, 7-4, • Test: Chapter 7 • Test: Chapter 8 • Test: Chapter 9 • Test: Chapter 10 • **Technology Skills Activity** – Students will design a voltage divider network for equal voltages without a load, then add a load across the lowest voltage, then redesign the divider to bring the voltages back into equality. ***(Synthesis)*** • **Science Skills Activity** – Students will design a demonstration of how adding resistors to a parallel circuit affects the required current from a power supply. ***(Synthesis)*** • **Technology Skills Activity** – Students will design a demonstration showing how series parallel combinations can be used to increase the power rating of resistive circuit elements using ¼ watt resistors. ***(Synthesis)*** • **Technology Skills Activity** – Students will break apart used polarized and used non-polarized capacitors of equal values, examine them under a hand lens, compare & contrast their construction , and sketch diagram and label their findings. ***(Synthesis)***

Suggested days of Instruction	**Curriculum Management System** **Grade Level/Subject:** **Grade 10-12/Electronics & Robotics I**	**Topic: Electric Circuits & Devices** **Goal 5: The student will be able to demonstrate understanding of electric circuits influenced by magnetism and inductance**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
7 and on-going	Explain the domain theory of magnetism. (CPI 5.4, 5.6, 5.7, 8.2) Draw a bar magnet with its associated magnetic field and label the poles and direction of the lines of force within the magnetic field. (CPI 5.4, 5.6, 5.7, 8.2) Define degaussing. (CPI 5.4, 5.6, 5.7, 8.2) Define electromagnetism. (CPI 5.4, 5.6, 5.7, 8.2) Describe the difference between a magnetic field produced by direct current and one produced by alternating current. (CPI 5.4, 5.6, 5.7, 8.2) Explain he operation of a solenoid. (CPI 5.4, 5.6, 5.7, 8.2) State Lenz's Law of induced voltages and currents. (CPI 5.4, 5.6, 5.7, 8.2) Calculate the current delivered to a load from a transformer. (CPI 5.4, 5.6, 5.7, 8.2) Define impedance. (CPI 5.4, 5.6, 5.7, 8.2) Calculate inductive reactance. (CPI 5.4, 5.6, 5.7, 8.2) Describe the magnetic field produced by alternating current. (CPI 5.4, 5.6, 5.7, 8.2) Define and calculate an RL time constant. (CPI 5.4, 5.6, 5.7, 8.2)	• What materials demonstrate magnetic properties? • What is a more common description of a magnetic effect of current? • What is the relationship between attractive or repulsive magnetic force and distance? • What path doe flux line take around a permanent bar magnet? • What is magnetic shielding? • What relationship is described by Lenz's Law? • What three factors must be present for induction to take place? • When a transformer steps up or steps down voltage, what happens to input and output power? • Transformers use what electrical characteristic to operate? • Opposition to changing current in a coil is referred to as what? • To design or analyze circuits with resistance and inductance, what formulas must be most often used?	Text: • Test: Text: Burban, Peter, Electricity and Electronics Technology, Chap 11 Magnetism • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 12 Electric Induction & Inductance • Lecture notes • OH Masters • Samples & Demos: OH Magnetic Field Demo, electromagnet demo, solenoid demo, OH Induction Demo, transformer samples, step up/step down demo, • Review Main Ideas Homework Chap 11 • Review Main Ideas Homework Chap 12 • Workbook Experiments 8-1, 8-2, 8-3, 8-4, 8-5, 8-6, 8-7 • Test: Chapter 11 • Test: Chapter 12 • **Science Skills Activity** – Students will design a demonstration to show the magnetic effect caused by current from a battery on a coil of wire that has an air core. ***(Synthesis)*** • **Communications Skills Activity** – Students will research the life of physicist Heinrich F. E. Lenz, identify institutions in which he worked, highlight his major contributions to Physics, and prepare a PowerPoint presentation of

Suggested days of Instruction	Curriculum Management System Grade Level/Subject: Grade 10-12/Electronics & Robotics I	Topic: Electric Circuits & Devices Goal 5: The student will be able to demonstrate understanding of electric circuits influenced by magnetism and inductance	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Essential Questions Sample Conceptual Understandings	Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model
			their findings. ***(Knowledge)***

Suggested days of Instruction	Curriculum Management System **Grade Level/Subject:** **Grade 10-12/Electronics & Robotics I**	**Topic: Semi-conductors & Integrated Circuits** **Goal 6: The student will be able to demonstrate understanding of semi-conductors, integrated circuits and special devices**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
20 and on-going	Draw and label a schematic diagram that uses a single diode to illustrate half-wave rectification of an ac current. (CPI 5.4, 5.6, 5.7, 8.2) Draw and label a schematic diagram that uses four diodes to illustrate full-wave rectification of an ac current. (CPI 5.4, 5.6, 5.7, 8.2) Test a diode for performance. (CPI 5.4, 5.6, 5.7, 8.2) Explain hole movement and electron flow. (CPI 5.4, 5.6, 5.7, 8.2) Describe a heatsink. (CPI 5.4, 5.6, 5.7, 8.2) Explain how silicon-controlled rectifiers operate. (CPI 5.4, 5.6, 5.7, 8.2) Describe how monolithic integrated circuits are built. (CPI 5.4, 5.6, 5.7, 8.2) Compare the characteristics of TTL-type and MOS-type integrated circuits. (CPI 5.4, 5.6, 5.7, 8.2) List five applications of optoelectronics. (CPI 5.4, 5.6, 5.7, 8.2)	• What best describes the conductance of a semi-conductor material? • What does doping do to resistance of a semi-conductor material? • How do the existence of holes and free electrons affect the conductance of a semi-conductor material? • What twp elements are the most frequently used substrates in the manufacture of semi-conductor devices? • What atomic level changes do arsenic and iridium create in semi-conductor materials when used for doping? • What type of semi-conductor junctions do arsenic and iridium create in semi-conductor materials? • Define bias voltage? • What is the most basic and most common type of semi-conductor device? • How do diodes, zeners, triacs, diacs and transistors function?	Text: • Test: Text: Burban, Peter, Electricity and Electronics Technology, Chap 17 Semi-conductors & Diodes • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 18 Integrated Circuits & Special Devices • Lecture notes • OH Masters • Samples & Demos: Atomic Model, semi-conductor device samples, Tronix Diode board, rectifier demo, Tronix Transistor boards, thermocouple demo, smd, & dip samples, Tronix LED, Photodiode boards • Review Main Ideas Homework Chap 17 • Review Main Ideas Homework Chap 18 • Workbook Experiments 9-1, 9-2, 9-3, 9-4, 9-5, 10-1, 10-2, 10-3, 10-4, 11-2, 11-3 • Test: Chapter 17 • Test: Chapter 18 • **Mathematics Skills Activity** –Students will obtain specifications for a rectifier diode and for three standard heat sinks, use the data to calculate and graph the current limit increase for the diode with each heat sink, and enter their data into an Excel Spreadsheet. ***(Synthesis)*** • **Technology & Mathematics Skills** Activity – Students will calculate the

Suggested days of Instruction	Curriculum Management System Grade Level/Subject: Grade 10-12/Electronics & Robotics I	Topic: Semi-conductors & Integrated Circuits Goal 6: The student will be able to demonstrate understanding of semi-conductors, integrated circuits and special devices	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Essential Questions Sample Conceptual Understandings	Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model
			capacitive reactance of a Diode AM Detector Circuit at a standard 455 kHz intermediate AM frequency, a 400 Hz audio modulating signal and a 100 pF capacitor and explain why the signals split using their calculations as proof in a short summary report. ***(Synthesis)***

Suggested days of Instruction	**Curriculum Management System** **Grade Level/Subject** **Grade 10-12/Electronics & Robotics**	**Topic: Semi-conductors & Integrated Circuits** **Goal 7: The student will be able to demonstrate understanding of semi-conductors and integrated circuits including digital electronics circuits and computer fundamentals**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
7 and on-going	Define digital electronics. (CPI 5.4, 5.6, 5.7, 8.2) Name three methods by which binary conditions or states can be achieved. (CPI 5.4, 5.6, 5.7, 8.2) Draw the symbols and truth tables for AND, OR, NOT and XOR logic gates. (CPI 5.4, 5.6, 5.7, 8.2) Contrast the binary number system with the decimal system. (CPI 5.4, 5.6, 5.7, 8.2) Add binary numbers. (CPI 5.4, 5.6, 5.7, 8.2) Explain how bi-stable multivibrators (flip-flops) divide frequency. (5.4, 5.6, 5.7, 8.2) Identify the three basic elements of a computer system. (CPI 5.4, 5.6, 5.7, 8.2) Define terms used to describe computer memory. (CPI 5.4, 5.6, 5.7, 8.2) Describe the function of the central processing unit. (CPI 5.4, 5.6, 5.7, 8.2) Explain the function of ROM and RAM memory. (CPI 5.4, 5.6, 5.7, 8.2) Explain the purpose of low address and high address as it relates to memory location. (CPI 5.4, 5.6, 5.7, 8.2) Define the terms latch and tri-state IC. (CPI 5.4, 5.6, 5.7, 8.2)	• What type of voltage pulses are used in digital electronics? • What is the function of switching actions in a digital circuit? • What three means of representing the two binary states are used in digital systems? • Logic circuits represent what type of algebraic functions? • Why are binary numbers used by digital systems in mathematical operations and data storage? • What are the three basic systems in a computer system? • What are the five basic hardware components in a computer system? • What two types of memory subsystems are used for temporary storage? • What is the function of the Clock in a microprocessor? • How do input and output devices assist humans in interacting with the computer?	Text: • Test: Text: Burban, Peter, Electricity and Electronics Technology, Chap 24 Digital Electronic Circuits • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 25 Fundamentals of Computers • Lecture notes • OH Masters • Samples & Demos: binary demo, quickstep demo, AND, OR, NAND, NOR, XOR, half-adder & flip-flop Tronix boards • Review Main Ideas Homework Chap 24 • Review Main Ideas Homework Chap 25 • Workbook Experiments 11-4, 11-5, 11-6, 11-7 • Test: Chapter 24 • Test: Chapter 25 • **Technology & Mathematics Skills** Activity – Students will design a circuit consisting of logic gates that will handle the addition of 2 one-bit numbers, build the circuit on a breadboard, and test the circuit. ***(Synthesis)*** • **Science Skills Activity -** Students will design and demonstrate a circuit that demonstrates why data can be sent through a conductor in only one direction during one period of time. ***(Synthesis)***

Suggested days of Instruction	Curriculum Management System **Grade Level/Subject** **Grade 10-12/Electronics & Robotics**	**Topic: Semi-conductors & Integrated Circuits** **Goal 7:** The student will be able to demonstrate understanding of semi-conductors and integrated circuits including digital electronics circuits and computer fundamentals	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	Explain how data can be transmitted by computer over long distances. (5.4, 5.6, 5.7, 8.2)		

Suggested days of Instruction	**Curriculum Management System** **<u>Grade Level/Subject</u>:** **Grade 10-12/Electronics & Robotics I**	**Topic: Electricity & Electronics at Work** **<u>Goal 8:</u> The student will be able to demonstrate understanding of Computerized controls, Robotics Technology, Communications, Laser and Fiber Optic Systems**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
7 and on-going	Define the term dedicated control. (CPI 5.3, 5.4, 8.2, 8.2) Describe one method of driving a peripheral with a microcontroller. (CPI 5.3, 5.4, 8.2, 8.2) Define and describe an interface circuit for a microcontroller. (CPI 5.3, 5.4, 8.2, 8.2) Contrast the functions of an analog-to-digital converter with those of a digital-to-analog converter. (CPI 5.3, 5.4, 8.2, 8.2) Explain why a pull-up resistor is used with a switch. (CPI 5.3, 5.4, 8.2, 8.2) Draw a diagram of a photo-operated input and explain the operation of the circuit. (CPI 5.3, 5.4, 8.2, 8.2) Describe the Communication process. (CPI 5.3, 5.4, 8.2, 8.2) Explain the importance of the feedback process in communication. (CPI 5.3, 5.4, 8.2, 8.2) Describe the components of a stereo audio system. (CPI 5.3, 5.4, 8.2, 8.2) List several sources of noise and explain how they affect electronic communications. (CPI 5.3, 5.4, 8.2, 8.2) Explain how the landline telephone system works and contrast it with wireless and cellular systems. (CPI 5.3, 5.4, 8.2, 8.2)	• What is an example of specialized digital computer used for dedicated control? • What are two common interface devices used to interface between a digital microcontroller and an external analog peripheral? • What are the differences between ADC and DAC devices? • What is typically used to give complex sets of instructions to computers? • What are the five steps in communicating information in electronic systems? • What basic components make up a modern audio system? • What are the two formats for storing sound? • What is the difference between FM and AM radio transmission technologies? • What is a major advantage of digital TV transmission over the traditional technology? • What are five common types of electric lamps? • The acronym LASER stands for what formal technology name? • What is unique about light wavelengths of laser light compared to traditional sources of light? • What are the four types of laser technologies? • How do fiber optic systems transmit signals?	Text: • Test: Text: Burban, Peter, Electricity and Electronics Technology, Chap 26 Computerized Controls • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 27 Communications Systems • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 32 Lamps, Lasers & Fiber Optics • Lecture notes • OH Masters • **Samples & Demos**: SenSci, Visual Mill Software, QuickStep, BSII Micro-Controller, Satellite Communications Demo, incandescent, fluorescent, MV, MH, Sodium lamp samples, laser pointer demo, fiber optics sample & demo • Review Main Ideas Homework Chap 26 • Review Main Ideas Homework Chap 27 • Review Main Ideas Homework Chap 32 • Workbook Experiments 12-1, 12-2, 12-3, 12-4, 12-5, 12-6, 6-3 • Test: Chapter 26 • Test: Chapter 27 • Test: Chapter 32 • **Technology Skills Activity** – Students will design external circuitry to control a LED display with the Basic Stamp

Suggested days of Instruction	Curriculum Management System Grade Level/Subject: **Grade 10-12/Electronics & Robotics I**	Topic: Electricity & Electronics at Work Goal 8: The student will be able to demonstrate understanding of Computerized controls, Robotics Technology, Communications, Laser and Fiber Optic Systems	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	Describe the internet and other computer networks. (CPI 5.3, 5.4, 8.2, 8.2) Explain the differences between AM and FM technology. (CPI 5.3, 5.4, 8.2, 8.2) Compare and contrast traditional TV technology and digital TV technology. (CPI 5.3, 5.4, 8.2, 8.2) Specify the frequency and wavelength of visible light. (CPI 5.3, 5.4, 8.2, 8.2) Explain the processes of generating a laser beam in solid state, gas, liquid and semi-conductor lasers. (CPI 5.3, 5.4, 8.2, 8.2) Explain the way in which a light wave is transmitted in a fiber optic cable. (CPI 5.3, 5.4, 8.2, 8.2) Identify five elements in a fiber optics communication system. (CPI 5.3, 5.4, 8.2, 8.2)	• What are three advantages of fiber optic systems over traditional copper conductor signal transmission systems?	microcontroller and write the control code to program the microcontroller. ***(Synthesis)*** • **Technology Skills Activity** – Students will design external circuitry to control a motor with the Basic Stamp microcontroller and write the control code to program the microcontroller. ***(Synthesis)*** • **Technology Skills Activity** – Students will design external circuitry to read a photocell sensor with the Basic Stamp microcontroller and write the control code to program the microcontroller. ***(Synthesis)*** • **Mathematics Skills Activity** – Students will calculate the time for a standard speed electromagnetic wave to travel halfway around the world, to the moon, and to mars. ***(Synthesis)*** • **Workplace Skills Activity** – Students will build a simple AM tuning circuit and using an oscilloscope, demonstrates what AM signals look like and how many are present at any given time. ***(Synthesis)*** • **Social Studies Skills Activity** – Students will research the impact of fiber optics on communications and prepare a PowerPoint presentation of their findings. ***(Knowledge)***

Suggested days of Instruction	**Curriculum Management System** **<u>Grade Level/Subject</u>:** **Grade 10-12/Electronics & Robotics I**	**Topic: Testing & Troubleshooting** **<u>Goal 9:</u> The student will be able to demonstrate understanding of Measuring Electrical Quantities, Troubleshooting and Repair**	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) **The student will be able to:**	**Essential Questions** **Sample Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
90	9.1. Identify common meters. (CPI 5.3, 5.4, 8.2, 8.2) 9.2. Explain how to operate a multi-meter. (CPI 5.3, 5.4, 8.2, 8.2) 9.3. Describe how a voltmeter is connected. (CPI 5.3, 5.4, 8.2, 8.2) 9.4. Describe how an ammeter is connected. (CPI 5.3, 5.4, 8.2, 8.2) 9.5. Explain the operation of an oscilloscope. (CPI 5.3, 5.4, 8.2, 8.2) 9.6. Explain how to use a signal generator. (CPI 5.3, 5.4, 8.2, 8.2) 9.7. Explain how to use a logic probe. (CPI 5.3, 5.4, 8.2, 8.2) Identify how common sense can be useful in troubleshooting. (CPI 5.3, 5.4, 8.2, 8.2) Identify and describe five types of electronic test equipment used in troubleshooting electronics circuits. (CPI 5.3, 5.4, 8.2, 8.2) Identify the main differences between thru-hole and surface mount technology. (CPI 5.3, 5.4, 8.2, 8.2)	• What quantity is a voltmeter used to measure? • What quantity is an ammeter used to measure? • What quantity is an ohmmeter used to measure? • What is an oscilloscope display? • What information does a logic probe give the troubleshooter? • What is a breakout box used for? • What does troubleshooting identify? • What are the two most common types of circuit board component attachment methods?	Text: • Test: Text: Burban, Peter, Electricity and Electronics Technology, Chap 22 Measuring Electrical Quantities • Text: Burban, Peter, Electricity ands Electronics Technology, Chap 23 Troubleshooting & Repair • Lecture notes • OH Masters • **Samples & Demos**: Bench Multi-meter Demo, Shunted Current Measurement Demo, Oscilloscope Demo, Signal Generator Demo, Logic Probe Demo, Breakout box Demo, Solder/De-solder Demo • Review Main Ideas Homework Chap 22 • Review Main Ideas Homework Chap 23 • Workbook Experiments 6-1, 6-2, 6-4, 11-1, 11-2 • Test: Chapter 22 • Test: Chapter 23 • **Mathematics Skills Activity** – Students will compare measurements from several different types of digital and analog meters of known electrical quantities of voltage, amperage and resistance, then determine the percentage error of each instrument tested***(Evaluation)*** • **Workplace Skills Activity** – Students

Suggested days of Instruction	Curriculum Management System Grade Level/Subject: Grade 10-12/Electronics & Robotics I	Topic: Testing & Troubleshooting Goal 9: The student will be able to demonstrate understanding of Measuring Electrical Quantities, Troubleshooting and Repair	
	Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:	Essential Questions Sample Conceptual Understandings	Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model
			will open and observe a properly operating VCR and malfunctioning VCR, list all mechanical functions in sequence, and identify the differences in operation to trouble shoot possible causes of the malfunction***.(Comprehension)***

ELECTRONICS & ROBOTICS I - COURSE BENCHMARKS

1. **Careers, Workplace and Communications & Safety Skills** - Students will explore occupational and career opportunities in the fields of electricity and electronics. Students will read technical information, express technical concepts in oral and written formats and develop documentation and presentation skills. Students will understand and demonstrate safe and proper electronics laboratory procedures.

2. **Mathematics Skills** - Students will use essential mathematical theory and formulas to investigate electric and electronics systems.

3. **Science Skills** - Students will apply basic physical science knowledge in investigation of electric and electronics processes.

4. **Design and Problem Solving Skills** - Students will apply procedures used in research, development and manufacturing, including the use of software, circuit diagrams, components, tools and test instruments utilized by engineers to identify solutions to design challenges.

5. **Nature of Electricity and Production of Electricity** - Students will apply existing knowledge and gain new understandings of atoms, electric charges, static electricity, voltage, current, capacitance, impedance, resistance, magnetic fields, optoelectronics, sources of electric energy and electricity production.

6. **Circuits and Devices** - Students will gain new knowledge and understandings of circuit elements, resistors, ohm's law, series, parallel, series-parallel, transformers, voltage dividers, junction currents, , capacitors, inductors, circuit diagrams, circuit analysis, semiconductor structure, p-n junctions, diodes, transistors, amplifiers, detectors, regulators, thyristors, FETs, integrated circuits, op amps, binary conditions, logic circuits, logic gates, microcomputers, input/output, single chip computers, ADC/DCA converters & fiber optics.

7. **Applications of Electricity and Electronics** - Students will gain new knowledge and understandings of circuit elements, uses of DC & AC current, design & construction of series/parallel/series-parallel circuits, use of solenoids, transformers, inductors, cells & batteries, transistor switching and amplification, registers & counters, basic computer elements, microcomputers, logic circuits, single chip computers, computer interfacing, microcontroller programming, lasers/fiber optics & CAD/CAM/Rapid Prototyping.

8. **Testing and Troubleshooting** - Students will apply new knowledge to investigate application of ohm's law in capacitor, transformer & inductors tests, diode & transistor testing, using analog & digital meters, bench instruments, logic probes, oscilloscopes, function & signal generators.

9. **Computer Applications and Robotics Technology** - Students will understand and demonstrate knowledge of robotics systems, including components, sensors, remote control vs. autonomous, classification of robot , operating systems, programming, micro-controllers & embedded controllers, vision & tactile systems, and proximity sensors.