

# Apprenticeship CET (APP)—2007

## BASIC ELECTRONICS COMPETENCIES

Training electronics workers as entry level, apprenticed, or installer personnel should include the following 9 Categories and 61 Item subject matter headings:

### 1.0 Electrical Theory

- 1.1 Describe atomic structure, the components of the atom, their charges and importance to electronics technology
- 1.2 Explain the term coulomb and its relationship to the ampere
- 1.3 List common uses for magnetism in electronics technology
- 1.4 Explain basic uses for electricity
- 1.5 Describe the basic methods of using electricity to operate a motor and how mechanical motion causes a generator to produce electrical current
- 1.6 Explain the differences between current, voltage and resistance
- 1.7 List different types of resistive materials and describe how resistors are used in electronics
- 1.8 Explain time and magnitude values of a sinusoidal waveform
- 1.9 Describe how to calculate wavelength
- 1.10 Explain how to derive harmonics from a given frequency
- 1.11 Describe the purposes of capacitors and List common types and construction designs
- 1.12 Explain how inductance relates to magnetism and describe coil construction, cores and usages
- 1.13 Show a comparison between reactance and resistance and describe current/voltage relationships
- 1.14 Compare impedance with reactance and resistance and explain the causes and effects of impedance
- 1.15 List voltage sources, AC and DC, batteries and natural generation
- 1.16 List ohms law formulas for current, voltage, resistance and the power formula; solve math problems utilizing each
- 1.17 Calculate power consumption and requirements
- 1.18 Explain voltage relationships: Kirchhoff's voltage law, voltage reference, and voltage divider
- 1.19 Explain current relationships: Kirchhoff's current law, current sources, and current divider
- 1.20 State the maximum power transfer theorem

## **2.0 Electronic Components**

- 2.1 Identify resistor values from color code or other marks and list composition and reasons for different usages
- 2.2 Identify capacitor types; list common usages; methods of varying capacitance and explain the term *charge*
- 2.3 Identify inductor types and reasons for various core materials; how diameter and wire size affects the values
- 2.4 Identify common types of transformers and list uses for each; explain step up/down voltage methods; explain why laminations are used

## **3.0 Cabling**

- 3.1 List wire types and construction
- 3.2 List wire gauges used for various purposes
- 3.3 Describe how Telco uses Load-coils and why
- 3.4 List common identifications for copper cables, such as #18 and #24, and UTP telephone cable
- 3.5 Explain the effects of proper and improper termination
- 3.6 Explain the purposes of grounding and common conventions used in electrical and electronics
- 3.7 Explain what is meant by Telco's local loop and how it is tested

## **4.0 Power Supplies**

- 4.1 Describe battery supplies and list common usages; also explain recharging principles
- 4.2 Explain where fuses and circuit breakers are commonly (and electrically) located in circuits; approximate sizes for common circuits, and circuit breaker configuration.

## **5.0 Test Equipment & Measurements**

- 5.1 Describe how volt-ohm-current meters operate
- 5.2 Identify meter protection, safety and usage
- 5.3 Explain care of equipment and test leads
- 5.4 List the purposes of signal generators
- 5.5 Describe oscilloscope usage; explain the purposes of the front panel control
- 5.6 Build and test a bread boarded resistive parallel and series-parallel circuit for following measurements using a DVOM: resistance, current, & voltage
- 5.7 Build and test a bread boarded series resonant and parallel resonant circuit using a signal generator and oscilloscope

## **6.0 Safety Precautions**

- 6.1 Describe the physiological reactions electrical shock causes; list various degrees of current the human body can tolerate
- 6.2 Explain the concept of First Aid and its particular importance to workers in electric and electronics fields; explain precautions for untrained people
- 6.3 Explain what the National Electric Code is and describe various rules technicians must abide by
- 6.4 Describe fusing and circuit breaker rules and reasons for different types of fuses
- 6.5 List tools hazards that are associated with technician activities in the workplace and in the field.
- 6.6 Describe lockout and tagging rules for potentially unsafe electrical or mechanical hazards
- 6.7 Explain eye and ear protection needed by technicians
- 6.8 List ladder handling and usage and OSHA heights safety rules
- 6.9 List service vehicle safety concerns such as ladder or transporting security and flying objects, driver screens inside the vehicle

## **7.0 Mathematics and Formulas**

- 7.1 Quote Ohms law and the basic power equation and solve for circuit values when given voltage, current, resistance, or power
- 7.2 List other common basic electronic formulas
- 7.3 Explain how to convert a decimal number into a binary number or a binary number into a decimal number

## **8.0 Electronic Circuits: Series and Parallel**

- 8.1 Identify and describe the operation of common DC circuits
- 8.2 Identify and describe the operation of common AC circuits
- 8.3 Explain how series circuits, R, L, C are used in electronics equipment
- 8.4 Explain series resonance and parallel resonance
- 8.5 Describe filter circuits, why and how they are used

## **9.0 Technician Work Procedures**

- 9.1 Demonstrate location/cross referencing of parts and product in catalogs
- 9.2 Explain the purposes and requirements for proper record keeping
- 9.3 Explain estimate concepts for service work
- 9.4 Describe field technician work procedures that may differ from in-shop routines

Notes: The purpose in distributing the above Competencies List is to provide a detailed syllabus for electronics educational institutions and instructors. Also to go further and explain what the student should be able to do with each of the items included in the Categories and Competencies listings.

**Suggested study texts:**

*The Associate CET Certification Study Guide 2008*—Available through ETA-I, 800-288-3824, for \$60

*Electronics; Principles and Applications 2002 6th ed.*, by Schuler; Glencoe/McGraw Hill Publications ISBN—0078288932, \$76.75 order at [www.barnesandnoble.com](http://www.barnesandnoble.com)

The *CEA Study Guide* by CEA (EIA), Anatonakos; (Available from IS CET)

*Electronics Theory*, Delton Horn;

order at [www.barnesandnoble.com](http://www.barnesandnoble.com)

*Mastering Technical Mathematics*, 2nd ed; McGraw-Hill; 592 p.; \$34.95; 1-800-2-MCGRAW

*How to Test Almost Everything Electronic*; Delton Horn, McGraw-Hill #030406-8; \$19.95;

1-800-2-MCGRAW

Check online for NEETS module content: [www.tpub.com/neets/index.htm](http://www.tpub.com/neets/index.htm)

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