DOCUMENT RESUME

ED 458 379 CE 082 490

TITLE	Electronics. FasTrak Specialization Integrated Technical and Academic Competency (ITAC). Revised.
INSTITUTION	Ohio State Dept. of Education, Columbus. Div. of Career-Technical and Adult Education.
PUB DATE	2001-09-14
NOTE	11p.; For other FasTrak ITACs, see CE 082 485-494 and CE 082 496.
AVAILABLE FROM	For full text: http://www.ode.state.oh.us/ctae/teacher/fastrak/list.asp.
PUB TYPE	Guides - Non-Classroom (055)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Adult Education; Competence; *Competency Based Education; Computer Oriented Programs; Degrees (Academic); Educational Certificates; *Electromechanical Technology; *Electronic Technicians; *Electronics; Graduation Requirements; *Integrated Curriculum; Job Skills; Labor Force Development; Postsecondary Education; Repair; Secondary Education; State Programs; Statewide Planning; *Technology Education; Troubleshooting
IDENTIFIERS	Office Machine Servicers; *Ohio

ABSTRACT

This document contains an introduction to the Ohio Integrated Technical and Academic Competency (ITAC) and Specialization ITAC; and overview of the electronics field; an list acknowledging the professionals who helped develop the competency list; and the comprehensive listing of the professional or occupational competencies deemed essential for graduates to perform proficiently when they graduate from an Ohio specialization workforce development program on electronics. The introduction explains the following: (1) critical academic, employability, and information technology skills have been integrated throughout the list to support the technical skills; (2) the competency profile can be used as the basis for curriculum development in Ohio's secondary, adult, and postsecondary programs; (3) the specialization competency profile is organized so that it can be clustered or grouped in a modular approach. The overview of the electronics profession describes general duties, some specific tasks, employment opportunities, length of program, type of program (classroom instruction and/or work experience), and types of certificates and/or degrees. The competencies are grouped under broader skills that are, in turn, categorized under these nine major topics: electronics orientation; basic electronic theory; basic electronic skills; basic troubleshooting and repair; troubleshoot and repair common consumer and business office equipment; computer applications and servicing; electro-optic technology applications and servicing; professionalism in electronics; and academic skills in electronics. (YLB)

Electronics

FasTrak

Specialization Integrated Technical and Academic Competency (ITAC)

Updated Friday, September 14, 2001 01:26 PM

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Acknowledgements

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Bob Taft, Governor | Susan Tave Zelman, Superintendent of Public Instruction
Contact ODE | Web site notes | Contact Web Manager | ODE home | Ohio home
Ohio Department of Education, 25 South Front Street, 6th Floor, Columbus, Ohio 43215-4183
1-877-644-6338
Career-Technical and Adult Education 614-466-3430

Updated Friday, September 14, 2001 02:20 PM

Introduction to the Specialization ITAC

Revised 2001

The Ohio Integrated Technical and Academic Competency (ITAC) profiles are developed under the auspices of the Ohio Department of Education and the Ohio State Board of Education. They provide a broad-based educational response to Ohio's need for a skilled workforce. Each Specialization ITAC represents a profile of the professional or occupational competencies deemed essential for a graduate to perform proficiently when he or she graduates from the specialization workforce development programs in Business and Marketing, Industrial and Engineering Systems, Health Occupations, or Family and Consumer Sciences. The Specialization ITAC profile, in conjunction with the competencies identified in the Foundation and Clusters ITACs, provide a career pathway that can lead to employment or further education.

Process and Intent

The integrated competency lists are the result of all encompassing research and review of existing competency profile lists and includes input from industry, labor, professional organizations, professional and industrial representation, and national standards for a specific industry/profession. Representatives from a broad cross-section of Ohio professional organizations, businesses/professions, industry, and labor played a critical role in identifying current and future knowledge and skills for the industry, and defining the vision and scope of the profession/industry. The instructional methods and teaching strategies are the responsibility of the local school system and/or instructor.

Curriculum Applications Using the ITAC Competency Profiles

Each profile includes a comprehensive listing of occupational skill competencies that reflect the job opportunities and skills that are required to work in a specific profession/career pathway. Critical academic, employability and information technology skills have been integrated throughout the list to support the technical skills. These competency profiles will be used as the basis for curriculum development in Ohio's secondary, adult, and post-secondary programs. The specialization competency profiles are organized so that they can be clustered or grouped in a modular approach. Individual curriculum specialists can use the competencies profiles to develop instructional programs based on local needs as determined in conjunction with their local advisory committees. i.e., the specialization cluster academy approach. Final assessments will be designed to accompany each profile list and to accommodate student evaluation by modules.

Career Pathways | FasTrak ITACs

Acknowledgements
Ohio Department of Education
Office of Career-Technical and Adult Education
2001 Revision

Electronics

Vicki Melvin, Interim Director

Industrial and Engineering Systems and Health Careers

Robert Bowermeister, Assistant Director
Joyce R. Boudreau, Consultant
Michael Cowles, Consultant
Gayle Parlin, Consultant
Richard Wancho, Consultant

Curriculum Consultants

Dee Allenspach, Consultant
Joyce Leimbach, Consultant

Professional Panel

Harold Alexander, ETA-CA, E Ohio Net, Inc., Cadiz
James Davis, PE, Muskingum Area Technical College, Zanesville
Jeffrey Hutchinson, IEEE Representative, Carrier Corporation, Powell
Ross Lilley, SPHR, RBB Systems, Shreve
Theodore Manos, RCDD Dynalectric, Joint Apprenticeship and Training Committee (JATC), Columbus
Larry Mauer CET, ISCET, Best Buy, Independence
Kevin Sheedy, Atlas Industrial Electric, Joint Apprenticeship and Training Committee (JATC), Columbus

Educational Review Panel

Dennis Batig, Polaris Career Center, Middleburg Hts.
Nick Costein, Pioneer Career and Technology Center, Shelby
Joe Delio, Parma High School, Parma
Gary Wimer, Wayne County Career Center, Smithville

Overview

Electronics

The electronics profession is one that involves using a variety of math and science skills and requires good manual dexterity along with good color vision. A course of study in electronics may include applied physics and math, basic electricity and circuits, AC/DC circuits, basic computer programming, network cabling and design, and other relevant applications. A career in electronics is in a clean work environment and can be very rewarding and challenging. This is a career that requires ongoing education to maintain pace with the ever-changing technology. The advances in technology in the past decade have been phenomenal and it appears the next decade will continue to change just as quickly.

Electronics technicians may work in research, development, quality control, design, production, or sales. Technicians need to have a basic foundation of electronics theory and technical applications so they can work on [radios, televisions, machine controls, computers, robots, radar, sonar, and a variety of communications equipment.] Technicians use information from blueprints and detailed drawings to troubleshoot/repair, test, adjust, and inspect products. Some electronics technicians may help in the development of electronic products. Other technicians may focus on installing, repairing, or servicing equipment.

As a person gains experience in the electronics field, he or she is generally given more responsible assignments and can move into positions of considerable financial reward. Experienced technicians may advance to supervisory positions or may be promoted to professional positions. Progressive positions may include engineering technicians, production or testing supervisors, and quality assurance supervisors. Advancement opportunities can be endless with advanced education and the initiative to be creative. There are a variety of certifications available with advanced training and assessment.

28.00.00.0 Electronics

28.01.00.0 Electronics Orientation

28.01.01.0 Define electronics career parameters

28.01.01.01 Explore the history of electronics
28.01.01.02 Outline the scope of the electronics field (i.e., areas of specialization, work techniques, processes, and procedures one might be required to perform)
28.01.01.03 Identify the professional associations related to the electronics profession
28.01.01.04 Explore career opportunities in electronics profession

28.01.02.0 Orient self to laboratory facility

28.01.02.01 Identify location of fire exits
28.01.02.02 Identify location of lockers and workstation
28.01.02.03 Identify location of all emergency power-kill switches
28.01.02.04 Interpret standard safety symbols

28.01.03.0 Demonstrate procedures for locating and using emergency equipment and techniques

28.01.03.01 Identify location of fire extinguishers
28.01.03.02 Demonstrate established procedures for using different types of fire extinguishers
28.01.03.03 Identify location of first-aid kit
28.01.03.04 Identify location of personal safety equipment
28.01.03.05 Wear personal protective equipment appropriate for given job
28.01.03.06 Demonstrate knowledge of appropriate actions to take in response to given emergencies
28.01.03.07 Demonstrate emergency action techniques

28.01.04.0 Demonstrate knowledge of the procedures for working with hazardous materials

28.01.04.01 Interpret MSDS labels
28.01.04.02 Identify location of material safety data sheet (MSDS) manual
28.01.04.03 Identify the established safety procedures/regulations for handling hazardous materials
28.01.04.04 Identify the established safety procedures/regulations for disposing of hazardous materials

28.01.05.0 Follow safety rules and regulations

28.01.05.01 Follow safety procedures established for all types of circuits, components, and equipment
28.01.05.02 Follow MSDS guidelines
28.01.05.03 Comply with OSHA standards
28.01.05.04 Demonstrate knowledge of the applications of safety grounding systems (e.g., lightning arresters, ground-fault interrupters)
28.01.05.05 Demonstrate an understanding of ergonomics (i.e., repetitive motion injury, lifting techniques, approved noise levels, proper lighting, scheduling, chair heights, and work-station positioning)

28.01.06.0 Demonstrate procedures for the selection, use, and care of tools

28.01.06.01 Identify each tool in kit by name and function
28.01.06.02 Obtain required tools
28.01.06.03 Demonstrate proper and safe use of each tool in kit
28.01.06.04 Organize tools in kit
28.01.06.05 Maintain each tool in kit

28.02.00.0 Basic Electronic Theory

28.02.01.0 Apply knowledge of values in direct current (DC) circuits

28.02.01.01 Solve problems in electronic units utilizing metric prefixes
28.02.01.02 Demonstrate knowledge of electronic theory and electromotive force (EMF)
28.02.01.03 Identify sources of electricity in DC circuits
28.02.01.04 Demonstrate knowledge of the principles, operation, and applications of batteries
28.02.01.05 Identify the physical and electrical characteristics of capacitors
28.02.01.06 Demonstrate knowledge of magnetic properties
28.02.01.07 Demonstrate knowledge of the operational principles of motors
28.02.01.08 Demonstrate knowledge of the operational principles of generators
28.02.01.09 Differentiate between conductors, insulators, and resistors
28.02.01.10 Identify the physical and electrical characteristics of inductors
28.02.01.11 Measure resistance, current, and voltage in DC using a multimeter
28.02.01.12 Interpret resistor color codes
28.02.01.13 Compare resistance (R) established by color code to resistance as measured with an ohmmeter
28.02.01.14 Calculate conductance (G)
28.02.01.15 Demonstrate knowledge of the principles and operation of inductors in DC circuits
28.02.01.16 Demonstrate knowledge of the principles and operation of capacitors in DC circuits
28.02.01.17 Demonstrate knowledge of the relationship of voltage, current, resistance, and power in DC circuits (i.e.,Ohm's, Kirchhoffs, and Watts Laws)
28.02.01.18 Demonstrate knowledge of the maximum power transfer theorem
28.02.01.19 Operate power supplies for DC circuits
28.02.01.20 Breadboard DC series circuits for testing and evaluate test results
28.02.01.21 Breadboard DC parallel circuits for testing and evaluate test results
28.02.01.22 Breadboard DC series-parallel circuits for testing and evaluate test results
28.02.01.23 Breadboard DC bridge circuits for testing and evaluate test results
28.02.01.24 Demonstrate knowledge of the principles of resistive-capacitive (RC) and resistive-inductive (RL) time constants (t) in DC circuits

28.02.02.0 Apply knowledge of values in alternating current (AC) circuits

28.02.02.01 Compare peak (PK), root mean square (RMS), and average values of AC sine waves
28.02.02.02 Demonstrate knowledge of the relationship between frequency and phase in AC sine waves
28.02.02.03 Identify the characteristics of inductors and inductance (series and parallel)
28.02.02.04 Demonstrate knowledge of the principles and operation of inductors in AC series circuits
28.02.02.05 Demonstrate knowledge of the principles and operation of capacitors in AC series circuits
28.02.02.06 Demonstrate knowledge of the principles and operation of inductors in AC parallel circuits
28.02.02.07 Demonstrate knowledge of the principles and operation of capacitors in AC parallel circuits
28.02.02.08 Demonstrate knowledge of inductive reactance
28.02.02.09 Demonstrate knowledge of capacitive reactance
28.02.02.10 Demonstrate knowledge of impedance
28.02.02.11 Demonstrate knowledge of the principles of series RC circuits
28.02.02.12 Demonstrate knowledge of the principles of parallel RC circuits
28.02.02.13 Demonstrate knowledge of the principles of series RL circuits
28.02.02.14 Demonstrate knowledge of the principles of parallel RL circuits
28.02.02.15 Demonstrate knowledge of the principles of series RLC circuits
28.02.02.16 Demonstrate knowledge of the principles of parallel RLC circuits
28.02.02.17 Demonstrate knowledge of the uses of oscilloscopes and signal generators in the evaluation of RLC circuits
28.02.02.18 Breadboard series and parallel RLC circuits for testing and evaluate test results
28.02.02.19 Demonstrate knowledge of the application of series and parallel RLC circuits as filters (i.e., low-pass, high-pass, band-pass, and band-reject)
28.02.02.20 Identify the characteristics of different types of transformers
28.02.02.21 Demonstrate knowledge of the principles and operation of transformers in AC circuits
28.02.02.22 Demonstrate knowledge of the operational principles of motors
28.02.02.23 Demonstrate knowledge of the operational principles of generators
28.02.02.24 Demonstrate knowledge of the principles, operation, and applications of power conditioning, isolation transformers, surge suppressors, and uninterruptable power systems

28.02.03.0 Apply knowledge of the characteristics of diodes and basic power

28.02.03.01 Identify the properties of semiconductor materials
28.02.03.02 Identify the applications of PN junctions
28.02.03.03 Identify diode characteristics
28.02.03.04 Demonstrate knowledge of the operational principles of half-wave, full-wave, and bridge rectifiers
28.02.03.05 Demonstrate knowledge of the operational principles of nonregulated power supplies
28.02.03.06 Demonstrate knowledge of the operational principles of zener diodes
28.02.03.07 Demonstrate knowledge of the operational principles of thermistors and varistors
28.02.03.08 Demonstrate knowledge of the operational principles of regulated power supplies
28.02.03.09 Breadboard diode circuits for testing and evaluate test results
28.02.03.10 Breadboard nonregulated power supply circuits for testing and evaluate test results
28.02.03.11 Breadboard regulated power supply circuits for testing and evaluate test results
28.02.03.12 Demonstrate knowledge of the operational principles of light-emitting diodes (LEDs)
28.02.03.13 Demonstrate knowledge of the operational principles of optoelectronic circuits (e.g., gate isolators, interrupt sensors, infrared sensors)
28.02.03.14 Breadboard optoelectronic circuits for testing and evaluate test results

28.02.04.0 Apply knowledge of transistor circuits

28.02.04.01 Demonstrate knowledge of the operational principles of NPN transistors
28.02.04.02 Demonstrate knowledge of the operational principles of PNP transistors
28.02.04.03 Analyze current gain (beta) and characteristic curves
28.02.04.04 Demonstrate knowledge of the operational principles of common emitter (CE) amplifiers
28.02.04.05 Demonstrate knowledge of the operational principles of common base (CB) amplifiers
28.02.04.06 Demonstrate knowledge of the operational principles of common collector (CC) or emitter follower amplifiers
28.02.04.07 Demonstrate knowledge of the operational principles for biasing solid-state amplifiers
28.02.04.08 Categorize classes of amplification (i.e., A, B, C, AB)
28.02.04.09 Demonstrate knowledge of the operational principles of audio amplifiers and frequency response
28.02.04.10 Demonstrate knowledge of the operational principles of switching transistors
28.02.04.11 Breadboard single-stage amplifiers for testing and evaluate test results
28.02.04.12 Measure the frequency response of single-stage solid-state amplifiers
28.02.04.13 Identify amplifier coupling techniques
28.02.04.14 Identify the applications of bipolar transistors

28.02.05.0 Apply knowledge of field effect transistor (FET) circuits

28.02.05.01 Demonstrate knowledge of the operational principles of N- and P-channel junction field-effect transistors (JFETs)
28.02.05.02 Demonstrate knowledge of the operational principles and necessary handling precautions (i.e., static discharge) of metal-oxide-semiconductor field-effect transistors (MOSFETs)
28.02.05.03 Demonstrate knowledge of the application of biasing techniques in JFETs and MOSFETs
28.02.05.04 Identify the applications of field-effect transistors (FETs, MOSFETs)
28.02.05.05 Breadboard field-effect transistor circuits for testing and evaluate test results

28.02.06.0 Apply knowledge of control and power circuits

28.02.06.01 Demonstrate knowledge of the operational principles of silicon-controlled rectifiers (SCRs)
28.02.06.02 Demonstrate knowledge of the operational principles of diacs
28.02.06.03 Demonstrate knowledge of the operational principles of triacs
28.02.06.04 Demonstrate knowledge of the operational principles of Darlington amplifier circuits
28.02.06.05 Demonstrate knowledge of the operational principles of unijunction transistors (UJT)
28.02.06.06 Breadboard thyristor circuits for testing and evaluate test results

28.02.07.0 Apply knowledge of linear integrated circuits

28.02.07.01 Demonstrate knowledge of the operational principles of operational amplifiers (op amps)
28.02.07.02 Demonstrate knowledge of the operational principles of differential amplifiers
28.02.07.03 Demonstrate knowledge of the operational principles of op amp timing circuits (e.g., 555 timers)

28.02.08.0 Apply knowledge of power supply and amplifier circuits

28.02.08.01 Demonstrate knowledge of the principles, operation, and applications of multistage amplifiers
28.02.08.02 Demonstrate knowledge of the principles, operation, and applications of IF circuits
28.02.08.03 Demonstrate knowledge of the principles of DC voltage divider circuits (loaded and unloaded)
28.02.08.04 Demonstrate knowledge of the principles, operation, and applications of linear power supplies and filters
28.02.08.05 Demonstrate knowledge of the principles and operation of audio power amplifiers
28.02.08.06 Demonstrate knowledge of the principles, operation, and applications of regulated power-supply circuits
28.02.08.07 Demonstrate knowledge of the operational principles of cathode-ray tubes (CRTs)
28.02.08.08 Demonstrate knowledge of principles and operations of oscillator circuits

28.02.09.0 Apply knowledge of digital circuits

28.02.09.01 Identify the characteristics of integrated circuit (IC) logic families
28.02.09.02 Demonstrate knowledge of numbering systems, codes, arithmetic operations, and Boolean Operations
28.02.09.03 Determine the Boolean expressions for a given combinational logic circuit (AND, OR, NOT)
28.02.09.04 Identify methods for minimizing logic circuits using Boolean operations
28.02.09.05 Demonstrate knowledge of the principles and operation of different types of logic gates and their truth tables
28.02.09.06 Demonstrate knowledge of the principles and operation of combinational logic circuits
28.02.09.07 Demonstrate knowledge of the principles and operation of types of flip-flop circuits
28.02.09.08 Demonstrate knowledge of the principles and operation of different types of registers and counters
28.02.09.09 Demonstrate knowledge of the principles and operation of clock and timing circuits
28.02.09.10 Demonstrate knowledge of the principles and operation of different types of arithmetic logic circuits
28.02.09.11 Demonstrate knowledge of the principles and operation of different types of digital-to-analog circuits
28.02.09.12 Demonstrate knowledge of the principles and operation of different types of analog-to-digital circuits
28.02.09.13 Demonstrate knowledge of the principles and operation of different types of digital display circuits
28.02.09.14 Demonstrate knowledge of the principles of power-distribution-noise problems
28.02.09.15 Convert numbers and codes (e.g., binary, hex, octal, and BCD) from one numbering system to another
28.02.09.16 Determine state of digital circuits using a logic probe
28.02.09.17 Introduce digital pulses into digital circuits using a logic pulser
28.02.09.18 Observe waveforms in digital circuits using an oscilloscope

28.02.10.0 Apply knowledge of microprocessors

28.02.10.01 Demonstrate knowledge of the operational principles of the central processing unit (CPU)
28.02.10.02 Demonstrate knowledge of the operational principles of bus structure (e.g., power, control, data,
28.02.10.03 Demonstrate knowledge of the interface between microprocessors and memory devices (e.g., random-access memory (RAM), read-only memory (ROM), erasable, programmable read-only memory
28.02.10.04 Demonstrate knowledge of the operational principles of interfacing through input/output (I/O) devices (e.g., serial, parallel, analog to digital/digital to analog)

28.03.00.0 Basic Electronic Skills

28.03.01.0 Communicate electronics information using drawings

28.03.01.01 Match schematic symbols with the devices they represent
28.03.01.02 Interpret circuit operations using block diagrams
28.03.01.03 Interpret circuit operations using electronics schematics
28.03.01.04 Interpret circuit operations using technical drawings
28.03.01.05 Interpret circuit operations using flow charts

28.03.02.0 Work with data

28.03.02.01 Locate needed data using manufacturer's data books
28.03.02.02 Select electronic components for specific purposes using specification sheets and substitution guides
28.03.02.03 Analyze data from design curves
28.03.02.04 Analyze data from tables
28.03.02.05 Analyze data from graphs
28.03.02.06 Record data results
28.03.02.07 Present data using curves and graphs
28.03.02.08 Prepare equipment-failure reports

28.04.00.0 Basic Troubleshooting and Repair

28.04.01.0 Apply established basic troubleshooting steps

28.04.01.01 Verify circuit operation
28.04.01.02 Assess signs and symptoms of malfunction
28.04.01.03 Determine problem area by symptom
28.04.01.04 Determine the general location of a circuit malfunction using a block diagram
28.04.01.05 Analyze schematics to determine circuit function
28.04.01.06 Diagnose problem by signal tracing or signal injection
28.04.01.07 Use computer software programs to evaluate circuits
28.04.01.08 Isolate defective unit, circuit, and components
28.04.01.09 Verify operation following repair

28.04.02.0 Demonstrate use and maintenance of tools used in making repairs
28.04.02.01 Select the tools appropriate for a given task
28.04.02.02 Clean tools
28.04.02.03 Maintain tools
28.04.02.04 Store tools
28.04.02.05 Perform basic assembly tasks using hand and power tools

28.04.03.0 Use testing equipment to isolate cause of problem
28.04.03.01 Interpolate values when reading the scale on measurement devices
28.04.03.02 Measure voltage, current, and resistance using a digital volt-ohm-milliammeter (DVOM)
28.04.03.03 Measure voltage, current, and resistance using an analog volt-ohm-milliammeter (AVOM)
28.04.03.04 Test circuits using an oscilloscope
28.04.03.05 Introduce known signals into an electronics component, circuit, or piece of equipment using signal generators
28.04.03.06 Determine frequency response of an electronics component, circuit, or piece of equipment using a frequency counter
28.04.03.07 Determine frequency of a signal in a circuit or piece of equipment using a frequency counter
28.04.03.08 Provide various voltages to electronic equipment using a variable output transformer
28.04.03.09 Provide isolation for electronics equipment using an isolation transformer

28.04.04.0 Repair circuits
28.04.04.01 Select replacement part(s) appropriate for given repair job
28.04.04.02 Apply substitution techniques
28.04.04.03 Replace faulty components
28.04.04.04 Verify circuit operation through testing
28.04.04.05 Clean exterior of unit
28.04.04.06 Apply soldering and desoldering techniques appropriate to the job
28.04.04.07 Repair printed-circuit boards
28.04.04.08 Repair electromechanical control devices
28.04.04.09 Repair analog electronic control devices
28.04.04.10 Repair digital electronic control devices

28.04.05.0 Repair circuit boards using surface-mounted devices (SMDs)
28.04.05.01 Follow safety procedures established for servicing SMDs
28.04.05.02 Identify various type of SMDs used in manufacturing circuit boards (e.g., Ics, transistors, capacitors, resistors)
28.04.05.03 Identify the steps for handling static-sensitive devices
28.04.05.04 Locate defective SMDs using troubleshooting techniques
28.04.05.05 Replace SMDs

28.05.00.0 Troubleshoot and Repair Common Consumer and Business Office Equipment

28.05.01.0 Service consumer products
28.05.01.01 Demonstrate knowledge and basic principles and operations of radio and television receiving systems
28.05.01.02 Demonstrate knowledge and basic principles of recording and playback systems
28.05.01.03 Demonstrate knowledge and basic principles of audio systems

28.05.02.0 Service business office equipment
28.05.02.01 Demonstrate knowledge and basic principles of copiers and fax machines
28.05.02.02 Demonstrate knowledge and basic principles of phone and security systems

28.06.00.0 Computer Applications and Servicing

28.06.01.0 Apply knowledge of computer system architecture
28.06.01.01 Follow safety procedures established for working with computer system architecture
28.06.01.02 Demonstrate knowledge of the basic principles and operation of computer system architecture
28.06.01.03 Demonstrate knowledge of the basic principles and operation of addresses and interrupts
28.06.01.04 Resolve address and interrupt conflicts
28.06.01.05 Demonstrate knowledge of the basic principles and operation of volatile and nonvolatile memory

28.06.02.0 Use computer application fundamentals
28.06.02.01 Follow established media-handling techniques
28.06.02.02 Operate system software
28.06.02.03 Construct flow charts
28.06.02.04 Analyze flow charts

28.07.00.0 Electro-optic Technology Applications and Servicing

28.07.01.0 Demonstrate knowledge of the principles of light

28.07.01.01 Identify the characteristics of light sources
28.07.01.02 Identify the radiometric and photometric quantities of light that can be measured using light meters and related equipment
28.07.01.03 Identify the properties of light
28.07.01.04 Identify the characteristics and functions of different parts of the eye
28.07.01.05 Identify the maximum permissible exposure (MPE) guidelines

28.07.02.0 Service optical systems

28.07.02.01 Follow safety procedures established for servicing optical systems
28.07.02.02 Identify the characteristics and properties of optical materials
28.07.02.03 Identify the optical components used (e.g., lenses, beam splitters)
28.07.02.04 Demonstrate knowledge of the basic principles, operation, and applications of optical systems (e.g., ray tracing, refraction)
28.07.02.05 Troubleshoot optical systems

28.08.00.0 Professionalism in Electronics

28.08.01.0 Demonstrate established professional work ethics

28.08.01.01 Exhibit responsibilities and positive work behaviors (e.g., dependability, meeting expectations)
28.08.01.02 Follow rules and regulations, and policies as established by employer
28.08.01.03 Comply with employer standards in dress and personal hygiene
28.08.01.04 Practice cost effectiveness
28.08.01.05 Demonstrate time-management
28.08.01.06 Exhibit pride in work
28.08.01.07 Display initiative, respect, and ethical principles in decision making
28.08.01.08 Demonstrate interactive relationships required for effective teamwork

28.08.02.0 Demonstrate basic communications skills in oral and written

28.08.02.01 Organize thoughts
28.08.02.02 Use courtesy in all interactions
28.08.02.03 Write legibly using correct grammar and spelling
28.08.02.04 Speak clearly using correct grammar utilizing standard electronics terminology
28.08.02.05 Listen attentively
28.08.02.06 Translate technical terms into common terminology for clients

28.08.03.0 Demonstrate technical literacy

28.08.03.01 Demonstrate basic keyboarding skills
28.08.03.02 Demonstrate ability to use standard applications software (e.g., word processors, database management, and spreadsheets)
28.08.03.03 Demonstrate knowledge of business products and services
28.08.03.04 Maintain state-of-the-art skills in technical literacy (e.g., continuing education, inservice training, professional seminars/workshops)

28.08.04.0 Demonstrate problem solving and critical thinking skills

28.08.04.01 Exhibit problem solving processes (i.e., identification, clarification, possible solutions, options, decisions)
28.08.04.02 Exhibit critical thinking (i.e., creative thinking, decision-making, abstract thinking, how to learn skills)

28.09.00.0 Academic Skills in Electronics

28.09.01.0 Demonstrate proficiency in reading/interpreting electronics

28.09.01.01 Read various technical resource documents
28.09.01.02 Apply information from various sources of technical information (e.g., manufacturers' literature, codes, and regulations)

28.09.02.0 Demonstrate proficiency in mathematics

28.09.02.01 Demonstrate ability to use calculator
28.09.02.02 Round and/or truncate numbers to designated place value
28.09.02.03 Compare order and determine equivalences of real numbers
28.09.02.04 Solve problems/make applications involving integers, fractions, decimals, percentages, and ratios
28.09.02.05 Translate written and/or verbal statements into mathematical expressions
28.09.02.06 Compare, compute, and solve problems involving binary, octal, decimal, and hexadecimal numbering systems
28.09.02.07 Read scale on measurement device(s)/make interpolations where appropriate
28.09.02.08 Understand statistical terms and charts needed for interpretation of continuous improvement processes
28.09.02.09 Collect/organize data
28.09.02.10 Interpret/use tables, charts, maps and/or graphs
28.09.02.11 Identify patterns, note trends and/or draw conclusions from tables, charts, maps and/or graphs
28.09.02.12 Compute/interpret mean, median, and/or mode
28.09.02.13 Simplify/solve algebraic expressions and formulas
28.09.02.14 Select/use formulas appropriately
28.09.02.15 Understand/use scientific notations
28.09.02.16 Use properties of exponents and logarithms
28.09.02.17 Determine slope, midpoint, and distance
28.09.02.18 Graph functions
28.09.02.19 Determine perimeters, areas, surface areas, and volumes of geometric figures
28.09.02.20 Recognize, classify, and use properties of lines and angles
28.09.02.21 Recognize, classify, and use properties of two-and-three dimensional figures
28.09.02.22 Apply Pythagorean theorem
28.09.02.23 Identify basic functions of sine, cosine, and tangent
28.09.02.24 Compute/solve problems using basic trigonometric functions
28.09.02.25 Graph basic functions using polar and/or Cartesian coordinate systems

28.09.03.0 Demonstrate proficiency in physics

28.09.03.01 Demonstrate knowledge of principles for light, heat, and sound
28.09.03.02 Understand fundamental principles of mechanics, pneumatics, and hydraulics
28.09.03.03 Understand principles of electricity and magnetism

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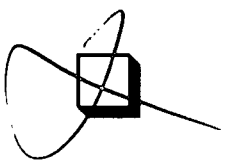

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