

Electronics Technician Program

Common Core

Blueprint

(Revision 10)



Prepared by the
International Electronics Technician Articulation Committee
(IETAC)

Foreword

This document represents the eight revision to the *Electronics Technician Program: Common Core Program Blueprint*. The original document was produced in April of 1989.

The document lists the basic competencies or skills that a student should have upon completion of the Electronics Technician Core program. This is the minimum standard and is a prerequisite for entry into an Electronics Technician advanced/specialty option.

It is not intended for the Electronics Technician Program: Common Core to be sufficient to train students to the entry level for employment. Students taking the Common Core program are expected to take a specialty option in order to achieve a level of training sufficient for entry level employment. Students completing the Common Core will, however, receive institution recognition.

The document is designed to be a blueprint listing the skill competencies a student must learn, it is not a course description nor is it intended in any way to indicate method of instruction.

The competency list was developed using the DACUM process. The development of the International Electronics Common Core competencies is a joint project of the Electronics Technician Articulation Committee and the Ministry of Education, Skills and Training of British Columbia.

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GLOSSARY OF BEHAVIORAL TERMS

Each competency, learning task and practical competency begins with a behavioral term to indicate the desired learning outcome. Listed below are the most commonly used behavioral verbs and their definitions:

Analyse	to examine and interpret the operation of a circuit or component
Define	to set forth the meaning of a term, or of an expression
Describe	to give the characteristics and/or properties of an object to give a detailed and/or graphic account of a process or procedure: the use of correct terminology, the sequencing of events, and the interrelationships of the elements are required when necessary
Examine	to observe closely and assess or weigh the condition of an object
Identify	to use the correct terminology to describe objects, both individually and collectively, to state their application or use and to point out and name them
Inspect	to look into, or at, carefully; to examine or observe critically in order to detect errors or flaws
Interpret	to explain the meaning of; to have and be able to show an understanding of the meaning
List	to give, in point form, several items of information; no sequence or interrelationship is required
Locate	to seek out and determine the position of
Maintain	to keep in good condition, to keep functional and in good repair
Perform	to carry out: to do in a formal manner or according to a prescribed ritual; to carry out an action or pattern of behavior
Program	to direct the operations of a computer or programmable controller using a series of coded instructions
Repair	to put back into good condition after damage or wear: to mend or fix
Select	to choose the most appropriate object, process or procedure, given a specific situation; when selecting objects, the ability to identify is implicit
Test	to measure the operational parameters of a component or system and compare the results to predicted values
Troubleshoot	to investigate a problem or malfunction, including listing typical faults which might occur and describing how to identify each, inspecting the circuit or component for obvious signs of damage or breakdown, testing at key points of the circuit in a logical order, isolating faults, repairing faults, and documenting the troubleshooting procedure
Use	to put into action or service: to carry out a purpose or action by means of

EVALUATION CRITERIA:

Each competency and learning tasks (sub-competency) is to be evaluated according to specific criteria. The general criteria are as follows:

1. Successful evaluation of the stated learning outcomes.
2. For those competencies requiring testing and measuring:
 - (a) Testing and measuring are done correctly.
 - (b) Measurements are within acceptable limits (industry standards, and generally within 5% of those of the instructor).
3. When components are connected, they are connected correctly and operate within specifications.
4. When circuits are constructed, they are neatly wired and soldered and they function properly.
5. When devices are tested, faulty devices are detected.
6. When troubleshooting is carried out, faults are isolated and repaired within acceptable time frames (industry standards or entry level).

Unless otherwise stated, the above criteria will apply to all competencies and sub-competencies, as appropriate.

In all cases where practical skills are required, it is expected that the student perform the task satisfactorily without assistance and consultation.

MAIN COMPETENCY AREAS

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On completion of the Electronics Technician Common Core, the student will be able to:

A. USE SAFE WORK PRACTICES	1. Use safe work practices				
B. USE SHOP TOOLS, MATERIALS AND TECHNIQUES	1. Select, use and maintain hand and power tools	2. Select and use hardware	3. Solder and desolder	4. Use chemicals and lubricants	5. Assemble, test and install cable
C. USE TEST EQUIPMENT	1. Use multimeters	2. Use bench power supplies	3. Use oscilloscopes	4. Use function generators and frequency counters	
D. USE, TEST AND SELECT PASSIVE ELECTRONICS COMPONENTS	1. Identify electronic components	2. Use, test and select batteries	3. Use, test and select resistive devices	4. Use, test and select switches and relays	5. Use, test and select transducers
	6. Use, test and select inductors	7. Use, test and select transformers	8. Use, test and select capacitors		
E. USE, TEST AND SELECT ACTIVE ELECTRONICS COMPONENTS	1. Use, test and select diodes	2. Use, test and select bipolar junction transistors	3. Use, test and select field effect transistors	4. Use, test and select thyristors	5. Use, test and select optoelectronic devices
F. TROUBLESHOOT PASSIVE DC CIRCUITS	1. Describe basic principles of electrical theory	2. Verify Ohms Law and power equations	3. Construct, measure & analyze simple series resistive circuits	4. Construct, measure & analyze simple parallel resistive circuits	5. Construct, measure & analyze series-parallel resistive circuits

- 6. Troubleshoot passive DC circuits
- 7. Describe the principles of magnetism and electromagnetism
- 8. Construct and measure time constant circuits
- 9. Analyze resistance networks

- G. TROUBLESHOOT PASSIVE AC CIRCUITS**
- 1. Interpret waveforms
 - 2. Troubleshoot resistive inductive (RL) circuits
 - 3. Troubleshoot transformer circuits
 - 4. Troubleshoot resistive capacitive (RC) circuits
 - 5. Troubleshoot reactive (RLC) circuits

- 6. Construct, measure & analyze resonant circuits
- 7. Construct, measure & analyze passive filter circuits

- H. TROUBLESHOOT ACTIVE DISCRETE COMPONENT CIRCUITS**
- 1. Troubleshoot simple power supply circuits
 - 2. Troubleshoot bipolar junction transistor amplifier circuits
 - 3. Troubleshoot sinusoidal and non-sinusoidal oscillators
 - 4. Troubleshoot field effect transistor amplifiers

- I. TROUBLESHOOT LINEAR INTEGRATED CIRCUITS**
- 1. Replace integrated circuits
 - 2. Troubleshoot operational amplifiers
 - 3. Troubleshoot integrated circuit timers
 - 4. Troubleshoot integrated circuit regulators

- J. TROUBLESHOOT DIGITAL INTEGRATED CIRCUITS**
- 1. Perform arithmetic operations in various numbering systems
 - 2. Construct and test simple logic circuits
 - 3. Use, test and select digital devices
 - 4. Construct, test combinational logic circuits
 - 5. Construct, test and troubleshoot sequential logic circuits

- 6. Troubleshoot digital/analog converter circuits
- 7. Troubleshoot semi-conductor memory circuits
- 8. Troubleshoot data conversion and transmission circuits

- K. PROGRAM AND INTERFACE SIMPLE MICROPROCESSOR BASED SYSTEMS**
- 1. Describe basic principles of microprocessors
- 2. Identify components of a microcomputer
- 3. Write simple machine language programs
- 4. Write input/output (I/O) drivers for microprocessor system

- L. USE PERSONAL COMPUTERS**
- 1. Connect and operate a personal computer system
- 2. Use operating systems
- 3. Use common applications software packages

- M. USE, MAINTAIN AND PRODUCE TECHNICAL DOCUMENTS**
- 1. Use, maintain and/or produce electronics documentation

COMPETENCY AI USE SAFE WORK PRACTICES**Learning Tasks:**

1. Describe the purposes of legislation concerning safety in the workplace.
2. Describe safety precautions and procedures.
3. Describe correct safety procedures for hand and power tools.
4. Locate and describe shop safety equipment.

Practical Competencies:

1. Use safe work practices.

COMPETENCY B1 SELECT, USE AND MAINTAIN HAND AND POWER TOOLS**Learning Tasks:**

1. Identify hand tools.
2. Describe the procedures to be used to care for and maintain hand tools.
3. Identify the proper use and care of power tools and their accessories

Practical Competencies:

1. Select, use and maintain hand tools.
2. Select, use and maintain power tools and their accessories.

Criteria:

1. General.
2. The right tool is chosen for each assigned task.
3. The tools are used correctly and safely.
4. No damage is done to the tools hardware, or components.
5. Each tool is kept sharp, clean, oiled, tinned, etc. , as applicable.

COMPETENCY B2 SELECT AND USE HARDWARE**Learning Tasks:**

1. Identify nuts, bolts, screws, and washers.
2. Identify cable and wire support hardware.

Practical Competencies:

1. Select and use the hardware.

Criteria:

1. General.
2. The nuts fit securely on the bolts.
3. The bolts are not stripped and the nuts are not cross-threaded.
4. The heads of the screws and bolts are not damaged.
5. The clamps and brackets are not damaged and are correctly fastened.

COMPETENCY B3 SOLDER AND DESOLDER**Learning Tasks:**

1. Explain the principles of soldering and desoldering.
2. Describe appropriate soldering techniques.
3. Describe the danger of electrostatic discharge (ESD) and the precautions to be followed to prevent ESD during soldering.
4. Describe the techniques and tools used to solder and desolder surface mount discrete and integrated components.
5. Describe the techniques and tools used to perform track and pad repair on printed circuit boards.

Practical Competencies:

1. Perform soldering and desoldering on through-hole single sided and double sided P.C. boards.
2. Perform soldering and desoldering on Surface Mount Discrete and Integrated components.

Criteria:

1. General.
2. Only appropriate solder is used.
3. Correct tools are chosen.
4. Soldered connections have the correct shape and color.
5. There is no excess resin.
6. There are no solder splashes.
7. Connections are mechanically and electronically secure.
8. No damage is done to the tools, hardware, or components.

COMPETENCY B4 USE CHEMICALS AND LUBRICANTS**Learning Tasks:**

1. Identify chemicals and lubricants used in the electronics industry.
2. Describe the safe storage, handling and disposal of chemicals and hazardous materials.

Practical Competencies:

1. Identify hazardous materials.

Criteria:

1. General.

COMPETENCY B5 ASSEMBLE, TEST AND INSTALL CABLE**Learning Tasks:**

1. Identify types and gauges of wires and cables.
2. Identify connectors.

Practical Competencies:

1. Assemble, test and install cable.

Criteria:

1. General.
2. On all the leads and cables, the connectors are correctly installed and tested.

COMPETENCY C1 USE MULTIMETERS**Learning Tasks:**

1. Describe the proper handling, storage and use of digital meters.
2. Describe the proper handling, storage and use of analog meters.

Practical Competencies:

1. Use multimeters.

Criteria:

1. General.

COMPETENCY C2 USE BENCH POWER SUPPLIES

Learning Tasks:

1. Describe the operation of a bench power supply and its controls.

Practical Competencies:

1. Use power supplies.

Criteria:

1. General.
2. Operate a bench power supply correctly.

COMPETENCY C3 USE OSCILLOSCOPES**Learning Tasks:**

1. Describe the safe use of oscilloscopes and probes.
2. Describe voltage, frequency and phase angle of on-screen waveforms.
3. Describe the basic construction and operation of the oscilloscope.

Practical Competencies:

1. Use oscilloscopes following the first-time operating procedures.
2. Use an oscilloscope to measure DC voltage, AC voltage, period and phase.

Criteria:

1. General.
2. Calibration is checked correctly.
3. Oscilloscope is connected correctly.

COMPETENCY C4 USE FUNCTION GENERATORS AND FREQUENCY COUNTERS**Learning Tasks:**

1. Describe the basic construction, operation and safe use of a simple function generator.
2. Describe the basic construction, operation and safe use of a frequency counter.

Practical Competencies:

1. Use function generators and frequency counters.

Criteria:

1. General.
2. The correct waveforms, amplitude and frequency are produced and meet the specifications set by the instructor.

COMPETENCY D1 IDENTIFY ELECTRONIC COMPONENTS**Learning Tasks:**

1. Identify electronic components.
2. Using standard electronic multiplication prefixes, determine the values for electronic components from their markings and physical characteristics.

Practical Competencies:

1. Identify electronic components.

Criteria:

1. General.

COMPETENCY D2 USE, TEST AND SELECT BATTERIES**Learning Tasks:**

1. Describe the construction, operation, testing and maintenance of batteries.

Practical Competencies

1. Consult manufacturers' web site or manual for information addressing:
 - Maintenance
 - Application
 - Safety

Criteria:

1. General.

COMPETENCY D3 USE, TEST AND SELECT RESISTIVE DEVICES**Learning Tasks:**

1. Describe the principles of resistance.
2. Identify resistive devices and draw their schematic symbols.
3. Describe the function of resistive devices.
4. Describe the procedures for testing resistive devices.

Practical Competencies:

1. Use, test and select resistive devices.

Criteria:

1. General.

COMPETENCY D4 USE, TEST AND SELECT SWITCHES AND RELAYS**Learning Tasks:**

1. Describe switch types, schematic symbols and operation.
2. Describe relay types , their major parts, schematic symbols and operation.
3. Describe procedures for selecting, connecting and testing switches and relays.

Practical Competencies:

1. Connect, test and select switches.
2. Test, select and connect relays.

Criteria:

1. General.

COMPETENCY D5 USE, TEST AND SELECT TRANSDUCERS**Learning Tasks:**

1. Describe the structure, operation, application, testing, schematic symbols and typical failures of common transducers (such as electrical/acoustic, electrical/light and electrical/mechanical).
2. Apply knowledge of transducers.

Practical Competencies:

1. Connect transducers in a circuit.
2. Select new and replacement transducers using manufacturer's data.

Criteria:

1. General.

COMPETENCY D6 USE, TEST AND SELECT INDUCTORS

Learning Tasks: Specifications to select appropriate replacement parts.

1. Describe the structure, operation, application, testing, schematic symbols and typical failures of common inductors.
2. Describe the behavior of inductors under DC conditions.
3. Describe the behavior of inductors under AC circuits.
4. Apply knowledge of inductor specifications to select appropriate replacement parts.

Practical Competencies:

1. Use, test and select inductors.

Criteria:

1. General.

COMPETENCY D7 USE, TEST AND SELECT TRANSFORMERS**Learning Tasks:**

1. Describe the common types of transformers, their schematic symbols, major parts, uses and principles of operation.
2. Use formulas to predict the operation of transformers.
3. Describe the procedures for selecting, connecting and testing transformers.

Practical Competencies:

1. Use, test and select transformers.

Criteria:

1. General.

COMPETENCY D8 USE, TEST AND SELECT CAPACITORS**Learning Tasks:**

1. Describe the structure, operation, application, testing, schematic symbols and typical failures of common capacitors.
2. Describe the behavior of capacitors under DC conditions.
3. Describe the behavior of capacitors under AC conditions.
4. Apply the knowledge of capacitor specifications to select appropriate replacement parts.

Practical Competencies:

1. Use, test and select capacitors.

Criteria:

1. General.

COMPETENCY E1 USE, TEST AND SELECT DIODES**Learning Tasks:**

1. List the common types of diodes, draw their schematic symbols and state their uses.
2. Describe the principles of operation of semiconductor diodes.
3. Draw and interpret the characteristic curves of semiconductor diodes.
4. Describe the procedures for testing and connecting diodes.

Practical Competencies:

1. Select and take measurements on simple diode circuits.

Criteria:

1. General.
2. The plotted curves are within 10% of predicted curves.

**COMPETENCY E2 USE, TEST AND SELECT BIPOLAR JUNCTION
TRANSISTORS****Learning Tasks:**

1. Describe the types of bipolar junction transistors, their characteristics and principles of operation.
2. Explain how to correctly test bipolar junction transistors.
3. Apply knowledge of bipolar junction transistor specifications to select appropriate replacement parts.

Practical Competencies:

1. Use, test and select transistors.

Criteria:

1. General.
2. The plotted curves are within 10% of the predicted curves.

COMPETENCY E3 USE, TEST AND SELECT FIELD EFFECT TRANSISTORS**Learning Tasks:**

1. Describe the structure, operation, application, testing, schematic symbols and typical failures of common field effect transistors (FETs).
2. Apply knowledge of FET specifications to select appropriate replacement parts.

Practical Competencies:

1. Use, test and select FETs.

Criteria:

1. General.

COMPETENCY E4 USE, TEST AND SELECT THYRISTORS**Learning Tasks:**

1. Describe thyristor types, schematic symbols and principles of operation.
2. Describe the procedures for selecting, connecting and testing thyristors.

Practical Competencies:

1. Use, test and select thyristors.

Criteria:

1. General.

COMPETENCY E5 USE, TEST AND SELECT OPTOELECTRONIC DEVICES**Learning Tasks:**

1. Describe the operation, application, testing, schematic symbols and typical failures of common optoelectronic devices.
2. Apply knowledge of optoelectronic device specifications to select appropriate replacement parts.

Practical Competencies:

1. Use, test and select optoelectronic devices.

Criteria:

1. General.

COMPETENCY FI DESCRIBE BASIC PRINCIPLES OF ELECTRICAL THEORY

Learning Tasks:

1. Describe the atomic structure of matter.
2. Describe the units of electrical charge, voltage and current.
3. Describe the factors that affect the movement of electrical charges.

Criteria:

1. General.

COMPETENCY F2 VERIFY OHM'S LAW AND POWER EQUATIONS**Learning Tasks:**

1. State Ohms Law and graph the relationships between voltage, current and resistance in circuits.
2. Use formulas and basic mathematics to solve Ohms Law problems.
3. For resistive components, calculate dissipated power and required power rating.
4. Describe power dissipation in resistive devices.
5. From schematic diagrams, predict the voltage, current, and resistance in all parts of a circuit.
6. Describe the relationship between device power rating, dissipated power, device temperature and reliability.

Practical Competencies:

1. Construct resistive circuits, measure voltage, current and resistance, and calculate current and power.

Criteria:

1. General.

COMPETENCY F3 CONSTRUCT, MEASURE AND ANALYZE SIMPLE SERIES RESISTIVE CIRCUITS**Learning Tasks:**

1. Describe the principles of series circuits.
2. Calculate the voltage across, current through, equivalent resistance of and power dissipation for any component or group of components in a series resistive circuit.
3. State and use Kirchoff's voltage law and the voltage divider formula.

Practical Competencies:

1. Construct, measure and analyze simple series circuits.

Criteria:

1. General.

COMPETENCY F4 CONSTRUCT, MEASURE AND ANALYZE SIMPLE PARALLEL RESISTIVE CIRCUITS**Learning Tasks:**

1. Describe parallel circuit principles.
2. Calculate the voltage across, current through, equivalent resistance of and power dissipation for any component or group of components in a parallel resistive circuit.
3. State and use Kirchoff's current law and the current divider formula to solve parallel circuit problems.

Practical Competencies:

1. Construct , measure and analyze simple parallel circuits.

Criteria:

1. General.

COMPETENCY F5 CONSTRUCT, MEASURE AND ANALYZE SERIES PARALLEL RESISTIVE CIRCUITS**Learning Tasks:**

1. Describe series-parallel circuit principles.
2. Calculate the voltage across, current through, equivalent resistance of and power dissipation for any component or group of components in a series-parallel resistive circuit.
3. Identify chassis-ground connections and explain their effect when located at various points in a circuit.
4. Describe the applications of series parallel circuits.
5. Describe internal resistance of source, constant voltage source, matching and loading.
6. Analyze a loaded voltage divider, describe bleeder current and explain how specified values of voltage and current are supplied to the loads.

Practical Competencies:

1. Construct, measure and analyze series-parallel circuits.

Criteria:

1. General.

COMPETENCY F6 TROUBLESHOOT PASSIVE DC CIRCUITS**Learning Tasks:**

1. Describe a logical method for isolating faults and repairing circuits.
2. Identify faults in series circuits.
3. Identify faults in parallel circuits.
4. Identify faults in series-parallel circuits.

Practical Competencies:

1. Troubleshoot passive DC circuits.

Criteria:

1. General.

COMPETENCY F7**DESCRIBE PRINCIPLES OF MAGNETISM AND
ELECTROMAGNETISM****Learning Tasks**

1. Explain the principles of magnetic fields.
2. Explain the principles of electromagnetic fields.
3. Describe the operation and application of magnetic devices.
4. Describe the principles of electromagnetic induction.

Criteria:

1. General.

COMPETENCY F8 CONSTRUCT AND MEASURE TIME CONSTANT CIRCUITS**Learning Tasks:**

1. Explain the operation and application of RC timing circuits.
2. Explain the operation and application of RL timing circuits.
3. Calculate time constants, voltages and current in RC and RL circuits.

Practical Competencies:

1. Construct and measure time constant circuits.

Criteria:

1. General.

COMPETENCY F9 ANALYSE RESISTANCE NETWORKS**Learning Tasks:**

1. Use Thevenin's theorem to determine the Thevenin equivalent for series-parallel resistive circuits.
2. Simplify circuits using Norton's Theorem.
3. Simplify circuits using Millman's Theorem.
4. Use superposition to calculate voltage across and current through any resistive component in a multisource series-parallel resistive circuit.

Criteria:

1. General.

COMPETENCY G1 INTERPRET WAVEFORMS**Learning Tasks:**

1. Describe AC current and voltage.
2. List the characteristics of waveforms.
3. Determine voltage value in various measuring systems.

Criteria:

1. General.

COMPETENCY G2 TROUBLESHOOT RESISTIVE INDUCTIVE (RL) CIRCUITS

Learning Tasks:

1. Describe the process of testing and troubleshooting inductive circuits.

Practical Competencies:

1. Troubleshoot resistive inductive (RL) circuits.

Criteria:

1. General.

COMPETENCY G3 TROUBLESHOOT TRANSFORMER CIRCUITS**Learning Tasks:**

1. Describe the procedure for constructing, testing and troubleshooting transformer circuits.

Practical Competencies:

1. Troubleshoot transformer circuits.

Criteria:

1. General.

COMPETENCY G4 TROUBLESHOOT RESISTIVE CAPACITIVE (RC) CIRCUITS**Learning Tasks:**

1. Explain phase relationship.
2. Calculate values of capacitance, reactance, impedance, voltage and power in series and parallel capacitive circuits.
3. Describe the procedures for constructing, testing and troubleshooting capacitive circuits.

Practical Competencies:

1. Troubleshoot resistive capacitive (RC) circuits.

Criteria:

1. General.

COMPETENCY G5 TROUBLESHOOT REACTIVE (RLC) CIRCUITS**Learning Tasks:**

1. Describe the response of RLC circuits to sine wave signals:
2. Calculate values of reactance, impedance, voltage, current and power for simple reactive circuits.
3. Describe the procedures for testing and troubleshooting RLC circuits.

Practical Competencies:

1. Troubleshoot reactive circuits.

Criteria:

1. General.

COMPETENCY G6 CONSTRUCT AND MEASURE RESONANT CIRCUITS**Learning Tasks:**

1. Describe the properties of resonant circuits.
2. Calculate the resonant frequency, bandwidth, impedance, voltage and currents in currents operating at resonance.
3. Draw graphs that show the response curves of series and parallel resonant circuits.
4. Describe the procedures for constructing, and measuring resonant circuits.

Practical Competencies:

1. Construct and measure resonant circuits.

Criteria:

1. General.

COMPETENCY G7 CONSTRUCT AND MEASURE PASSIVE FILTER CIRCUITS**Learning Tasks:**

1. Describe the operation of and draw the frequency response curves of filters.
2. Explain the operation and applications of filter configurations.
3. From schematic diagrams, predict and plot the frequency response of filter circuits.

Practical Competencies:

1. Construct and measure passive filter circuits.

Criteria:

1. General.

COMPETENCY H1 TROUBLESHOOT SIMPLE POWER SUPPLY CIRCUITS**Learning Tasks:**

1. Draw schematic diagrams of power supplies and explain their operating principles and characteristics.
2. Explain the operating principles of voltage regulators.
3. Predict power supply DC output voltage, ripple frequency and percent ripple.
4. Describe the procedures for constructing, testing and troubleshooting power supply circuits.

Practical Competencies:

1. Construct and make measurements on power supply circuits.
2. Troubleshoot power supply circuits.

Criteria:

1. General.

**COMPETENCY H2 TROUBLESHOOT BIPOLAR JUNCTION TRANSISTOR
AMPLIFIER CIRCUITS****Learning Tasks:**

1. Explain the concepts of linear amplification.
2. Draw schematic diagrams of simple bipolar junction transistor (BJT) amplifier circuits and explain their operating principles and characteristics.
3. Describe the operating principles and characteristics of BJT biasing circuits.
4. Describe typical BJT amplifier coupling arrangements and their characteristics.
5. Describe the characteristics of common BJT power amplifier circuits.
6. Describe the procedures for constructing, testing and troubleshooting BJT amplifier circuits.

Practical Competencies:

1. Troubleshoot bipolar junction transistor amplifier circuits.

Criteria:

1. General.

**COMPETENCY H3 TROUBLESHOOT SINUSOIDAL AND NON-SINUSOIDAL
OSCILLATORS****Learning Tasks:**

1. Describe the principles of oscillator operation.
2. Explain the operation of sinusoidal oscillators.
3. Explain the operation of non-sinusoidal oscillators.
4. Describe the procedures for constructing, testing and troubleshooting BJT oscillator circuits.

Practical Competencies:

1. Construct and make measurements on oscillator circuits.
2. Troubleshoot oscillator circuits.

Criteria:

1. General.

COMPETENCY H4 TROUBLESHOOT FIELD EFFECT TRANSISTOR AMPLIFIER CIRCUITS**Learning Tasks:**

1. Draw schematic diagrams of simple field effect transistor (FET) amplifier circuits and explain their operating principles and characteristics.
2. Describe the operating principles and characteristics of FET biasing circuits.
3. Describe typical FET amplifier coupling arrangements and their characteristics.
4. Describe the characteristics of common FET power amplifier circuits.
5. Describe the procedures for constructing, testing and troubleshooting FET amplifier circuits.

Practical Competencies:

1. Troubleshoot field effect transistor amplifier circuits.

Criteria:

1. General.

COMPETENCY I1 REPLACE INTEGRATED CIRCUITS (IC's)**Learning Tasks:**

1. Describe linear and digital integrated circuits and their applications.
2. Identify common integrated circuit packages
3. Describe safe handling of integrated circuits.

Practical Competencies

1. Replace non-soldered types of ICs.

Criteria:

1. General.

COMPETENCY I2 TROUBLESHOOT OPERATIONAL AMPLIFIERS**Learning Tasks:**

1. Describe basic operational amplifier concepts.
2. Describe the characteristics of operational amplifier circuit configurations.
3. Explain operational amplifier terms and specifications:
4. Describe the procedures for constructing, testing and troubleshooting operational amplifier circuits

Practical Competencies:

1. Construct operational amplifier circuits.
2. Measure the voltage levels, waves shape, gain, frequency response and phase relationships in operational amplifier circuits.
3. Troubleshoot integrated circuit operational amplifier circuits.

Criteria:

1. General.

COMPETENCY I3 TROUBLESHOOT INTEGRATED CIRCUIT TIMERS**Learning Tasks:**

1. Describe the principles of operation of a typical integrated circuit timer.
2. Describe the operation of monostable and astable multivibrator timers.
3. Use equations to design monostable and astable timer circuits.

Practical Competencies:

1. Construct, test and measure signals in an IC timer circuits
2. Troubleshoot faulty IC timer circuits.

Criteria:

1. General.

COMPETENCY I4 TROUBLESHOOT INTEGRATED CIRCUIT REGULATORS**Learning Tasks:**

1. Describe the roles of the major functional blocks in linear and switching voltage regulators.
2. Describe the similarities and differences between linear and switching regulators.
3. Explain the operation of step down and step up switching voltage regulators.
4. Explain the operation of the fixed and adjustable voltage regulators.
5. Describe the procedures for constructing, testing and troubleshooting integrated circuit regulators

Practical Competencies:

1. Construct and measure signals in an IC regulator circuit.
2. Troubleshoot faulty IC regulators circuits.

Criteria:

1. General.

**COMPETENCY J1 PERFORM ARITHMETIC OPERATIONS IN VARIOUS
NUMBERING SYSTEMS****Learning Tasks:**

1. Define the basic structure of the, decimal, binary, octal and hexadecimal numbering systems.
2. Convert whole number quantities between each of the following number systems: decimal, binary, octal, and hexadecimal.
3. Using complementation, perform addition and subtraction using the binary and hexadecimal number systems.
4. Define the binary characteristics of BCD, Gray, and ASCII code.

Criteria:

1. General.

COMPETENCY J2 CONSTRUCT AND TEST BASIC CIRCUITS**Learning Tasks:**

1. Define the Boolean equation, truth table, and logic symbol for the AND, OR, NOT, NAND NOR, XOR and XNOR gates.
2. From a logic circuit diagram, produce a truth table and a Boolean equation.
3. From a truth table, produce a logic sum of product Boolean equation.
4. From a Boolean equation, produce a truth table and logic circuit diagram.
5. Describe the procedures for testing and troubleshooting logic circuits.

Practical Competencies:

1. Construct and test basic logic circuits.

Criteria:

1. General.

COMPETENCY J3 USE, TEST AND SELECT DIGITAL DEVICES**Learning Tasks:**

1. Identify common digital families
2. Identify the levels of integration and chip component density.
3. Describe the procedures for testing and selecting digital devices

Practical Competencies:

1. Use, test and select digital devices.

Criteria:

1. General.

**COMPETENCY J4 CONSTRUCT, TEST AND TROUBLESHOOT
COMBINATIONAL LOGIC CIRCUITS****Learning Tasks:**

1. Simplify Boolean equations to the minimum sum of product using Boolean identities.
2. Simplify complex Boolean equations to the sum of products using DeMorgan's theorem.
3. Convert combinational logic circuits to all NAND or all NOR equivalent gates.
4. Use Karnaugh maps to determine the minimum sum of product (MSP).
5. Write the truth table of arithmetic circuits and describe how each works.
6. Describe the procedures for testing and troubleshooting combinational logic circuits.

Practical Competencies:

1. Construct, test and troubleshoot combinational logic circuits.

Criteria:

1. General.

COMPETENCY J5**CONSTRUCT, TEST AND TROUBLESHOOT
SEQUENTIAL LOGIC CIRCUITS****Learning Tasks:**

1. Define the properties of latches and flip-flop, edge triggered versus level triggered.
2. Describe the principles of operation of a D flip-flop, with synchronous and asynchronous inputs.
3. Describe the principles of operation of JK flip-flops, with synchronous and asynchronous inputs.
4. Describe the operation and application of shift registers.
5. Describe the operation and application of frequency dividers and counters.
6. Describe the operation and application of synchronous up/down and shift register counters.
7. Describe the operation and application of multivibrators.
8. Describe the procedures for testing and troubleshooting sequential logic circuits

Practical Competencies:

1. Construct, test and troubleshoot sequential logic circuits.

Criteria:

1. General.

COMPETENCY J6**TROUBLESHOOT DIGITAL/ANALOG CONVERTER
CIRCUITS****Learning Tasks:**

1. Describe the operation of analog to digital (A/D) and digital to analog (D/A) converter circuits.
2. Describe the procedures for testing and troubleshooting converter circuits.

Practical Competencies:

1. Troubleshoot digital /analog converter circuits.

Criteria:

1. General.

COMPETENCY J7 TROUBLESHOOT SEMI-CONDUCTOR MEMORY CIRCUITS**Learning Tasks:**

1. Describe principles of operation of semi-conductor memory devices.
2. Describe the applications of semiconductor memory devices and the procedures for constructing, testing and troubleshooting circuits containing them.

Practical Competencies:

1. Troubleshoot circuits containing semi-conductor memory devices.

Criteria:

1. General.

**COMPETENCY J8 TROUBLESHOOT DATA CONVERSION AND
TRANSMISSION CIRCUITS****Learning Tasks:**

1. Describe the operation and applications of decoders and encoders.
2. Describe the operation and application of multiplexers and demultiplexers.
3. Describe the operation and application of parity checkers and generators.
4. Describe the operation, application and troubleshooting of data transmission circuits (such as tri-state, line drivers, transceivers, etc.).

Practical Competencies:

1. Troubleshoot data conversion and transmission circuits.

Criteria:

1. General.

COMPETENCY K1 DESCRIBE BASIC PRINCIPLES OF MICROPROCESSORS**Learning Tasks:**

1. Describe the functional elements of a model microprocessor
2. Define microprocessor, microcontroller, microcomputer and personal computer.
3. Describe the process of executing instructions in a microprocessor.
4. Describe the purpose and typical signal behavior of signals found on the address, data and control busses of a typical microprocessor.

Criteria:

1. General.

COMPETENCY K2 IDENTIFY COMPONENTS OF A MICROCOMPUTER

Learning Tasks:

1. Describe the function of the CPU, memory and I/O in a typical microcomputer.

Criteria:

1. General.

COMPETENCY K3 WRITE SIMPLE MACHINE LANGUAGE PROGRAMS**Learning Tasks:**

1. Describe the elements of programming.
2. Describe the procedures for flowcharting a program or process.
3. Describe microprocessor codes and addressing modes.
4. Describe the procedure for instruction coding and program debugging.

Practical Competencies:

1. Flowchart, code, document and debug a simple machine language program.

Criteria:

1. General.
2. Machine language programs execute properly.

**COMPETENCY K4 WRITE INPUT/OUTPUT (I/O) DRIVERS FOR
MICROPROCESSOR SYSTEMS****Learning Tasks:**

1. Describe the fundamental principles of microprocessor interfacing.
2. Describe the operation of common input/output interfacing.
3. Explain how interrupt priority can be achieved by hardware and software.
4. Describe procedures for prototyping an I/O interface and for developing a machine language I/O driver.

Practical Competencies:

1. Access input-output (I/O) using a microprocessor.

Criteria:

1. General.
2. Interfaces work properly.
3. Faulty interfaces are repaired.
4. I/O Drivers work properly.

COMPETENCY L1 CONNECT AND OPERATE A PERSONAL COMPUTER SYSTEM**Learning Tasks:**

1. Describe applications of personal computer systems in an electronic technician's work.
2. Describe the principles of operation of a personal computer system, using a block diagram.
3. Describe the interface and interconnections between the computer and its peripherals.
4. Describe the layout and use of a typical keyboard.

Practical Competencies:

1. Connect and operate a personal computer system.

Criteria:

1. General.
2. Connects a personal computer system properly and enters text on screen using keyboard (given detailed instructions).

COMPETENCY L2 USE OPERATING SYSTEMS**Learning Tasks:**

1. Describe common operating systems and their functions.
2. Describe disk and file handling in Windows.
3. Describe disk and file handling in DOS.

Practical Competencies:

1. Use operating systems.

Criteria:

1. General.
2. Executes DOS and Windows commands correctly.

COMPETENCY L3 USE COMMON APPLICATIONS SOFTWARE PACKAGES

Learning Tasks:

1. Describe common types of applications and simulation software.

Practical Competencies:

1. Use common applications software and simulation packages.

Criteria:

1. General.
2. Programs are used appropriately.

**COMPETENCY MI USE, MAINTAIN AND/OR PRODUCE ELECTRONICS
DOCUMENTATION****Learning Tasks:**

1. Describe the types of information that may be found in catalogues, data sheets, bulletins and manuals.
2. Describe the types of product information that may be found on the Internet.
3. Describe the use of diagrams in electronics
4. Describe methods of record keeping

Practical Competencies:

- 1 Use, maintain and/or produce electronics documentation.

Criteria:

1. General.
2. Catalogues used correctly.
3. Technical manuals and bulletins accessed and used properly.
4. Forms completed accurately.
5. Obtain product specifications from manufacturer's web site or CDs.