Career and Technical Education
Adapted CTE Course Blueprint
of
Essential Standards and Indicators

Trade and Industrial Education

7632 Electronics II
Field Test

Public Schools of North Carolina
State Board of Education • Department of Public Instruction
Academic Services and Instructional Support
Division of Career and Technical Education
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Special thanks to the following educators who developed this Adapted CTE Course Blueprint.

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Keith Simpson – LabVolt
Ray Stroud – ETA-I

This Adapted CTE Course Blueprint has been reviewed by business and industry representatives for technical content and appropriateness for the industry.

Adapted CTE Course Blueprint

Essential standards are big, powerful ideas that are necessary and essential for students to know to be successful in a course. Essential standards identify the appropriate verb and cognitive process intended for the student to accomplish. Essential standards provide value throughout a student's career, in other courses, and translate to the next level of education or world of work.

This document lays out the essential standards for Electronics II which aligns with the Electronic Technician Association – International (ETA-i) standards for basic AC, Analog, and Comprehensive electronics industry certifications. The particular certifications covered by this course are as follows: EM2- Associate C.E.T. - AC BASICS, EM3 – Associate C.E.T. – ANALOG BASICS, and COMPREHENSIVE BASICS. ETA-I, the certifying organization, provides the standard to use in preparation for taking this exam. Industry curriculum providers provide the post-assessments aligned with these standards. The essential standards use Revised Bloom's Taxonomy (RBT) category verbs (remember, understand, apply, analyze, evaluate, create) that reflect the overall intended cognitive outcome of the indicators written by ETA-i. Each essential standard and indicator reflects the intended level of learning through two dimensions; The Knowledge Dimension is represented with letters A-C, and the Cognitive Process Dimension by numbers 1-6.

The Adapted Electronics II Course Blueprint includes units of instruction, essential standard(s) for each unit, and the specific indicators aligned with the ETA-I certification. Also included are the relative weights of the units and essential standards within the course.

This document will help teachers plan for curriculum delivery for the year, prepare daily lesson plans, and construct valid formative, benchmark, and summative assessments. Curriculum for this course is not provided by NCDPI. Industry curriculum providers reviewed and approved for this course collaborated with the North Carolina Department of Public Instruction (NCDPI) to develop a valid and reliable test item bank used to produce a secure postassessment administered by NCDPI. Assessment for this course is written at the level of the ***ESSENTIAL STANDARD*** and assesses the intended outcome of the sum of its indicators. The following industry curriculum providers participated in the development of the secure test item bank. To assure alignment of the postassessment with the credential, the following curriculum providers have been reviewed and determined to provide curriculum to cover the essential standards. See appendix A for a list of curriculum providers.

For additional information about this blueprint, contact the Division of Career and Technical Education, North Carolina Department of Public Instruction, 6361 Mail Service Center, Raleigh, North Carolina 27699-6361.

Reference: Anderson, Lorin W. (Ed.), Krathwohl, David R. (Ed.), et al., *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives,* Addison Wesley Longman, Inc., New York, 2001.

Interpretation of Columns on the NCDPI Adapted CTE Course Blueprint

No.	1	2	3	4
Heading	Essential Std #	Unit Titles, Essential Standards, and Indicators	Course Weight	RBT Designation
Column information	Unique course identifier and essential standard number.	Statements of unit titles, essential standards per unit, and specific indicators per essential standard. If applicable, includes % for each indicator.	Shows the relative importance of each unit and essential standard. Course weight is used to help determine the percentage of total class time to be spent on each essential standard.	Classification of outcome behavior in essential standards and indicators in Dimensions according to the Revised Bloom's Taxonomy. **Cognitive Process Dimension:** 1 Remember 2 Understand 3 Apply 4 Analyze 5 Evaluate 6 Create **Knowledge Dimension:** A Factual Knowledge B Conceptual Knowledge C Procedural Knowledge

Career and Technical Education conducts all activities and procedures without regard to race, color, creed, national origin, gender, or disability. The responsibility to adhere to safety standards and best professional practices is the duty of the practitioners, teachers, students, and/or others who apply the contents of this document.

Career and Technical Student Organizations (CTSO) are an integral part of this curriculum. CTSOs are strategies used to teach course content, develop leadership, citizenship, responsibility, and proficiencies related to workplace needs.

Adapted CTE Course Blueprint for
7632 ELECTRONICS II

(Recommended hours of instruction: 270 or 360 minimum)

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	100%	
A	**Associate C.E.T. - =AC BASICS (EM2)**	**25%**	
201.00	**Understand Principles of Alternating Current including components and terms**	**3%**	**B2**
	1.1 Describe AC wave form characteristics 1.1.1 Effective voltage (RMS) 1.1.2 Average voltage 1.1.3 Negative Alternation 1.1.4 Positive Alternation 1.1.5 Wavelength 1.1.6 Amplitude 1.1.7 Period 1.2 Calculate peak, RMS, and average voltage values for an AC waveform 1.3 Identify the frequency terms 1.3.1 Cycle 1.3.2 Hertz 1.3.3 Phase 1.4 Identify capacitor types; list common usages; methods of varying capacitance 1.5 Identify inductor types and reasons for various core materials 1.6 Identify common types of transformers and list uses for each; explain why laminations are used 1.7 Indentify the following terms: 1.7.1 Charge 1.7.2 Coulomb 1.7.3 Joule 1.7.4 Reluctance 1.7.5 Capacitors 1.7.6 Inductors 1.7.7 Capacitance 1.7.8 Inductance 1.7.9 Reactance 1.7.10 Impedance		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	100%	
202.00	**Apply Principles of Inductance**	**5%**	**C3**
	2.1 Describe the requirements for inductance in AC electrical circuits 2.2 Explain Lenz's law in complement with Faraday's law of induction 2.3 Identify the differences between self-inductance and mutual inductance 2.4 Explain the factors affecting inductance 2.4.1 Number of turns of a coil 2.4.2 Coil Diameter 2.4.3 Length of the coil 2.4.4 Core material 2.5 List the factors used in calculating inductance for a single and multi-layer air core coil 2.6 Explain how inductance relates to magnetism and describe coil construction, cores and usages 2.7 Describe the differences between reactance and resistance and describe current/voltage relationships 2.8 Compare impedance with reactance and resistance and explain the causes and effects of impedance 2.9 Describe the types of power losses associated with inductors 2.10Calculate power consumption and requirements in inductors in AC circuits 2.11 Solve series, parallel and series-parallel problems utilizing each appropriate formula for reactance, voltage, current and power 2.12 Describe the different types of transformer construction and operation 2.13 List the various types of transformers 2.14 Determine the method for determining a step-up or step-down transformer 2.15 Describe the operation of a saturable reactor		
203.00	**Apply Principles of Capacitance**	**3%**	**C3**
	3.1 Describe the factors affecting capacitor operation in AC circuits 3.2 Show the different purposes for capacitors and list common types and construction of the different types 3.3 Explain the advantages and disadvantages of utilizing an electrolytic capacitor in an AC circuit 3.4 Describe the differences between capacitive reactance and resistance and describe current/voltage relationships 3.5 Solve series, parallel and series-parallel problems utilizing each appropriate formula for reactance, voltage, current and power		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	**2**	**3**	**4**
	Total Course Weight	**100%**	
204.00	**Understand AC Generator and Motor Theory**	**4%**	**B2**
	4.1 Describe the components associated with an AC generator 4.2 Explain the Left-Hand rule for generators 4.3 Define Lenz's law for induction 4.4 Explain the difference between single and three phase power generation 4.5 Describe how three phase power can be manipulated to obtain a desired voltage and number of phases 4.6 List the differences associated with Delta and Wye three phase power connections7.1 List different types of AC motors and methods of operation 4.7 Describe the components and principles associated with the operation of an AC motor 4.8 Describe the basic methods of using electricity to operate an induction motor and how transferred mechanical motion causes a generator to produce electrical current 4.9 Calculate the number of pole pairs needed to produce desired rpm's 4.10 Explain the principle behind Shaded-pole and Split-phase induction motors 4.11 Describe the various methods used for starting induction motors		
205.00	**Apply RC, RL and RCL Principles and general Mathematics and Formulas used in AC**	**6%**	**C3**
	5.1 Explain phase relationships of voltage and current for series and parallel RL, RC and RCL circuits 5.2 Calculate power, current, impedance and voltage vectors for series and parallel RCL circuits 5.3 Explain bandwidth and selectivity for series and parallel resonant circuits 5.4 Describe the component configurations used in PI, L, and T type high and low pass filter circuits 5.5 Quote Ohms law power, voltage, current and resistance formulas and solve for circuit values 5.6 List other common basic electronic formulas relative to AC		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
206.00	**Understand Cabling, Test Equipment & Measurements, and Basic Electrical Safety Precautions**	**4%**	**B2**
	6.1 Describe impedance and its causes; explain reasons for maintaining a cable's characteristics 6.2 Explain the effects of proper and improper termination 6.3 Explain the purposes of grounding and common conventions used in electrical and electronics work 6.4 Describe how volt-ohm-current meters operate 6.5 List the purposes and types of signal generators 6.6 Describe how oscilloscope front panel controls are used 6.7 Explain what LRC substitution equipment is and its purposes 6.8 Explain reasons for using rheostats, isolation transformers and variacs and why size 6.9 Describe personal safety precautions for working with electric and electronic devices 6.10 Describe the human physiological reactions electrical shock causes. 6.10.1 List various degrees of current the human body can tolerate. 6.11 Emergency response 6.11.1 Explain the concept of First Aid and its particular importance to workers in electric and electronic fields 6.11.2 Explain precautions needed in the area of electronic safety 6.12 Describe the different classes (A, B, C, & D) of fires and the type of extinguishers used to fight them. 6.13 List applicable governing fire safety regulations NEC (National Electrical Code) and NFPA 70 (National Fire Protection Association) 6.14 Explain what the NEC (National Electrical Code) and NFPA 70 (National Fire Protection Association) are, and describe various rules technicians must abide by		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
B	**Associate C.E.T. - = ANALOG BASICS (EM3)**	**25%**	
207.00	**Understand Diodes**	**2%**	**B2**
	7.1 Describe the electrical characteristics of semiconductors. 7.2 Explain the difference between intrinsic and doped semiconductors. 7.3 Explain how current flows through intrinsic and doped semiconductors. 7.4 Describe the construction of a PN junction diode. 7.5 Explain the behavior of a forward and reverse biased diode. 7.6 Identify diodes with a proper front to back ratio. 7.7 Describe the forward and reverse current-voltage characteristics of a typical zener diode. 7.8 Describe how the zener diode is used to provide voltage regulation. 7.9 Identify a diagram for a zener voltage regulator and explain its operation. 7.10 Describe how capacitance is produced in a varactor diode and explain how it is affected by a change in operating voltage. 7.11 Explain the operational and electrical characteristics of the following types of diodes: 7.11.1 Pin 7.11.2 Gunn 7.11.3 Tunnel 7.11.4 Schottky 7.11.5 Laser Diodes 7.11.6 Light Emitting 7.11.7 Photodiodes 7.11.8 Super-Barrier 7.12 Identify the various types of diodes from their schematic symbols, alphanumerical designation, and color code. 7.13 Explain the proper procedure for both operational and acceptance testing of diodes. 7.14 List the safety precautions to be taken when working with diodes.		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
208.00	**Apply procedures used with Transistors and Thyristors**	**5%**	**C3**
	8.1 Explain the operational and electrical characteristics of bipolar junction transistors. 8.1a Describe the construction of PNP and NPN bipolar junction transistors 8.2 Explain the proper biasing of bipolar junction transistors for normal operation. 8.3 Explain the relationship between emitter, base, and collector currents in bipolar junction transistors. 8.4 Identify the schematic diagram for and explain the function of the three basic bipolar junction transistor amplifier circuits. 8.5 Explain the differences between heterojunction bipolar transistors and bipolar junction transistors 8.6 Describe the operational and electrical characteristics of a unijunction transistor. 8.6a Explain the conditions necessary to turn on and off unijunction transistor. 8.7 Determine an amplifier gain using a transistor collector characteristic curve. 8.8 Determine input and output resistance of transistor amplifier circuit. 8.9 Explain the meaning of and calculate both alpha and beta cutoff frequency. 8.10 Explain the operational and electrical characteristics of JFETs (junction field effect transistors). 8.11 Explain the proper biasing of N-channel and P-channel JFETs for normal operation. 8.12 Determine the transconductance of the device using an FET's drain characteristic curve. 8.13 Explain the operational and electrical characteristics of a MOSFET (metal oxide semiconductor field effect transistor). 8.13a Identify enhancement mode and depletion mode MOSFET configurations 8.14 Identify the various types of transistors from their schematic symbols, alphanumerical designation, and color code. 8.15 Explain the proper procedure for both operational and acceptance testing of transistors. 8.16 List the safety precautions to be taken when working with transistors. 8.17 Describe the operational and electrical characteristics of a silicon-controlled rectifier. 8.18 Explain the conditions necessary to turn on and off a bidirectional triode thyristor. 8. 19 Identify the various types of thyristors from their schematic symbols, alphanumerical designation, and color code. 8.20 Explain the proper procedure for both operational and acceptance testing of thyristors. 8. 21 List the safety precautions to be taken when working with thyristors.		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
209.00	**Understand Integrated Circuits, Optoelectronic Devices, and Power Supplies and Test Equipment & Measurements used in Analog**	**6%**	**B2**
	9.1 Describe the operational and electrical characteristics of integrated circuits. 9.2 Explain the difference between linear and digital integrated circuits. 9.3 Given their schematic symbols, alphanumerical designation, and color code, identify various integrated circuits packages and explain their use. 9.4 Explain the proper procedure for both operational and acceptance testing of integrated circuits. 9.5 List the safety precautions to be taken when working with integrated circuits. 9.1 Describe the characteristics of light. 9.2 Given a light frequency, determine its wavelength. 9.3 Explain the operational and electrical characteristics of both light emitting and light sensitive devices. 9.4 Explain the proper biasing of light sensitive and light emitting devices. 9.5 Explain the operational and physical characteristics of light transmission media. 9.6 Explain the operation of optoelectronic couplers and isolators. 9.7 Explain the operation of light amplifiers. 9.8 Explain the proper procedure for both operational and acceptance testing of optoelectronic devices. 9.9 List the safety precautions to be taken when working with optoelectronic devices. 9.10 Describe the configuration of various rectifier circuits. 9.11 Describe the electrical and operational characteristics of rectifier circuits. 9.12 Describe the configuration of various power supply filters. 9.13 Describe the configuration of various voltage multipliers. 9.14 Describe the electrical and operational characteristics of various voltage multipliers. 9.15 Describe the configuration of various voltage regulators. 9.16 Describe the electrical and operational characteristics of various voltage regulators. 9.17 Describe the configuration of switching power supplies. 9.18 Describe the electrical and operational characteristics of switching power supplies. 9.19 Describe the configuration of series, shunt and biased clippers. 9.20 Describe the electrical and operational characteristics of series, shunt, and biased clippers. 9.21 Describe the configuration of clampers. 9.22 Describe the electrical and operational characteristics clampers. 9.23 Explain the proper procedure for both operational and acceptance testing of power supplies. 9.24 List the shock hazards and safety precautions to be taken when working with power supplies. 19.1 Describe “meter loading” and precautions. 9.25 Explain the purposes of frequency counters and list their limitations. 9.26 Explain proper use of the oscilloscope. 9.27 Explain fundamental block diagram of oscilloscope and function/purpose of each block 9.28 Describe oscilloscope usage; explain the purposes of each front panel control. 9.29 List the uses for pattern generators. 9.30 Define dummy load; show where and why used.		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
210.00	**Apply Mathematics and Formulas used in Analog**	**2%**	**C3**
	10.1 Calculate wavelength, frequency and power values 10.2 Explain decibels and show reasons for using dBs in signal level, voltage, and power level calculations: 10.2.1 dBm 10.2.2 dBW 10.2.3 dBV 10.2.4 dB (SPL) 10.2.5 dB (SIL) 10.2.6 sB (SWL) 10.3 Demonstrate how graphs are used to demonstrate electronics functions 10.4 Calculate PRF/PRR (pulse recurring frequency/pulse recurring rate) 10.5 Calculate duty cycle		

211.00	Understand Amplifiers, Operational Amplifiers, and Oscillators	5%	B2
	11.1 Describe basic amplifier configuration, biasing, coupling, and operation. 11.2 Describe the electrical and operational characteristics of the following types of amplifiers: 11.2.1 Direct current 11.2.2 Audio 11.2.3 Video 11.2.4 IF 11.2.5 RF 11.3 Explain the proper procedure for both operational and acceptance testing of amplifiers. 11.4 List the safety precautions to be taken when working with amplifiers. 11.5 Describe operational amplifier configurations, biasing, coupling, and operation. 11.1.1 Inverting amplifier 11.1.2 Non-inverting amplifier 11.1.3 Voltage follower 11.1.4 Summing amplifier 11.1.5 Integrator 11.1.6 Differentiator 11.1.7 Comparator 11.6 Describe the input and output impedance characteristics of various operational amplifiers. 11.7 Describe the input and output phase relationship and gain of various operational amplifiers. 11.8 Explain the proper procedure for both operational and acceptance testing of operational amplifiers. 11.9 List the safety precautions to be taken when working with operational amplifiers. 11.10 Describe the fundamentals of oscillation. 11.11 Describe the configuration of an Armstrong oscillator circuit. 11.12 Describe the electrical and operational characteristics of an Armstrong oscillator circuit. 11.13 Describe the configuration of a Hartley oscillator circuit. 11.14 Describe the electrical and operational characteristics of a Hartley oscillator circuit. 11.15 Describe the configuration of a Colpitts oscillator circuit. 11.16 Describe the electrical and operational characteristics of a Colpitts oscillator circuit. 11.17 Describe the configuration of a crystal controlled oscillator circuit. 11.18 Describe the electrical and operational characteristics of a crystal controlled oscillator circuit. 11.19 Describe the configuration of a resistive-capacitive oscillator circuit. 11.20 Describe the electrical and operational characteristics of a resistive-capacitive oscillator circuit. 11.21 Describe the configuration of a transformer oscillator circuit. 11.22 Describe the electrical and operational characteristics of a transformer oscillator circuit. 11.23 Explain the piezoelectric effect. 11.24 Explain regenerative feedback. 11.25 Explain frequency multiplication. 11.26 Explain the Barkhausen Criterion 11.27 Explain the proper procedure for both operational and acceptance testing of oscillators. 11.28 List the safety precautions to be taken when working with oscillators.		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
212.00	**Understand Filters and Wave-shaping Circuits**	**5%**	**B2**
	12.1 Describe the electrical and operational characteristics of the following filters: 12.1.1 RC high pass 12.1.2 RC low pass 12.1.3 RL high pass 12.1.4 RL low pass 12.1.5 Series LC band pass 12.1.6 Series LC band stop 12.1.7 LC tank band pass 12.1.8 LC tank band stop 12.1.9 PI-type RC 12.1.10 PI-type RL 12.1.11 PI-type LC 12.1.12 T-type RC 12.1.13 T-type RL 12.1.14 T-type LC 12.2 Describe the configuration of various active filters. 12.2.1 Butterworth 12.2.2 Chebyshev 12.2.3 Bessel 12.2.4 Multiple-Feedback Bandpass 12.2.5 Phase-locked loop 12.3 Describe the relationship between bandwidth and Q of a circuit. 12.4 Describe the configuration of a square wave generating circuit. 12.5 Describe the electrical and operational characteristics of a square wave generating circuit. 12.6 Describe the configuration of a sawtooth wave generating circuit. 12.7 Describe the electrical and operational characteristics of a sawtooth wave generating circuit. 12.8 Describe the configuration of a trapezoidal wave generating circuit. 12.9 Describe the electrical and operational characteristics of a trapezoidal wave generating circuit. 12.10 Describe the configurations of various differentiator and integrator circuits. 12.11 Describe the electrical and operational characteristics of various differentiator and integrator circuits. 12.12 Describe the configuration of a ramp generator circuit. 12.13 Describe the electrical and operational characteristics of a ramp generator circuit. 12.14 Explain the proper procedure for both operational and acceptance testing of wave-shaping circuits. 12.15 List the safety precautions to be taken when working with wave-shaping circuits.		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
C	**Associate C.E.T. - = COMPREHENSIVE BASIC (EM5)**	**50%**	
213.00	**Understand Soldering-Desoldering, and tools**	**8%**	**B2**
	13.1 Describe solder safety as it pertains to burns and potential fires or damage to facilities or customer products 13.2 Explain the cause of solder fumes and the effects of lead poisoning 13.3 List causes and precautions to prevent or reduce solder splatter 13.4 Explain the reasons for flux usage and describe types 13.5 List types of solder and reasons for choosing each 13.6 Explain heat shunts, why and how they are used 13.7 Describe cold solder joints and explain causes 13.8 Describe the differences between good and bad mechanical and electrical solder connections 13.9 Describe proper care of solder and de-solder equipment and aids 13.10 Explain de-soldering principles 13.11 Describe various types of de-soldering equipment and how they are used 13.12 Describe the use of braid-wick solder removers		
214.00	**Understand Electrical Conductors**	**6%**	**B2**
	14.1 Define insulation resistance and dielectric strength 14.2 Define mil-foot, square mil, circular mil and the mathematical equations for calculations for each 14.3 Explain the meaning of “resistivity” 14.4 Explain the American Wire Gauge system and how to measure wire using the AWG system 14.5 Explain the factors required in selecting proper size wire 14.6 State the advantages and disadvantages of copper, aluminum, and silver as conductors 14.7 Describe the effects that temperature coefficient of a given wire type can have on its operation 14.8 Describe types of insulation and factors in their selection for use 14.9 Describe conductor types, both solid and stranded, as well as the various bundling techniques 14.10 Describe the proper splicing and termination techniques for both solid and stranded conductors 14.11 Describe each of the following cable types, their construction, use, and termination: 14.11.1 Coaxial cable 14.11.2 Unshielded twisted pair 14.11.3 Shielded twisted pair		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
215.00	**Understand AC Power Distribution, Circuit Protection, and Circuit Controls**	**10%**	**B2**
	15.1 Describe the design of both single phase and multiphase AC power distribution 15.2 Describe the typical use of both single phase and multiphase AC power distribution 15.3 Describe the typical control and circuit protection devices used for AC power distribution 15.4 Describe the physical design of fuses and their current and voltage rating systems 15.5 Describe the numbering marking system used with fuses and their schematic symbols 15.6 Describe the physical design and current and voltage rating system of circuit breakers 15.7 Describe the numbering marking system used with circuit breakers and their schematic symbols 15.8 List the general types of circuit control devices and their use 15.9 Identify the schematic symbol for a switch, solenoid, and relay 15.10 Describe the operating principles and characteristics of a solenoid, relay, and switch 15.11 State the meaning of current and voltage ratings for a switch, solenoid, and relay		
216.00	**Understand DC and AC Generators**	**8%**	**B2**
	16.1 DC generators 16.1.1 State the principal by which generators convert mechanical energy to electrical energy 16.1.2 State the left hand rule for generators 16.1.3 Explain the process of commutation in DC Generators 16.1.4 Describe the design and operation of a DC generator 16.1.5 Describe the voltage and current variation from no load to full load in a DC generator 16.1.6 Describe how and why field strength can and may be varied in a DC generator 16.1.7 Describe the construction and operation of series wound, shunt wound, and compound wound generators 16.2 AC generators 16.2.1 Describe the principle of magnetic induction as it applies to AC generators 16.2.2 Describe the construction and operation of both rotating-armature and rotating-field alternators, and the advantages of each design 16.2.3 Describe the construction and operation of single-phase, two-phase, and three phase alternators 16.2.4 Describe the construction, operation and advantage of both delta and wye three phase connections for AC generators 16.2.5 Explain the principles of voltage control with AC generators		

Essential Std #	Units, Essential Standards, and Indicators (The Learner will be able to:)	Course Weight	RBT Designation
1	2	3	4
	Total Course Weight	**100%**	
217.00	**Understand DC and AC Motors**	**8%**	**B2**
	17.1 DC motors 17.1.1 State the factors that determine the direction of rotation of DC motors. 17.1.2 State the right hand rule for motors 17.1.3 Explain the process of commutation in DC motors 17.1.4 Describe the construction and operational characteristics of series, shunt, and compound DC motors 17.1.5 Describe speed and direction control techniques for DC motors 17.2 AC motors 17.2.1 Describe the construction and operational characteristics of single-phase, two-phase, and three-phase AC motors 17.2.2 Describe the construction, operation and advantage of both delta and wye threephase connections for AC motors 17.2.3 State the primary application of synchronous motors 17.2.4 Describe the construction and operational characteristics of induction motors		
218.00	**Understand Interfacing of Electronics Products**	**4%**	**B2**
	18.1 List input circuit signal levels which may be expected for various common electronics products or test equipment 18.2 List anticipated signal or voltage levels for output circuits in audio and video equipment 18.3 Explain the importance of impedance matching; list causes of mismatches 18.4 Explain the purposes of plugs and connectors and why it is necessary to use the proper ones 18.5 Explain grounding, proper and improper methods, and the results of power source mismatch 18.6 List potential signal conflict symptoms 18.7 List common wiring and splicing conventions for POTS (plain old telephone service)		
219.00	**Understand Technician Work Procedure**	**6%**	**B2**
	19.1 Explain major invoice and billing concepts for service businesses 19.2 Describe ways to procure service literature 19.3 Describe how to locate and cross-reference parts and products in catalogs 19.4 Explain the purposes and requirements for proper record keeping 19.5 Calculate individual and departmental productivity for a specific period 19.6 Describe how to contact product maker help desks and service departments 19.7 Explain estimate concepts for service work 19.8 Describe field technician work procedures which may differ from in-shop routines 19.9 Explain project management and list steps to follow to achieve maximum results		

Appendix A Credential Information

I. Credentials name

ETA-I: EM2 – Associate C.E.T. - AC BASICS, EM3 – Associate C.E.T. –ANALOG BASICS and EM5 Associate C.E.T. – COMPREHENSIVE BASICS

II. Vendor(s) name and contact information

A. NIDA - http://www.lli.com/products/electronics/nida.htm

B. LabVolt - http://www.seslabs.com/

C. Heathkit - http://www.carolinatraining.com/

III. Use (desirability) of credential in industry

The Electronics Modules program is based on ETA's Associate level certification, divided into five modules. The purpose of this is to align with a growing portion of the electronics education industry that is charged with providing electronics training that does not include the total content of traditional Basic Electronics courses. In some instances, technical institutions are asked to provide training in only certain areas of electronics. This is so companies that need only narrower skills and knowledge (than one expects of a complete Associate CET) can employ workers who have required knowledge and skills for only the technology and processes they currently use at that company. To provide a path for the technician leading to the Associate CET credential, the five BASIC modules of the AST can be acquired individually. Once a technician attains all five module certifications, ETA will issue an official Associate certification (all five must be passed within a two-year period). The technician may also choose to gain only those modules needed in order to be employable. The Electronics Modules are also a great retention tool. This course covers the following EM2 – Associate C.E.T. - AC BASICS, EM3 – Associate C.E.T. –ANALOG BASICS and EM5 Associate C.E.T. – COMPREHENSIVE BASICS

ETA International represents a wide variety of students and electronics professionals from all industries, including:

* Fiber Optics
* Customer Service
* Biomedical
* Computer and Computer Networking
* Telecommunications
* Wireless Communications
* Consumer Electronics
* Video Distribution
* Aviation
* Industrial Electronics
* Radar
* Satellite

IV. Impact on future employment opportunities

Employers worldwide choose ETA-certified electronics professionals because of our certification programs' competency criteria and testing benchmarks that conform to the highest international electronics standards.

ETA-certified professionals work for some of the most widely-known companies, including Bellsouth, ADT Security, American Airlines, AutoZone, Boeing, Budweiser, Canon, Caterpillar, Circuit City, Ford Motor Company, Home Depot, Kmart, Lockheed Martin, Motorola, Quest Communications, Raytheon, State Farm, TD Ameritrade, Verizon Communications and thousands more..

V. Cost of credential

NCDPI has arranged for a statewide membership for all electronic teachers in the state. This membership provides free membership for instructors, three certification test for teachers each year with free retakes, if necessary, and reduced cost for all students' certifications. The cost for each EM series test is $25, but with state membership the fee is approximately $22 per test. If LEAs would prefer to complete all courses and then have the student take the comprehensive test, Associate Electronics Technician (CETa), that cost is normally $60, however with the state membership, the cost is reduced to approximately $51. All ETA-I exams can be administered at the high school (the teacher would need to apply for proctor status with ETA-I).

Due to the cost of certification, NCDPI has partnered with NIDA to obtain a secured test bank that correlates to EM modules 1 through 4. This secure item bank is verified and validated by NIDA and is not assessable by instructors. These test items have been approved for use for the compilation of a statewide post-assessment for this course by all participating vendors. A final course exam will be provided to the NCDPI program area consultant and distributed using the same delivery channels for all CTE generated test. This exam will not have any additional cost to the LEA. The results from this third party assessment will be used for the students' technical attainment metrics.

Note: Some LEAs have opted to use the post-assessment as a metric to determine who it will purchase ETA-I exams for selected students. This is to ensure funds are not spent needlessly.

VI. Description of how to obtain assessment test from ETA-I

All testing for ETA-I certifications can be conducted online through their testing provider. Each NC Electronics' teacher will be certified by ETA-I as a Certification Administrator (CA) and be able to proctor any ETA-I exams. Exam can be purchased by LEA, Schools, or the individual. ETA-I is on e-procurement.

VII. Description of state or national cut score standard AND reportable to state in data timeline

Passing is 75% (excludes product-specific exams) on all ETA-I certifications. If the student is not successful, then they will be allowed to retake the examination after 30 days at no additional cost. All retakes must be completed within one year.

Since the exam is taken online, test results will be displayed immediately after completing the test.

All students will be required to take the NIDA generated final exam. Cut scores will be developed in accordance with all other NCDPI generated final exams.

Results can be provided from ETA-I for all students attempting the exam and will be used for technical attainment data related to certifications. All other technical attainment data will be obtained from the NIDA exam provided to all students and tracked through the NCDPI testing system.

The information from the NCDPI generated exam will be handled in accordance with all other NCDPI generated exams.