ETA® International
Associate C.E.T. - AC BASICS

BASIC ELECTRONICS CERTIFICATION COMPETENCIES—2009

(As suggested for segmenting the Associate CET Competencies into 5 BASIC areas: DC; AC; Analog; Digital; and Comprehensive)

1.0 Principles of Alternating Current

- 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

2.0 Electronic components and terms

- 2.1 Identify capacitor types; list common usages; methods of varying capacitance
- 2.2 Identify inductor types and reasons for various core materials
- 2.3 Identify common types of transformers and list uses for each; explain why laminations are used
- 2.4 Indentify the following terms:
  - 2.4.1 Charge
  - 2.4.2 Coulomb
  - 2.4.3 Joule
  - 2.4.4 Reluctance
  - 2.4.5 Capacitors
  - 2.4.6 Inductors
  - 2.4.7 Capacitance
  - 2.4.8 Inductance
  - 2.4.9 Reactance
  - 2.4.10 Impedance

3.0 Principles of Inductance

- 3.1 Describe the requirements for inductance in AC electrical circuits
- 3.2 Explain Lenz's law in complement with Faraday's law of induction
- 3.3 Identify the differences between self-inductance and mutual inductance
- 3.4 Explain the factors affecting inductance
  - 3.4.1 Number of turns of a coil
  - 3.4.2 Coil Diameter
  - 3.4.3 Length of the coil
  - 3.4.4 Core material

3.5 List the factors used in calculating inductance for a single and multi-layer air core coil
3.6 Explain how inductance relates to magnetism and describe coil construction, cores and usages
3.7 Describe the differences between reactance and resistance and describe current/voltage relationships
3.8 Compare impedance with reactance and resistance and explain the causes and effects of impedance
3.9 Describe the types of power losses associated with inductors
3.10Calculate power consumption and requirements in inductors in AC circuits
3.11 Solve series, parallel and series-parallel problems utilizing each appropriate formula for reactance, voltage, current and power

4.0 Transformer Theory

4.1 Describe the different types of transformer construction and operation
4.2 List the various types of transformers
4.3 Determine the method for determining a step-up or step-down transformer
4.4 Describe the operation of a saturable reactor

5.0 Principles of Capacitance

5.1 Describe the factors affecting capacitor operation in AC circuits
5.2 Show the different purposes for capacitors and list common types and construction of the different types
5.3 Explain the advantages and disadvantages of utilizing an electrolytic capacitor in a an AC circuit
5.4 Describe the differences between capacitive reactance and resistance and describe current/voltage relationships
5.5 Solve series, parallel and series-parallel problems utilizing each appropriate formula for reactance, voltage, current and power

6.0 AC Generator Theory

6.1 Describe the components associated with an AC generator
6.2 Explain the Left-Hand rule for generators
6.3 Define Lenz's law for induction
6.4 Explain the difference between single and three phase power generation
6.5 Describe how three phase power can be manipulated to obtain a desired voltage and number of phases
6.6 List the differences associated with Delta and Wye three phase power connections

7.0 AC Motor Theory

7.1 List different types of AC motors and methods of operation
7.2 Describe the components and principles associated with the operation of an AC motor
7.3 Describe the basic methods of using electricity to operate an induction motor and how transferred mechanical motion causes a generator to produce electrical current

7.4 Calculate the number of pole pairs needed to produce desired rpm’s
7.5 Explain the principle behind Shaded-pole and Split-phase induction motors
7.6 Describe the various methods used for starting induction motors

8.0 RC, RL and RCL Principles

8.1 Explain phase relationships of voltage and current for series and parallel RL, RC and RCL circuits
8.2 Calculate power, current, impedance and voltage vectors for series and parallel RCL circuits
8.3 Explain bandwidth and selectivity for series and parallel resonant circuits
8.4 Describe the component configurations used in PI, L, and T type high and low pass filter circuits

9.0 Cabling

9.1 Describe impedance and its causes; explain reasons for maintaining a cable’s characteristics
9.2 Explain the effects of proper and improper termination
9.3 Explain the purposes of grounding and common conventions used in electrical and electronics work

10.0 Test Equipment & Measurements

10.1 Describe how volt-ohm-current meters operate
10.2 List the purposes and types of signal generators
10.3 Describe how oscilloscope front panel controls are used
10.4 Explain what LRC substitution equipment is and its purposes
10.5 Explain reasons for using rheostats, isolation transformers and variacs and why size matters

11.0 Basic Electrical Safety Precautions

11.1 Safe practices and standards
- 11.1.1 Describe personal safety precautions for working with electric and electronic devices

11.2 Electrical shock
- 11.2.1 Describe the human physiological reactions electrical shock causes.
- 11.2.2 List various degrees of current the human body can tolerate.

11.3 Emergency response
- 11.3.1 Explain the concept of First Aid and its particular importance to workers in electric and electronic fields
- 11.3.2 Explain precautions needed in the area of electronic safety

11.4 Fire Safety
- 11.4.1 Describe the different classes (A, B, C, & D) of fires and the type of extinguishers used to fight them.

11.5 List applicable governing fire safety regulations NEC (National Electrical Code) and NFPA 70 (National Fire Protection Association)

11.6 Explain what the NEC (National Electrical Code) and NFPA 70 (National Fire Protection Association) are, and describe various rules technicians must abide by

12.0 Mathematics and Formulas

12.1 Quote Ohms law power, voltage, current and resistance formulas and solve for circuit values

12.2 List other common basic electronic formulas relative to AC

End of AC BASICS Competencies Listing

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 Competencies listings.