ASSOCIATE C.E.T. (CETa) - COMPETENCY LISTING
BASIC ELECTRONICS CERTIFICATION
(As recommended by the NCEE—National Coalition for Electronics Education and ETA’s Associate C.E.T. Exam Development Committee)
The Associate C.E.T. (CETa) is designed for covering the basic electronics theory and applications used in all electronics disciplines. The competencies listed below are considered the foundation of component based general electronics knowledge and skills.

1.0 Electrical Theory
1.1. Describe atomic structure, the components of the atom, their charges and importance to electronics technology
1.2. List ten uses for magnetism in electronics technology
1.3. Explain basic uses for electricity
1.4. Describe the basic methods of using electricity to operate a motor and how mechanical motion causes a generator to produce electrical current
1.5. Explain the differences between current, voltage and resistance
1.6. List different types of resistive materials and how resistors are used in electronics
1.7. Show the different purposes for capacitors and list common types and construction
1.8. Explain how inductance relates to magnetism and describe coil construction, cores and usages
1.9. Show a comparison between reactance and resistance and describe current/voltage relationships
1.10. Compare impedance with reactance and resistance and explain the causes and effects of impedance
1.11. List voltage sources, AC and DC, batteries and natural generation
1.12. List Ohms law formulas for current, voltage, resistance and power.
   1.12.1. Solve math problems utilizing each formula
1.13. Calculate power consumption and requirements

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 terms charge and coulomb
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
2.5. Identify transistors as to type and usage, such as unijunction, FETs and MOSFETS; explain beta and alpha and provide common DC and bias voltage ranges; list common usages
2.6. Identify other semiconductors and explain their uses: Darlington pairs; unijunction transistors and Gunn diodes
2.7. Compare thyristors with other semiconductors; identifying diacs, triacs and SCRs and explain their operation.
2.8. Explain zener diode ratings; describe usage in regulator circuits
2.9. List common optical devices (LEDs, LCDs, etc.); describe how photovoltaic cells are activated. Draw symbols for photo resistors, photodiodes and photo transistors; list materials from which these devices are made
2.10. Describe MOS, CMES, FET applications

3.0 Soldering - Desoldering Tools
3.1. Describe solder safety as it pertains to burns and potential fires or damage to facilities or customer products
3.2. Explain the cause of solder fumes and the effects of lead poisoning
3.3. List causes and precautions to prevent or reduce solder splatter
3.4. Explain the reasons for flux usage and describe types
3.5. List types of solder and reasons for choosing each
3.6. Explain heat shunts, why and how they are used
3.7. Identify cold solder joints and explain causes
3.8. Describe the differences between good and bad mechanical and electrical solder connections
3.9. Describe proper care of solder and de-solder equipment and aids
3.10. Explain de-soldering principles
3.11. Describe various types of de-soldering equipment and how it is used
3.12. Demonstrate the use of braid-wick solder removers

4.0 Block Diagrams - Schematics - Wiring Diagrams
4.1. Draw common electrical/electronic symbols
4.2. Explain block diagrams use for troubleshooting and maintenance of electronics products
4.3. Explain the differences between wiring prints, schematics and block diagrams
4.4. Describe the purpose and use of test points and indicate their likely placement on schematics
4.5. Point out common drafting principles used for electronic and electrical drawings
4.6. Explain methods used for signal tracing
4.7. Describe basic building and house wiring concepts and explain why technicians need to be familiar with them
4.8. Explain schematics use to locate component and wiring failures in electronics products
4.9. Explain the methods of using flow diagrams/charts

5.0 Cabling
5.1. List wire types and construction
5.2. List wire gauges used for various purposes
5.3. Explain construction of coaxial cable and the impedance characteristics
5.4. List common identifications for copper cables in standards, such as #18 and #24 diameter in the American Wire Gauge (AWG) and UTP telephone cable in ANSI/TIA 568
5.5. Explain major differences between copper, coaxial and fiber optic cables
5.6. Describe impedance and its causes; explain reasons for maintaining a cable’s characteristics
5.7. Explain the effects of proper and improper termination
5.8. Explain the purposes of grounding and common conventions used in electrical / electronics work
5.9. Describe splicing knowledge and ability of coaxial and copper cable
5.9.1. Explain two types of fiber splices
5.10. Demonstrate testing methods for all three types of cables and compare dB loss measurements and techniques
5.11. Compare the fittings and connectors used in cabling and list potential defects a technician may encounter
5.12. Describe proper crimping of communications wiring connectors
5.13. Explain how cable prep tools are used and demonstrate proper and improper crimping

6.0 Power Supplies
6.1. Explain shock hazards when servicing power supplies in electronic equipment
6.2. Describe the differences between transformer powered supplies and line-connected supplies
6.3. Describe battery supplies and list common usages; also explain recharging principles
6.4. Explain the reasons for filtering, describe hum, and identify common filter types (pi, t, l, etc.)
6.5. Explain the reasons for power supply regulation and list common components used in regulated supplies
6.6. Explain the term ‘Integrated high voltage transformer’ supply and explain how it differs from direct or other power supply types
6.7. Explain how multiple output supplies are able to supply more than one voltage
6.8. Explain where fuses and circuit breakers are commonly and electrically located in circuits; approximate sizes for common circuits; house service box common fuses and circuit breaker configuration and precautions for replacement

7.0 Test Equipment and Measurements
7.1. Describe how volt-ohm-current meters operate
7.2. Explain meter construction and components
7.3. Identify meter protection, safety and usage
7.4. Explain care of equipment and test leads
7.5. List the purposes and types of signal generators
7.6. Describe meter loading and precautions
7.7. Explain the purposes of frequency counters and list their limitations
7.8. Explain what R-C-L substitution equipment is and its purposes; explain ESR capacitance measurement equipment
7.9. List the uses and precautions for logic test probes
7.10. Explain how logic pulsers are used
7.11. Describe oscilloscope uses; explain the purposes of each front panel control
7.12. List the uses for pattern generators
7.13. Define dummy load; show where and why used
7.14. Explain reasons for using rheostats, isolation transformers and variacs and why size matters

8.0 Safety Precautions
8.1. Describe the physiological reactions electrical shock causes; list various degrees of current the human body can tolerate
8.2. Explain the concept of First Aid and its particular importance to workers in electric and electronics fields; explain precautions for untrained people
8.3. Explain what the National Electrical Code (NEC®) is and describe various rules technicians must abide by
8.4. Explain National Fire Protection Association (NFPA®) 70 rules and describe how technicians comply and may violate them
8.5. Describe fusing and circuit breaker rules and reasons for different type of fuses
8.6. Explain static causes and CMOS damage prevention straps, mats and grounding
8.7. List tools hazards which are associated with technician activities in the workplace and in the field.
8.8. Describe lockout and tagging rules for potentially unsafe electrical or mechanical hazards
8.9. Explain RF transmitter hazards and precautions
8.10. List fiber optics hazards to skin and eyes
8.11. Explain eye and ear protection needed by technicians
8.12. List ladder handling and usage and OSHA heights safety rules
8.13. List service vehicle safety concerns such as ladder or transporting security and flying objects, driver screens inside the vehicle
8.14. Describe the different classes (A, B, C, D & K) of fires and the types of extinguishers used to fight them

9.0 Mathematics and Formulas
9.1. Quote Ohms law power, voltage, current and resistance formulas and solve for circuit values
9.2. List other common basic electronic formulas
9.3. Calculate wavelength, frequency and power values
9.4. Convert binary, decimal, octal, hex number
9.5. Explain boolean algebra and its use in digital circuitry
9.6. Explain decibels and show reasons for using dBs in signal level, power and audio calculations
9.7. Demonstrate how graphs are used to demonstrate electronics functions

10.0 Radio Communications Technology
10.1. Explain wave propagation and its importance to wireless communications
10.2. Describe the theory of how antennas work; list the types of transmission lines
10.3. Explain polarization, electromagnetic and electro-static fields and their relationships to each other
10.4. Explain the differences between AM, FM radio and TV signals
10.5. Describe the differences in the usage of communications radios and commercial broadcast receivers.
10.6. Describe the major radio receiver circuitry sections
10.7. List common frequency bands
10.8. Demonstrate radio circuit tuning and adjustments
10.9. Demonstrate the relationships between frequency and wavelength
11.0 Electronic Circuits: Series and Parallel
11.1. Identify and describe the operation of common DC circuits
11.2. Identify and describe the operation of common AC circuits
11.3. Explain how series circuits, R, L, C are used in electronics equipment
11.4. Explain the purpose of oscillators
11.5. Show how oscillators and multivibrators are similar and how they differ
11.6. Classify circuits as inductive, capacitive and resistive
11.7. Explain resonance and show how to calculate resonant frequency
11.8. Describe polar and rectangular presentations of L, R, C circuits
11.9. Explain Kirchhoff’s law and its importance to electronics technicians
11.10. Explain the purposes and types of differentiator or integrator circuits
11.11. Describe the sections of a PLL (phase locked loop) circuit and PLL circuit use
11.12. Describe filter circuits, why and how they are used
11.13. Explain wave shaping circuits and explain their purposes
11.14. Describe the relationships between bandwidth and “Q” in an electronics circuit

12.0 Amplifiers
12.1. List common amplifier devices
12.2. Describe the purpose of each component in an amplifier circuit
12.3. List the usages and classes of amplifiers
12.4. Describe biasing and gain characteristics
12.5. Explain frequency response of an amplifier circuit and why it is important
12.6. Explain the words ‘preamplifier’ and ‘line amplifier’ and where these units are commonly used
12.7. Explain the uses of operational amplifiers and how they differ from other amplifiers
12.8. Show causes of distortion in amplifiers and list ways to reduce or eliminate it
12.9. Explain how inaccurate measurements can be experienced due to meter or scope loading.
   12.9.1. List ways to overcome loading problems
12.10. Describe specifications for broadband amplifiers as compared with common narrow band units
12.11. Explain the operation of high power electron tubes

13.0 Interfacing of Electronics Products
13.1. List input circuit signal levels which may be expected for various common electronics products or test equipment
13.2. List anticipated signal or voltage levels for output circuits in audio and video equipment
13.3. Explain the importance of impedance matching; list causes of mismatches
13.4. Explain the purposes of plugs and connectors and why it is necessary to use the proper ones
13.5. Explain grounding, proper and improper methods, and the results of power source mismatch
13.6. List potential signal conflict symptoms
13.7. Describe a basic telephone (POTS) circuit.
   13.7.1. List common wiring and splicing conventions for POTS

14.0 Digital Concepts and Circuitry
14.1. Describe ASCII code
14.2. Identify each basic digital gate
14.3. Construct truth tables for common gates
14.4. Explain how counters operate
14.5. Explain the purpose of flip flops and list common types
14.6. Explain the purpose of a digital bus and show how it is connected to various sections of a product
14.7. List types of display circuitry and describe how numbers and letters are activated digitally
14.8. Explain the purpose of computer clocks
14.9. Show how pulsers are used for digital signal tracing and how logic probes are used to verify states in digital equipment
14.10. Describe digital clock usage and circuitry
14.11. Describe how microprocessors function and identify the basic components and pin-outs
15.0 Computer Electronics
15.1. Describe the major sections of a computer
15.2. Demonstrate how the computer block diagram and flow charts are utilized
15.3. Sketch the major blocks contained in a microprocessor chip and describe the purpose of each block
15.4. Describe different types of computer memory and how storage is accomplished
15.5. Explain programmable logic controls (PLCs) and list usages
15.6. Describe basic programming concepts
15.7. Describe the reasons for different computer languages and their relationships
15.8. Define the word ‘peripheral’ and list various types
15.9. Explain the reasons for using interface devices/chips/cards and name common types

16.0 Computer Applications
16.1. Demonstrate knowledge of basic computer operation
16.2. Explain steps in installation/set up of a computer
16.3. Explain the reasons and choices used in configuring a computer
16.4. Demonstrate proper loading and storage of common programs and applications
16.5. Explain basic and common utilities programs and list reasons for their use
16.6. List ways to backup data and the importance of doing so
16.7. Explain the causes of line surges and viruses and protection procedures against each
16.8. Explain major components of the Internet, how it is accessed and common applications
16.9. Demonstrate how to download a service or application, data or programs
16.10. Explain how to use the Internet to locate parts and service literature
16.11. Explain the differences between an individual computer and basic networking

17.0 Audio and Video Systems
17.1. Explain major components of the most common home entertainment products
17.2. Describe microphone technology and usage
17.3. Explain speaker construction and precautions
17.4. Explain basic recording and playback products operation, mechanical and electrical technology
17.5. Explain the difference between individual home entertainment products and the Home Theater concept
17.6. Explain how alarm-security systems may be interfaced with entertainment/information products
17.7. Describe the differences between cable TV, off-air broadcast and telephone signals
17.8. Describe the differences between good quality and distorted sound and electronic/acoustical reasons for each
17.9. Explain how signals may conflict and the symptoms the conflict may produce
17.10. Explain how to isolate troubles between discrete equipment units

18.0 Optical Electronics
18.1. List common electronics display devices
18.2. Explain the operation of a kinescope
18.3. Explain how LCD displays operate, their advantages and disadvantages
18.4. Explain the basics of electronic cameras and sensors
18.5. Describe how LED remote hand units work
18.6. Describe plasma TV technology and its uses in TV and computer displays
18.7. Explain why and list some locations or circuits in which opto-isolators are used
18.8. List uses for light activated controls and how photo devices are incorporated
18.9. Describe how broadband signal RF and optical links are used

19.0 Telecommunications Basics
19.1. Describe major types of two-way radio communications (avionics, land mobile, maritime, etc.)
19.2. Describe wireless telephone/video/data technology basics and list the TIA-EIA standard which applies
19.3. Describe satellite communications principles
19.4. Describe wired data and voice communications network technology

20.0 Technician Work Procedures
20.1. Explain major invoice and billing concepts for service businesses
20.2. Describe ways to procure service literature
20.3. Describe location/cross referencing of parts and product in catalogs
20.4. Explain the purposes and requirements for proper record keeping
20.5. Calculate individual and department productivity for a specific period
20.6. Describe contacting product maker help desks and service departments
20.7. Explain estimate concepts for service work
20.8. Describe field technician work procedures that may differ from in-shop routines
20.9. Explain project management and list steps to follow to achieve maximum results

End of Basic Electronics Competencies Listing (with 20 major Categories)

Notes:
The NCEE (National Coalition for Electronics Education) and allied associations encourage the nation's school systems to adopt these competencies for their basic electronics courses.

Find an ETA approved school and approved test site:  http://www.eta-i.org/test_sites.html

Suggested study texts and resources:
The Associate CET Study Guide, 6E; ISBN 1-891749-07-2; ETA International; 2012; —Available through ETA at 800-288-3824, $60
EM Study Guide series; Karl Eilers; download through ETA at 800-288-3824 or www.eta-i.org
Introduction to Electricity, Electronics, and Electromagnetics, 5E; ISBN 978-0130105738;
Boylestad, Nashelsky; Prentice Hall; 2001
Teach Yourself Electricity and Electronics, 5E; ; Gibilisco ISBN 978-0071741354; McGraw-Hill / TAB Books; 2011
Introductory DC / AC Electronics, 6E; ISBN 978-0131139848; Cook; Prentice Hall; 2004
Introduction to Electronics; ISBN 978-0534012434; Crozier; Breton Pub.; 1983
Becoming An Electronics Technician, 4E; ISBN 978-0130932198; Reis; Prentice Hall; 2001
Review MasteringElectronicsDesign.com website; RMS material; Adrian S. Nastase; 2013
Review Radio-Electronics.com website; electronics material; Ian Poole; 2001

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