ASSOCIATE C.E.T. (CETa)

BASIC ELECTRONICS CERTIFICATION

COMPETENCY REQUIREMENTS

The Associate Certified Electronics Technician (CETa) is designed for encompassing the basic electronics theory and applications used in all electronics disciplines. By doing so, the Associate is the foundation for journeyman/senior/master certification program. The CETa is designed for technicians having less than two years' experience or training in electronics.
The competencies listed below are considered the foundation of component based general electronics knowledge and skills.

1.0 Safety Precautions

1.1. Describe the physiological reactions electrical shock causes
1.2. Explain the First Aid concepts and its particular importance to workers in electric and electronics fields explaining precautions for the untrained
1.3. Explain the National Fire Protection Association (NFPA®) 70 rules described as the National Electrical Code® - NEC®, explaining how technicians comply with safety and installations
1.4. Describe fusing and circuit breaker rules and reasons for different type of fuses
1.5. Explain static causes, electrostatic discharge and CMOS damage prevention straps, mats and grounding
1.6. List tools hazards which are associated with technician activities in the workplace and in the field
1.7. Describe lockout/tag out rules for potentially unsafe electrical or mechanical hazards
1.8. Explain RF transmitter and transmission hazards and precautions including MPE (maximum permissible exposure)
1.9. List optical fibers hazards to skin and eyes
1.10. Explain personal protection needed by technicians:
    1.10.1. Describe PPE (personal protection equipment) needs, i.e. NFPA Table 130.5(c)
    1.10.2. Describe MPE in RF Safety (OSHA and ANSI)
    1.10.3. Describe other OSHA safety rules
1.11. List ladder handling and usage (ANSI A14) and OSHA working at heights safety rules
1.12. List service vehicle safety concerns such as ladder or transporting security and flying objects, driver screens inside the vehicle
1.13. Differentiate the classes of fires (A, B, C, D & K) and the types of extinguishers used to fight them
1.14. Explain emergency responses/treatments for the above safety issues

2.0 Electrical Theory

2.1. Describe atomic structure, the components of the atom, their charges and importance to electronics technology
2.2. Describe the principles of electromagnetism
    2.2.1. Explain the different types of magnetic fields
    2.2.2. Explain the direct relationship between electricity and magnetism
2.3. Explain uses for magnetism in electronics technology
2.4. Explain basic uses for electricity
2.5. Describe the basic methods of using electricity to operate a motor and how mechanical motion causes a generator to produce electrical current
2.6. Explain the differences between current, voltage and resistance
2.7. Differentiate between the types of resistive materials and how resistors are used in electronics
2.8. Describe the different purposes for capacitors and list common types and construction
2.9. Explain how inductance relates to magnetism and describe coil construction, cores and usages
2.10. Compare reactance and resistance and describe current/voltage relationships
2.11. Compare impedance with reactance and resistance and then explain the causes and effects of impedance, combined reactance
2.12. List voltage sources, AC and DC, batteries and natural generation
    2.12.1. Identify Peak, Peak-to-Peak, and RMS AC sources
    2.12.2. Identify Duty Cycle and Pulse Width DC sources

2.13. List Ohms law formulas for current, voltage, resistance and power
    2.13.1. Explain how to calculate problems utilizing each formula
2.14. Explain how to calculate power consumption and requirements

3.0 Electronic Components

3.1. Identify resistors as to type and applications
    3.1.1. Describe the following type of resistors: carbon film, fixed value, metal film, potentiometer, rheostats, thermistors, and wire wound
    3.1.2. Identify resistor values from color code or other marks and list composition
    3.1.3. Explain how thermally sensitive components are used
    3.1.4. Calculate voltage division on a potentiometer
3.2. Identify capacitor types and list common usages
    3.2.1. Identify methods of varying capacitance
    3.2.2. Explain the terms charge and coulomb
3.3. Identify inductor types and reasons for various core materials
    3.3.1. Explain how diameter and wire size affects these values
3.4. Identify common types of transformers and list uses for each
    3.4.1. Explain step up/down voltage methods
    3.4.2. Explain why laminations are used
3.5. Identify transistors as to type, usage, biasing and applications:
    3.5.1. Describe MOS, CMOS, FET, IGBT and Darlington Pair operation and applications
    3.5.2. Analyze biasing voltages for NPN & PNP bipolar transistors, BJTs, JFETs, and MOSFETs
    3.5.3. Explain beta and alpha, enhance/depletion mode
3.6. Identify multi-junction semiconductors as to type and applications:
    3.6.1. Identify Diacs, Triacs and SCRs (silicon-controlled rectifiers) and explain their operation
    3.6.2. Compare SCRs with other semiconductors
3.7. Identify various diode types: Silicon, Schottky, Germanium, LED, photo, Zener
    3.7.1. Describe Silicon, Schottky, Germanium, LED, Photo, and Zener operations and applications
    3.7.2. Analyze voltage bias, current, and power consumption in a circuit for Silicon and Germanium diodes
    3.7.3. Explain Zener diode ratings; describe usage in regulator circuits
3.8. Describe types of integrated circuits (I.C.), such as microprocessors, identifying the basic components and pin-outs
3.9. Describe various relay types
    3.9.1. Identify normally-open and normally-closed contacts and their operation
    3.9.2. Identify the coil of a relay
    3.9.3. Compare the operation of a solid-state relay to a mechanical relay

4.0 Electronic Circuits: Series and Parallel

4.1. Identify and describe the operation of common DC circuits
4.2. Identify and describe the operation of common AC circuits
4.3. Explain how series circuits, R, L, C are used in electronics equipment
4.4. Explain how parallel circuits, R, L, C are used in electronics equipment, loads
4.5. Explain the purpose of oscillators: crystal use
4.6. Differentiate between oscillators and multivibrators
4.7. Classify circuits as inductive, capacitive and resistive
4.8. Explain resonance and show how to calculate resonant frequency
4.9. Describe polar and rectangular presentations of L, R, C circuits
4.10. Explain Kirchhoff's law and its importance to electronics technicians
4.11. Explain the purposes and types of differentiator or integrator circuits
4.12. Describe the sections of a PLL (phase locked loop) circuit and PLL circuit use
4.13. Describe filter circuits, why and how they are used
4.14. Explain wave-shaping circuits and explain their purposes
4.15. Describe the relationships between bandwidth and "Q" in an electronics circuit
4.16. Explain the piezoelectric effect
4.17. Explain series and parallel calculations for resistive networks; voltage drop, etc

5.0 Soldering - Desoldering Tools

5.1. Describe solder safety as it pertains to burns and potential fires or damage to facilities or customer products
5.2. Explain the cause of solder fumes and the effects of lead poisoning
5.3. List causes and precautions to prevent or reduce solder splatter
5.4. Explain the reasons for flux usage and describe types
5.5. List types of solder and reasons for choosing each
5.6. Explain heat shunts, why and how they are used
5.7. Identify cold solder joints and explain causes
5.8. Describe the differences between good and bad mechanical and electrical solder connections
    5.8.1. Explain basic handling procedures of surface mount (SMT), ball grid array (BGA), gold finger contacts on a printed circuit board (PCB)
    5.8.2. Explain basic procedures for pad repairs (SMT, BGA), plated through hole (PTH), and PCB trace repair
5.9. Describe proper care of solder and de-solder equipment and aids
5.10. Explain de-soldering principles
5.11. Describe various types of de-soldering equipment and how it is used
5.12. Demonstrate the use of solder-wick

6.0 Block Diagrams - Schematics - Wiring Diagrams

6.1. Describe common electrical/electronic symbols
6.2. Explain block diagrams use for troubleshooting and maintenance of electronics products
6.3. Explain the differences between wiring diagrams, schematics and block diagrams
6.4. Describe the purpose and use of test points and indicate their likely placement on schematics
6.5. Point out common drafting principles used for electronic and electrical drawings
6.6. Explain methods used for signal tracing
6.7. Describe basic building and house wiring concepts and explain why technicians need to be familiar with them
6.8. Explain use of schematics to locate component and wiring failures in electronics products
6.9. Explain the methods of using flow diagrams/charts
6.10. Describe basic wiring concepts for I.C. types and pinouts

7.0 Cabling

7.1. List wire types and construction
7.2. List wire gauges used for various purposes
7.3. Explain construction of coaxial cable and the impedance characteristics
7.4. List common identifications for copper cables in standards, such as #18 and #24 diameter in the American Wire Gauge (AWG) and UTP cable in ANSI/TIA 568
7.5. Explain major differences between copper, coaxial and fiber optic cables
7.6. Describe impedance and its causes:
    7.6.1. Explain reasons for maintaining a cable's characteristics
7.7. Explain the effects of proper and improper termination
7.8. Explain the purposes and types of cabling grounding (bonding) and common conventions used in electrical / electronic work
7.9. Describe splicing knowledge and ability of coaxial and copper cable
    7.9.1. Explain types of fiber splices
7.10. Briefly explain testing methods for all three types of cables and compare decibel (dB) loss measurements and techniques
7.11. Compare the fittings and connectors used in cabling and list potential defects a technician may encounter
7.12. Describe proper crimping of communications wiring connectors
7.13. Explain how cable prep tools are used and demonstrate proper and improper crimp applications

8.0 Test Equipment and Measurements

8.1. Describe how digital and analog meters operate
8.2. Explain meter construction and components
8.3. Identify meter protection, safety and usage
8.4. Explain care of equipment and test leads
8.5. List the purposes and types of signal generators
8.6. Describe meter loading and precautions
8.7. Explain the purposes of frequency counters and list their limitations
8.8. Explain what R-C-L substitution equipment is and its purposes
8.9. Explain ESR (Equivalent Series Resistance) capacitance measurement equipment
8.10. List the uses and precautions for logic test probes
8.11. Explain how logic pulsers are used
8.12. Describe oscilloscope uses:
    8.12.1. Explain the purposes of each front panel control
8.13. Describe spectrum analyzer uses and operation
8.14. Define dummy load; show where and why used
8.15. Explain reasons for using rheostats, isolation transformers and variacs and why size matters
8.16. Explain how a potentiometer functions and its use as a variable voltage divider

9.0 Mathematics and Formulas

9.1. Quote Ohm's law formulas for power, voltage, current and resistance and solve for circuit values
9.2. List other common basic electronic formulas
9.3. Explain how to calculate wavelength, frequency and power values
9.4. Convert binary, decimal, octal, hexadecimal numbers
9.5. Explain Boolean algebra and its use in digital circuitry
9.6. Explain decibels (dB) and show reasons for using dBs in signal level, power and audio calculations
9.7. Explain how graphs are used to demonstrate electronics functions
9.8. Explain the International System of Units (SI) prefixes (metric) and conversions
    9.8.1. Describe the NIST.gov Special Publication 811, 9.3: unit name with SI prefix exceptions, (i.e. kilohm and megohm)
9.9. Define exponents (powers of 10) and their calculations

10.0 Power Supplies

10.1. Explain shock hazards when servicing power supplies in electronic equipment
10.2. Describe the differences between transformer powered supplies and line-connected supplies
10.3. Describe battery supplies and list common usages:
    10.3.1. Explain battery recharging principles
10.4. Explain the reasons for filtering, describe hum, and identify common filter types:
    10.4.1. "L" (L-section, choke or inductor) filter – an inductor in series with a capacitor in parallel
    10.4.2. "T" filter –add a second choke on output side, taking the output across the capacitor
    10.4.3. "Pi" filter – a single inductor with a capacitor at each end to common
10.5. Explain the reasons for power supply regulation and list common components used in regulated supplies
10.6. Explain the term 'Integrated high voltage transformer' supply and explain how it differs from direct or other power supply types
10.7. Explain how multiple output supplies can supply more than one voltage
10.8. Explain where fuses and circuit breakers are commonly and electrically located in circuits; approximate fuse sizes for common circuits; common fuses and circuit breaker configuration and precautions for replacement in a house service box
10.9. Explain how to calculate DC voltages from power supply circuits
10.10. Identify and analyze rectifier circuits
10.11. Describe switch mode power supply operation

11.0 Amplifiers

- 11.1. List common amplifier devices: such as power amps, audio preamps, video amps
- 11.2. Describe the purpose of each component in an amplifier circuit
- 11.3. List the usages and classes of amplifiers
  - 11.3.1. Analyze BJT amplifier circuits for gain and power
  - 11.3.2. Analyze FET based amplifier circuits for gain and power
- 11.4. Explain frequency response of an amplifier circuit and why it is important
- 11.5. Explain the words ‘preamplifier’ and ‘line amplifier’ and where these units are commonly used
- 11.6. Explain the uses of operational amplifiers and how they differ from other amplifiers
  - 11.6.1. Analyze op-amp circuits to determine gain and power
- 11.7. Explain how distortion occurs in amplifiers and list ways to reduce or eliminate it
- 11.8. Explain how inaccurate measurements can be experienced due to meter or scope loading
  - 11.8.1. List ways to overcome loading problems
- 11.9. Describe specifications for broadband amplifiers as compared with common narrow band units

12.0 Interfacing of Electronics Products

- 12.1. List input circuit signal levels which may be expected for various common electronics products or test equipment
- 12.2. Explain the purposes of plugs and connectors and why it is necessary to use the proper ones
- 12.3. Explain grounding, proper and improper methods, and the results of power source mismatch
- 12.4. List potential signal conflict symptoms
- 12.5. Describe other electronic interfacing such as USB, Zigbee, I^2C (inter-integrated circuit)

13.0 Digital Concepts and Circuitry

- 13.1. Identify each of the basic digital gate(s) and devices
- 13.2. Construct truth tables for common gates
- 13.3. Explain how electronic counters operate
- 13.4. Explain the purpose of flip-flops and list common types
- 13.5. Explain the purpose of a digital bus and show how it’s connected to various sections of a product
- 13.6. List types of display circuitry and describe how numbers and letters are activated digitally
- 13.7. Distinguish how pulsers are used for digital signal tracing
- 13.8. Describe how logic probes are used to verify states in digital equipment
- 13.9. Explain how to troubleshoot digital signals
- 13.10. Describe digital clock(s) usage and circuitry
- 13.11. Explain voltages and logic families (TTL, CMOS)
- 13.12. Define microcontrollers and simple programming commands

14.0 Computer Electronics

- 14.1. Describe the major sections of a computer
- 14.2. Differentiate how the computer block diagram and flow charts are utilized
- 14.3. Describe the major blocks contained in a microprocessor chip and describe the purpose of each block
- 14.4. Describe different types of computer memory and how storage is accomplished
- 14.5. Explain programmable logic controls (PLCs) and list usages
- 14.6. Describe basic programming concepts
- 14.7. Describe the reasons for different computer languages and their relationships
- 14.8. Define a ‘peripheral’ and list various types
- 14.9. Explain the reasons for using interface devices/chips/cards and name common types

15.0 Computer Applications and Software

- 15.1. Explain knowledge of basic computer operation
- 15.2. Explain steps in installation/set up of a computer
- 15.3. Explain the reasons and choices used in configuring a computer
- 15.4. Describe proper loading and storage of common programs and applications
- 15.5. Explain basic common utilities software and list reasons for their use
- 15.6. List ways to backup data and the importance of doing so
- 15.7. Explain the causes of line surges and viruses and protection procedures against each

15.8. Explain how to access the Internet, cybersecurity best practices and common applications
15.9. Describe how to download a service or application, data or software
15.10. Explain the differences between an individual stand-alone computer and basic networking

16.0 Audio and Video Systems

16.1. Explain major components of the most common home entertainment products
16.2. Describe microphone technology usage
16.3. Explain speaker construction and precautions
16.4. Explain basic recording and playback technology
16.5. Explain how alarm-security systems may be interfaced with entertainment/information products
16.6. Differentiate between good quality sound output and distorted sound, then the electronic/acoustical reasons for each
16.7. Explain how signals may conflict and the symptoms that conflict may produce
16.8. Explain how to isolate faults/glitches between discrete equipment units
16.9. List anticipated signal or voltage levels for output circuits in audio and video equipment

17.0 Optical Electronics

17.1. List common electronics display devices
  17.1.1. Explain how displays operate, their advantages and disadvantages
17.2. List common optical devices as to type and applications:
  17.2.1. Describe operation and application of component LEDs and Seven-Segment displays
  17.2.2. Describe operation and application of LCDs and OLEDs, display types
17.3. Describe how photo-electronic components operate:
  17.3.1. Explain how photovoltaic cells are activated
  17.3.2. Identify materials from which these devices are made
17.4. Explain the basics of electronic cameras and sensors
17.5. Explain why opto-isolators are used
  17.5.1. List some locations or circuits in which opto-isolators are used
17.6. List uses for light activated controls and how photo devices are incorporated
  17.6.1. Identify symbols for photo-resistors, photodiodes and photo-transistors
17.7. Describe how broadband signal RF and optical links are used

18.0 Radio (RF) Communications Technology

18.1. Explain basic wave propagation and its importance to wireless communications
18.2. Describe the basic theory of how antennas work
  18.2.1. List the types of transmission lines (feedline) used between antennas and RF equipment
18.3. Define polarization, electromagnetic and electro-static fields and their relationships to each other
18.4. Differentiate between the signals/signaling of AM, FM radio/TV, LMR including CDMA, GSM, LTE, 5G (i.e., modulation)
18.5. Differentiate usage of communications radios and commercial broadcast receivers
18.6. Describe the major radio receiver circuitry sections
18.7. List common frequency bands (spectrum)
18.8. Explain radio circuit tuning and adjustments
18.9. Explain Standing Wave Ratios (SWR) and measuring voltage standing wave ratios (VSWR)
18.10. Explain the relationships between frequency and wavelength
18.11. Explain the importance of impedance matching; list causes of mismatches

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, list applicable ANSI/TIA standard
19.3. Describe satellite communications principles
19.4. Describe wired data and voice communications network technology
19.5. Describe a basic telephone (POTS) circuit with the common wiring and splicing conventions

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 locations/cross referencing of parts and products

20.4. Explain the purposes and requirements for proper record keeping, report generation
20.5. Explain how to 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 including test planning
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)

Note:

ETA International and allied associations encourage the nation's school systems to adopt these competencies for their basic electronics courses. Dedicated to the tireless technicians who shared their knowledge, skills and experience to help further electronics study for future technicians.

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

ETA Basic Electronics Certification Subject Matter Advisory Board:

Abel, CETma, Randy	Texas	jr@vlnet.us
Agard, RESIma, Rich	Philadelphia, PA	
Ahmed, SGM Saleh A.	Virginia / N.C.	
Arcaro, CETsr, Jim	Ohio	
Ashton, James L.	Tobyhanna, PA	
Atkins, Mark David	Indiana	
Bailey, PhD, William C.	IN; S.C.	wcbjrphd1@att.net
Bakkeren, CESma,CESms(RF), John	ON, Canada	Johannes.bakkeren@iname.com
Baldwin, CETsr, John	Minnesota	jbaldwin@hickorytech.net
Barrett, CETsr, GVT Zachary	Rhode Island	
Bates, CET, Dave	Minnesota	batesd13@gmail.com
Berlin, CETsr, Bob	Orlando, FL	
Booth, FOT, Richard W.	Tucson, AZ	richard.w.booth@gmail.com
Boyd, CETsr, Gerry	Beltsville, MD	gerry.boyd@teltronic.com
Brinker, CETma, Bill	Shawnee, KS	
Cannady, CETa, David W,	Great Lakes, IL	
Carroll, Dave		davec@nida.com
Cerniglia, Vic	Mississippi	
Chisum, CETsr, John E.	Utica, MS	jchisum@accesscontrolgroup.net
Collum, James	Mississippi	
Crotts, CETsr, Jim		w3atv@aol.com
Crozier, Gary	Ladson, SC	gcrozier@comcast.net
Dolly, CETma, Clyde J.	Melbourne, FL	
Douglas, CETa, CSS, Mikel	Idaho	
Felix, Ron	Bellingham, WA	
Fleeman, Prof., Stephen		S.Fleeman@RockValleyCollege.edu
Garmon, CETa, Michael	Gadsden, AL	
Geiger, CETsr; Dan		
Glass, CETsr; Dick	Greencastle, IN	
Gossick, CET, Louis C.	OH; S.C.	

Goudy, CETsr, J. Joe	Iowa	
Gray, CETma; Mark L.	Cape Fear, NC	
Hartline, Thomas	Gadsden, AL	
Heller, Jr, CETsr, Don	Speedway, IN	
Hinds, Sr, CETsr, Edwin R.	Jamaica, NY	ehinds6062@aol.com
Hoch, CETma, Chris	AZ; IN	
Holmes-Smith, Dr. David	CO, HI, Japan; AR; AZ	
Hopkins, FOI, Jason D.	Arlington, WA	
Janik, CETsr, Louis A.	Jacksonville, FL	
Keller, CETma; Charles	San Diego, CA	
Kirkpatrick, PVI, CSS, Ed	Greencastle, IN	
Koch, CETma, Gordon P.	Grand Junction, CO	gkoch@mesastate.edu
Lister, CETma, George		gplister@tstc.edu or supertech@suddenlink.net
Matthews, CETa, Frank	Pinetops, NC	
Martini, PVI, John	Ft. Smith, AR	
McCauley, CST, Phillip W.	Albuquerque, NM	
McNair, Barry	AL	barry_mcnair@ecboe.org
McNease, Sam	MS	
McNeill, CETsr, Dr. Dennis		mcneill.dennis@pti.edu
Miller, CETsr, Chris		chris.miller@heartland.edu
Morris, CETma, CETms(RF), CETms(IT), Shane		
Mueller, James	PA	
Novak, Robert T.	ID	
Okerberg, CETsr, Rollin R.	UT	
Parady Sr., CETsr, Edward E.	Pitcairn, PA	
Pinkava, CST, Rick		rick.pinkava@cvccworks.edu
Retzinger, FOI, Dan	Anchorage, AK	
Rondeau, Robert L.	Tyngsboro, MA	brondeau@gltech.org
Salmons, CETma, Cliff	Mason, IA	
Smalling, CETsr, Andre	Richmond Hills, NY	gent2001@hotmail.com
Stover, Robert	VA	
Thompson, CETsr, Jay	IN and AZ	
Trepka, CSS, Jim	Cedar Rapids, IA	
Walters, Jason E.	MS	
Weiss, CET; Fred	FL	
Wiesenfeld, CETms(RF), PE; Ira	Dallas, TX	ira@iwatsi.com
Wilcher, CETa, Don	Madison, AL	mrdon219@aol.com
Williams, CETa, Robert R.	Tobyhanna, PA	
Woodward, FOD, PE, Bill		
Yager, Ed	Middleburg Hts, OH	
Zielinski, CETma, John		johnzielinski0@gmail.com

Additional suggested study materials and resources:

The Associate CET Study Guide, 6E, Third printing 2020; ISBN 1-891749-07-2; ETA International; 2016; —Available through ETA at 800-288-3824, $60
EM Study Guide series; Karl Eilers; download through ETA at 800-288-3824 or www.etai.org
Electronics; Principles and Applications,8E; Schuler; ISBN 978-0077567705; McGraw Hill; 2012
Introduction to Electricity, Electronics, and Electromagnetics, 5E; ISBN 978-0130105738; Boylestad, Nashelsky; Prentice Hall; 2001
Teach Yourself Electricity and Electronics, 6E; Gibilisco ISBN 978-1259585531; McGraw-Hill / TAB; 2016
Contemporary Electronics: Fundamentals, Devices, Circuits, and Systems; ISBN 978- 0073373805; Frenzel; McGraw-Hill Education; 2013
Electronics Principles, 8E; Malvino, Bates; ISBN 978-0073373881; McGraw-Hill Higher Ed; 2015
Electricity & Electronics, 10E;, Gerrish, Dugger & Roberts; ISBN 978-159070-883-5, Goodheart-Wilcox; 2008
Electricity; Principles and Applications, 8E; Fowler; ISBN 978-0077567620; McGraw Hill, 2013
Arduino Electronics Blueprints; Wilcher; ISBN 978-1-7843-93606; Packt Publishing, 2015
Digital Electronics: Principles and Applications, 9E; Tokheim, Hope; ISBN 978-1259872983; McGraw Hill, 2022
Cabling: The Complete Guide to Copper and Fiber-Optic Networking, 5E; Oliviero & Woodward; ISBN 978-1-118-80732-3; Sybex, Inc.; 2014; Available through ETA at 800-288-3824 or www.etai.org
Introductory DC / AC Electronics, 6E; Cook; ISBN 978-0131139848; Prentice Hall; 2004, o.o.p.
Electronic Devices and Circuit Theory, 11E; Paperback = ISBN 978-1292025636; Boylestad & Nashelsky ; Pearson; 2013
Electronic Communications, 6E; ISBN 978-0070571570; Shrader ; McGraw-Hill Co; 1990
How to Diagnose and Fix Everything Electronic; Geier; ISBN 978- 0071744225; McGraw-Hill/TAB Elec. 2011
Electronic Communications: A System Approach; Beasley, Hymer, Miller; ISBN 978-0132988636; Pearson; 2013
Encyclopedia of Electronic Components (3 book series); Platt, Jansson; Vol.1 ISBN 978-1449333898 in 2012; Vol.2 ISBN 978-1449334185 in 2014; Vol.3 ISBN 978-1449334314 in 2016; Make Community, LLC
The Soldering Handbook, 3E; ISBN 978-0871716187; Vianco; American Welding Society; 2000
Mastering Technical Mathematics, 3E; ISBN 978-0071494489; Gibilisco, Crowhurst; McGraw-Hill / TAB Electronics; 2007
AC/DC Principles and Applications, 2E; Schultz; ISBN 978-0826913579; American Tech. Pub.; 2016
There Are No Electrons: Electronics for Earthlings; Amdahl; ISBN 978-1737252405; Clearwater Pub.; Reprinted 2021 (orig.1991)
Becoming An Electronics Technician, 4E; ISBN 978-0130932198; Reis; Prentice Hall; 2001

Review **MasteringElectronicsDesign.com** website; RMS material**;** Adrian S. Nastase; 2013
Review **Electronics-notes.com** website; electronics material; Ian Poole; 2001, 2006 and refined in 2016
Review **AwesomeCube.com** website; electronics projects; Jeff LeSueur; 2013
Review RSD Academy website; electronics tutorials; 2023
Review SparkFun website; electronics tutorials; 2023
Review **tutorialspoint.com** website; digital circuits; https://www.tutorialspoint.com/digital_circuits/index.htm
Review **IPC.org** website; IPC Corporation, electronics/solder standards/training; 2023
Review **NIDA.com** website; Nida Corporation, electronics training systems; 2023
Review **NIST.gov** website; Special Pub. 811, section 9.3; 2008

Check online for NEETS module content: www.tpub.com/neets/index.htm
Please see the many other webpages and study materials educators and industry professionals use

ETA certification programs are accredited through ICAC, complying with the ISO/IEC 17024 standard.

ICAC International Certification Accreditation Council

