



ELECTRONICS TECHNICIAN

Advanced Electronics

A course that prepares individuals to apply technical knowledge and skills to assemble, install, operate, maintain, and repair electrical/electronic equipment used in business, industry, and manufacturing. Includes instruction in passive electronic components, passive AC and DC circuits, active discrete circuits, linear integrated circuits, digital integrated circuits, and program and interface microprocessors based systems.

**USOE
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ADVANCED ELECTRONICS

Levels: Grade 10-12
Units of Credit: Minimum 0.5
CIP Code 47.0107
Prerequisite: Electronics 1

CORE STANDARDS, OBJECTIVES AND INDICATORS

STANDARD 470107-01 **Students will be able to understand and demonstrate how to test and select passive electronic components.**

Objectives

- 470107-0101 Use, test, and select inductors.
- Describe inductors, their schematic symbols and principles of operation.
 - Describe the operation of inductors in DC circuits.
 - Describe the operation of inductors in AC circuits.
 - Describe the procedures for selecting, connecting and testing inductors.
- 470107-0102 Use, test, and select transformers.
- Describe the common types of transformers, their schematic symbols, major parts, uses and principles of operation.
 - Use formulas to predict the operation of transformers.
 - Describe the procedures for selecting, connecting and testing transformers.
 - Use, test, and select transformers.

STANDARD 470107-02 **Students will be able to trouble shoot passive DC circuits.**

Objectives

- 470107-0201 Construct, measure and analyze series parallel resistive circuits.
- Describe series-parallel circuit principles.
 - Calculate the theoretical values of voltage, current, resistance and power in all parts of a circuit.
 - Identify chassis-ground connections and explain their effect when located at various points in a circuit.
 - Describe the applications of series parallel circuits.
 - Describe internal resistance of source, constant voltage source, matching and loading.
 - Analyze a loaded voltage divider, describe bleeder current and explain how specified values of voltage and current are supplied to the loads.

- 470107-0202 • Construct, measure and analyze series-parallel circuits.
Troubleshoot passive DC circuits
 - Describe a logical method for isolating faults and repairing circuits.
 - Identify faults in series circuits.
 - Identify faults in parallel circuits.
 - Identify faults in series-parallel circuits.
 - Troubleshoot passive DC circuits
- 470107-0203 Construct and measure time constant circuits.
 - Explain the application of capacitive timing circuits.
 - Explain the application of RL timing circuits.
 - Calculate time constants, voltages and current in RC and RL circuits.
 - Construct and measure time constant circuits.
- 470107-0204 Analyze resistance networks.
 - Simplify circuits using Thevenin's Theorem.
 - Simplify circuits using Norton's Theorem.
 - Simplify circuits using Millman's Theorem.

**STANDARD
470107-03**

Students will be able to troubleshoot passive AC circuits.

Objectives

- 470107-0301 Interpret waveforms.
 - Describe AC current and voltage.
 - List the characteristics of waveforms.
 - Determine voltage value in various measuring systems.
- 470107-0302 Troubleshoot resistive inductive (RL) circuits.
 - Describe the process of testing and troubleshooting inductive circuits.
 - Troubleshoot resistive inductive (RL) circuits.
- 470107-0303 Troubleshoot resistive capacitive (RC) circuits.
 - Explain phase relationship.
 - Calculate values of reactance, impedance, voltage, current and power in series and parallel capacitive circuits.
 - Describe the procedures for constructing, testing and troubleshooting capacitive circuits.
 - Troubleshoot resistive capacitive (RC) circuits.
- 470107-0304 Troubleshoot reactive (RLC) circuits
 - Describe the response of RLC circuits to sine wave signals:
 - Calculate values of reactance, impedance, voltage, current and power for simple reactive circuits.
 - Describe the procedures for testing and troubleshooting RLC circuits.
- 470107-0305 Troubleshoot reactive circuits.
Construct and measure resonant circuits.
 - Describe the properties of resonant circuits.
 - Calculate the resonant frequency, bandwidth, impedance, voltage and

currents in currents operating at resonance.

- Draw graphs that show the response curves of series and parallel resonant circuits.
- Describe the procedures for constructing, and measuring resonant circuits.
- Construct and measure resonant circuits.

470107-0306

Construct and measure passive filter circuits.

- Describe the operation of and draw the frequency response curves of filters.
- Explain the operation and applications of filter configurations.
- From schematic diagrams, predict and plot the frequency response of filter circuits.
- Construct and measure passive filter circuits.

STANDARD
470107-04

Students will be able to troubleshoot active discrete component circuits.

Objectives

470107-0401

Troubleshoot simple power supply circuits.

- Draw schematic diagrams of power supplies and explain their operating principles and characteristics.
- Explain the operating principles of voltage regulators.
- Predict power supply DC output voltage, ripple frequency and percent ripple.
- Describe the procedures for constructing, testing, and troubleshooting power supply circuits.
- Construct and make measurements on power supply circuits.
- Troubleshoot power supply circuits.

470107-0402

Troubleshoot bipolar junction transistor amplifier circuits.

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

470107-0403

Troubleshoot sinusoidal and non-sinusoidal oscillators.

- Describe the principles of oscillator operation.
- Explain the operation of sinusoidal oscillators.

- Explain the operation of non-sinusoidal oscillators.
 - Describe the procedures for constructing, testing and troubleshooting BJT oscillator circuits.
 - Construct and make measurements on oscillator circuits
 - Troubleshoot oscillator circuits.
- 470107-0404 Troubleshoot field effect transistor amplifier circuits.
- Explain the concepts of linear amplifications.
 - Draw schematic diagrams of simple field effect transistor (FET) amplifier circuits and explain their operating principles and characteristics.
 - Describe the operating principles and characteristics of FET biasing circuits.
 - Describe typical FET amplifier coupling arrangements and their characteristics.
 - Describe the characteristics of common FET power amplifier circuits.
 - Describe the procedures for constructing, testing and troubleshooting FET amplifier circuits.

**STANDARD
470107-05**

Students will be able to troubleshoot linear integrated circuits.

Objectives

- 470107-0501 Replace integrated circuits (IC).
- Describe linear and digital integrated circuits and their applications.
 - Identify common integrated circuit packages.
 - Describe safe handling of integrated circuits.
 - Replace non-soldered types of ICs.
- 470107-0502 Troubleshoot operational amplifiers.
- Describe basic operational amplifier concepts
 - Describe the characteristics of operational amplifier circuit configurations.
 - Explain operational amplifier terms and specifications:
 - Describe the procedures for constructing, testing and troubleshooting operational amplifier circuits.
 - Construct operational amplifier circuits.
 - Measure the voltage levels, waves shape, gain, frequency response, and phase relationships in operational amplifier circuits.
 - Troubleshoot integrated circuit operational amplifier circuits.
- 470107-0503 Troubleshoot integrated circuit timers.
- Describe the principles of operation of a typical integrated circuit timer.
 - Describe the operation of monostable and astable multivibrator timers.
 - Use equations to design monostable and astable timer circuits.

- Construct, test and measure signals in an IC timer circuits
 - Troubleshoot faulty IC timer circuits.
- 470107-0504 Troubleshoot integrated circuit regulators.
- Describe the roles of the major functional blocks in linear and switching voltage regulators.
 - Describe the similarities and differences between linear and switching regulators.
 - Explain the operation of step down and step up switching voltage regulators.
 - Explain the operation of the fixed and adjustable voltage regulators.
 - Describe the procedures for constructing, testing and troubleshooting integrated circuit regulators.
 - Construct and measure signals in an IC regulator circuit.
 - Troubleshoot faulty IC regulators circuits.

**STANDARD
470107-06**

Students will be able to troubleshoot digital integrated circuits.

Objectives

470107-0601

Perform arithmetic operations in various numbering systems.

- Use the decimal number system.
- Use the octal number system.
- Use the hexadecimal number system.
- Use the binary number system.
- Convert from decimal to binary.
- Convert between octal and binary.
- Convert between hexadecimal and binary.
- Convert between octal and hexadecimal.
- Convert decimal to octal or hexadecimal.
- Perform binary addition.
- Perform binary subtraction.

470107-0602

Construct and test simple logic circuits.

- Describe standard digital gates.
- Simplify logic equations using Boolean algebra.
- From the truth table or Boolean equation, draw the logic diagram and predict the voltage and logic levels in all parts of the digital circuit.
- Describe the procedures for testing and troubleshooting logic circuits.
- Construct and test simple logic circuits.

470107-0603

Use, test and select digital devices.

- Identify common digital families
- Identify the levels of integration and chip component density.
- Describe the procedures for testing and selecting digital devices.
- Use, test and select digital devices.

470107-0604

Construct, test and troubleshoot combinational logic circuits.

- Analyze combinational logic circuits and write the Boolean equation and truth table for each circuit.
- Simplify combinational logic circuits using Boolean identities, de Morgan's Theorem and logical equivalencies.
- Use Karnaugh maps to simplify combinational logic circuits.
- Determine the logical expression for any combinational logic circuit.
- From schematic diagrams and specifications, write a truth table and the Boolean equation for combinational logic circuits.
- From the truth table, predict the logic levels in all parts of combinational logic circuits.
- Write the truth table of arithmetic circuits and describe how each works.
- Describe the procedures for testing and troubleshooting combinational logic circuits.
- Construct, test and troubleshoot combinational logic circuits

470107-0605

Construct, test and trouble shoot sequential logic circuits.

- Define the properties of flip-flops.
- Describe the principles of operation of a D flip-flop.
- Describe the principles of operation of JK flip-flop.
- Describe the operation and application of shift registers.
- Describe the operation and application of frequency dividers and counters.
- Describe the operation and application of synchronous up/down and shift counters.
- Describe the operation and application of multivibrators.
- Describe the procedures for testing and troubleshooting sequential logic circuits.
- Construct, test and troubleshoot sequential logic circuits.

470107-0606

Troubleshoot digital/analog converter circuits.

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

470107-0607

Troubleshoot semi-conductor memory circuits.

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

470107-0608

Troubleshoot data conversion and transmission circuits.

- Describe the operation and applications of the decoders and encoders.
- Describe the operation and application of multiplexers and demultiplexers.

- Describe the operation and application of parity checkers and generators. Troubleshoot data conversion and transmission circuits.

**STANDARD
470107-07**

Students will be able to understand and demonstrate how the program and interface simple microprocessor based systems.

Objectives

470107-0701

Describe basic principles of microprocessors.

- Describe the functional elements of a model microprocessor
- Describe the process of executing instructions in a microprocessor.
- Name and describe the conventions used in naming signal/control leads in microprocessor integrated chips (ICs)

470107-0702

Identify components of a microcomputer

- Identify the five main blocks that constitute a microcomputer sys

470107-0703

Write simple machine language programs.

- Describe the elements of programming
- Describe the procedures for flowcharting a program or process.
- Describe microprocessor codes and addressing modes.
- Describe the procedure for instruction coding and program debugging. Draw a flowchart for a typical program.

470107-0704

Write input/output (i/o) drivers for microprocessor systems.

- Describe the fundamental principles for microprocessor interfacing.
- Describe the operation of common input/output interfacing.
- Explain how interrupt priority can be achieved by hardware and software.
- Describe the procedures for wiring and troubleshooting simple interfaces and writing a program in machine language to operate it.
- Access input-output (I/O) using a microprocessor.

**STANDARD
470107-08**

Students will be able to understand and demonstrate the use of personal computers.

Objectives

470107-0801

Connect and operate a personal computer system.

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

470107-0802

Use operating systems.

- Describe common operating systems and their functions.
- Describe disk and file handling in Windows.

- Describe disk and file handling in DOS.
 - Use operating systems.
- 470107-0803 Use common applications software packages.
- Describe common types of applications software.
 - Use common applications software packages.

STANDARD **Students will be able to understand and demonstrate how to maintain and produce technical documents.**
470107-09

Objectives

- 470107-0901 Use, maintain and/or produce electronics documentation.
- Describe the types of information that may be found in catalogues, data sheets, bulletins and manuals.
 - Describe the use of diagrams in electronics.
 - Describe methods of record keeping.
 - Use, maintain and/or produce electronics documentation.

PROFESSIONAL DEVELOPMENT

STANDARD **Students will understand the need for professional development.**
470107-10

Objectives

- 470107-1001 Complete a personal inventory.
- 470107-1002 Set and meet goals.
- 470107-1003 Be self-motivated.
- 470107-1004 Know how to make decisions.
- 470107-1005 Know how to manage time.
- 470107-1006 Organize personal belongings and lab equipment.
- 470107-1007 Learn to communicate verbally.
- 470107-1008 Write effective communications.
- 470107-1009 Establish a personal reading program.
- 470107-1010 Develop effective work skills and attitudes.
- 470107-1011* Master a working knowledge of SkillsUSA.
- Learn the acronym SkillsUSA.
 - State the SkillsUSA motto.
 - State the SkillsUSA creed.
 - Learn the SkillsUSA colors.
 - Describe the official SkillsUSA dress.
 - Describe the procedure for becoming a SkillsUSA officer.

**STANDARD
470107-11**

Students will understand the need for leadership skills.

Objectives

- 470107-1101 Serve on a committee.
470107-1102 Prepare an agenda
470107-1103 Assist in planning a meeting
470107-1104 Review basic parliamentary procedures.
 - Make a main motion.470107-1105 Participate in a school project.
470107-1106 Attend a community meeting
470107-1107 Practice effective speaking.
470107-1108 Present a three-to-five minute talk.
470107-1109 Implement a leadership project.
470107-1110* Master a working knowledge of SkillsUSA
 - Describe the meaning of the SkillsUSA emblem.
 - State the SkillsUSA pledge.
 - Describe the duties of a SkillsUSA officer.

**STANDARD
470107-12**

Students will understand the need for career planning.

Objectives

- 470107-1201 Define your future occupation.
470107-1202 Survey employment opportunities.
470107-1203 Report on a trade journal article.
470107-1204 Explore opportunities for advanced training.
470107-1205 Conduct a worker interview
470107-1206 Contact a professional association.
470107-1207 Explore entrepreneurship opportunities.
470107-1208 Give a talk about your career.
470107-1209 Review career goals.

**STANDARD
4670105-13**

Students will understand the importance of employability and work habits.

Objectives

- 470107-1301 Develop a list of work standards to follow at school and on the job.
470107-1302 Evaluate your personal ethics.
 - Evaluate your personal ethics against acceptable workplace ethics.470107-1303 Build a job search network
470107-1304 Find job leads.
470107-1305 Write a resume.
470107-1306 Create a job portfolio.
470107-1307 Complete a job application.

470107-1308 Write a business letter and memo.

470107-1309 Participate in an actual or simulated job interview.

*SkillsUSA PDP requirements – recommended.