

Florida Department of Education  
CURRICULUM FRAMEWORK

**Program Title:** Autotronics  
**Occupational Area:** Industrial Education

	<u>PSAV</u>
<b>Program Numbers</b>	<b>I470614</b>
CIP Number	0647.060401
Grade Level	30, 31
Length	1785 hours
SOC	49-3023
Certification	ELECTRONIC @7 G AUTO MECH @7 G AUTO ELECT @7 G

- I. **MAJOR CONCEPTS/CONTENT:** The purpose of this program is to prepare students for initial employment as autotronics technicians (620.261-010).

This program includes selected competencies of the common core electronics program and others uniquely automotive.

The course content will include the following: direct current (DC); alternating current (AC), analog, relay, delay and time delay circuits; solid-state and digital devices, distribution, timing and control systems; microprocessors; industrial power supplies; transformers; DC and AC motors; digital motor controls; manual controllers; magnetic controllers and starters; pressure and strain measurements; temperature, photoelectric liquid level a process control; line diagrams and logic functions; gas and humidity sensing; and telemetry. The course content should also include training in communication skills, leadership skills, human relations and employability skills, and safe efficient work practices.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Autotronics industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

- II. **LABORATORY ACTIVITIES:** Shop or laboratory activities are an integral part of this program. These activities provide instruction in the use of tools, equipment, materials and processes found in the industry. Students will use various types of precision test equipment for analyzing, troubleshooting and repairing computer circuitry.
- III. **SPECIAL NOTE:** SkillsUSA, Inc. is the appropriate Career and Technical Student Organization (CTSO) for providing leadership training and for reinforcing specific career and technical skills. Career and Technical Student Organizations, when provided, shall be an integral part of the

career and technical instructional program, and the activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, FAC.

Cooperative training - OJT is appropriate for this program. Whenever cooperative training - OJT is offered, the following are required for each student: a training plan, signed by the student, teacher, and employer, which includes instructional objectives and a list of on-the-job and in-school learning experiences; a workstation that reflects equipment, skills and tasks that are relevant to the occupation which the student has chosen as a career goal. The student must receive compensation for work performed.

Algebra is recommended as a prerequisite for entry into this program.

In accordance with Rule 6A-10.040, FAC, the minimum basic-skills grade levels required for adult vocational students to complete this program are: Mathematics 10.0, Language 9.0, Reading 10.0. These grade-level numbers correspond to grade-equivalent scores obtained on one of the state-designated basic-skills examinations. If a student does not meet the basic-skills level required for completion of the program, remediation should be provided concurrently through Vocational Preparatory Instruction (VPI). Please refer to the Rule for exemptions.

***Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Adult students with disabilities must self-identify and request such services. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.***

To be transferable statewide between institutions, this program/course must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific program or course articulation agreements with each other.

This program may be offered in courses. Vocational credit will be awarded to the student on a transcript in accordance with Section 1001.44 (3) (b) F.S.

The standard length of this program is 1770 hours. This program provides the specialized technical content for the Automotive Service Management Technology (Autotronics Endorsement).

IV. **INTENDED OUTCOMES:** After successfully completing the program, the student will be able to:

**OCCUPATIONAL COMPLETION POINT - DATA CODE - A (150 Hours)**

LUBE TECHNICIAN 915.687-018 (SOC 49-3023)

- 01.0 Demonstrate proficiency in the equipment skills and safety regulations relating to the automotive industry. (01.01-01.16)
- 02.0 Demonstrate proficiency in appropriate math skills. (02.01-02.13)
- 03.0 Demonstrate proficiency in appropriate understanding of basic sciences. (03.01-03.04)
- 04.0 Demonstrate proficiency in employability skills. (04.01-04.10)

- 05.0 Demonstrate proficiency in appropriate communication skills.  
(05.01-05.04)
- 06.0 Demonstrate proficiency in understanding of entrepreneurship.  
(06.01-06.07)
- 07.0 Demonstrate proficiency in acceptable employee behavior in the  
automotive industry. (07.01-07.08)
- 08.0 Demonstrate proficiency in routine maintenance and consumer  
services. (08.01-08.27)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - B (285 Hours)**

AUTOMOTIVE TECHNICIAN 620.684-014 (SOC 49-3023)

- 08.0 Demonstrate proficiency in routine maintenance and consumer  
services. (08.28-08.58)

**OCCUPATIONAL COMPLETION POINT - DATA CODE - C (435 Hours)**

AUTOMOTIVE BASIC ELECTRONICS TECHNICIAN (SOC 49-3023)

- 09.0 Demonstrate a working knowledge of laboratory practices.
- 10.0 Demonstrate a working knowledge and theory of direct current  
practices.
- 11.0 Demonstrate a working knowledge and theory of alternating current  
circuits.
- 12.0 Demonstrate a working knowledge of dual trace oscilloscopes.
- 23.0 Demonstrate a working knowledge of system diagnosis and repair.
- 40.0 Demonstrate a working knowledge of electronically controlled  
charging systems.

**OCCUPATIONAL COMPLETION POINT - DATA CODE - D (495 Hours)**

**AUTOMOTIVE ELECTRONICS PERFORMANCE TECHNICIAN (SOC 49-3023)**

- 13.0 Demonstrate a working knowledge and theory of semi-conductor devices.
- 14.0 Demonstrate a working knowledge and theory of integrated circuits.
- 15.0 Demonstrate a working knowledge and theory of digital circuits.
- 16.0 Demonstrate a working knowledge of microprocessor fundamentals.
- 17.0 Demonstrate a working knowledge of electronic engine controls.
- 18.0 Demonstrate a working knowledge of electronic control module input and output devices and their functions.
- 19.0 Demonstrate a working knowledge of troubleshooting electronic control module systems.
- 20.0 Demonstrate a working knowledge of system operation.
- 21.0 Demonstrate a working knowledge of system input devices.
- 22.0 Demonstrate a working knowledge of system output devices.
- 41.0 Demonstrate a working knowledge of derivability lab.

**OCCUPATIONAL COMPLETION POINT - DATA CODE - E (420 Hours)**

**AUTOTRONICS TECHNICIAN (SOC 49-3023)**

- 24.0 Demonstrate a working knowledge of computer output displays.
- 25.0 Demonstrate a working knowledge of electronic instrumentation systems.
- 26.0 Demonstrate a working knowledge of theft deterrent systems.
- 27.0 Demonstrate a working knowledge of trip computer and trip monitor systems.
- 28.0 Demonstrate a working knowledge of windshield wiper and washer systems.
- 29.0 Demonstrate a working knowledge of cruise control systems.
- 30.0 Demonstrate a working knowledge of voice alert systems.
- 31.0 Demonstrate a working knowledge of audio systems.
- 32.0 Demonstrate a working knowledge of guide-matic and twilight sentinel systems.
- 33.0 Demonstrate a working knowledge of climate control systems.
- 34.0 Demonstrate a working knowledge of electronic seats with memory.
- 35.0 Demonstrate a working knowledge of fiber optics.
- 36.0 Demonstrate a working knowledge of automatic brake systems operation.
- 37.0 Demonstrate a working knowledge of anti-lock brake system diagnosis and repair.
- 38.0 Demonstrate a working knowledge of electronic level control systems.
- 39.0 Demonstrate a working knowledge of electronic steering systems.

**Florida Department of Education  
STUDENT PERFORMANCE STANDARDS**

**Program Title:** Autotronics  
**Secondary Number:**  
**Postsecondary Number:** I470614

**OCCUPATIONAL COMPLETION POINT - DATA CODE - A**

01.0 DEMONSTRATE PROFICIENCY IN THE EQUIPMENT SKILLS AND SAFETY REGULATIONS RELATING TO THE AUTOMOTIVE INDUSTRY--The student will be able to:

- 01.01 Apply shop safety rules, EPA and OSHA standards.
- 01.02 Identify and use appropriate emergency first aid procedures.
- 01.03 Identify, use and maintain hand and power tools properly.
- 01.04 Identify and practice using appropriate precision measuring tools and torque methods.
- 01.05 Identify and describe the proper procedure to apply and remove automotive fasteners, to include thread repair.
- 01.06 Identify and use metric and English measurement skills.
- 01.07 Use computer and operate keyboard.
- 01.08 Identify automobiles according to engine location, cylinders, type of drive system, purpose, etc.
- 01.09 Identify and describe typical automotive lubricants and lubricant properties.
- 01.10 Interpret the Florida "Workers Right-to-Know Law".
- 01.11 Identify and describe typical automotive seals and gaskets.
- 01.12 Identify and use the proper procedures required for cutting tubing and double and ISO flaring.
- 01.13 Utilize flat rate manuals, service manuals, service bulletins, parts manuals and electronic service information.
- 01.14 Demonstrate knowledge of the American Service Excellence (ASE) Certification and other applicable certification.
- 01.15 Describe and identify supplemental restraint system (SRS).
- 01.16 Disable supplemental restraint systems (SRS) in accordance with manufacturers' procedures.

02.0 DEMONSTRATE PROFICIENCY IN APPROPRIATE MATH SKILLS--The student will be able to:

- 02.01 Read and interpret measuring devices (rules and tapes).
- 02.02 Solve number word problems.
- 02.03 Write percents add fractions and decimals.
- 02.04 Solve percent problems.
- 02.05 Find the percent of a number.
- 02.06 Operate a calculator.
- 02.07 Understand and use the metric system.
- 02.08 Convert inches to millimeters and millimeters to inches.
- 02.09 Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares, and cylinders.
- 02.10 Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
- 02.11 Add, subtract, multiply and divide using fractions, decimals, and whole numbers.
- 02.12 Determine the correct purchase price, to include sales tax for a materials list containing a minimum of six items.
- 02.13 Understand and interpret gears and gear ratios.

- 03.0 DEMONSTRATE PROFICIENCY IN APPROPRIATE UNDERSTANDING OF BASIC SCIENCES--  
The student will be able to:
- 03.01 Understand molecular action as a result of temperature extremes, chemical reaction, and moisture content.
  - 03.02 Draw conclusions or make inferences from data.
  - 03.03 Identify health-related problems, which may result from exposure to work related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
  - 03.04 Understand pressure measurement in terms of P.S.I., inches of mercury, and K.P.A.
- 04.0 DEMONSTRATE PROFICIENCY IN EMPLOYABILITY SKILLS--The student will be able to:
- 04.01 Identify employment requirements for an Automotive career.
  - 04.02 Identify documents, which may be required when applying for a job.
  - 04.03 Complete a job application form correctly.
  - 04.04 Identify and adopt acceptable work habits.
  - 04.05 Demonstrate acceptable employee health habits; including infection control of blood born pathogens.
  - 04.06 Demonstrate appropriate telephone/communication skills.
  - 04.07 Conduct a job search.
  - 04.08 Demonstrate competence in job interview techniques.
  - 04.09 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other employees.
  - 04.10 Demonstrate knowledge of how to make job changes appropriately.
- 05.0 DEMONSTRATE PROFICIENCY IN APPROPRIATE COMMUNICATION SKILLS--The student will be able to:
- 05.01 Write logical and understandable statements, or phases, to accurately fill out forms/invoices commonly used in business and industry.
  - 05.02 Read and follow written and oral instructions.
  - 05.03 Answer and ask questions coherently and concisely.
  - 05.04 Read critically by recognizing assumptions and implications and by evaluating ideas.
- 06.0 DEMONSTRATE PROFICIENCY IN UNDERSTANDING OF ENTREPRENEURSHIP--The student will be able to:
- 06.01 Define entrepreneurship.
  - 06.02 Describe the importance of entrepreneurship to the American economy.
  - 06.03 List the advantages and disadvantages of business ownership.
  - 06.04 Identify the risks involved in ownership of business.
  - 06.05 Identify the necessary personal characteristics of a successful entrepreneur.
  - 06.06 Identify the business skills needed to operate a small business efficiently and effectively.
  - 06.07 Identify and apply communication skills used in automotive careers.
- 07.0 DEMONSTRATE PROFICIENCY IN ACCEPTABLE EMPLOYEE BEHAVIOR IN THE AUTOMOTIVE INDUSTRY--The student will be able to:
- 07.01 Explain the effects of chemical/substance abuse.
  - 07.02 Identify principles of stress management.

- 07.03 Demonstrate acceptable industry dress code.
- 07.04 Identify and demonstrate proper customer relation skills.
- 07.05 Identify and define payroll deductions (taxes, insurance, and social security) employee benefits and pay systems.
- 07.06 Identify principles of time management.
- 07.07 Identify acceptable customer relations.

08.0 DEMONSTRATE PROFICIENCY IN THE PROFICIENCY IN ROUTINE MAINTENANCE AND CONSUMER SERVICES AKA LIGHT LINE AKA GENERAL SERVICE TECHNICIAN--The student will be able to:

- 08.01 Inspect, test headlamps, tail lamps and stop lamps. Aim headlights.
- 08.02 Perform oil and filter change.
- 08.03 Service transmission; perform visual inspection; replace fluids and filters.
- 08.04 Inspect engine assembly for fuel, oil, coolant, and other leaks.
- 08.05 Inspect manual and power steering fluid levels and condition.
- 08.06 Check rear axle drive assembly seals and vents; check lube level.
- 08.07 Inspect and replace power steering hoses and fittings.
- 08.08 Lubricate suspension and steering systems.
- 08.09 Inspect, remove, and replace shock absorbers.
- 08.10 Remove, inspect, and service front and rear wheel bearings on non-drive axles.
- 08.11 Inspect tires, diagnose tire wear patterns, check and adjust air pressure.
- 08.12 Rotate tires according to manufacturer's recommendations, install wheels, torque lug nuts.
- 08.13 Balance wheel and tire assembly (static and dynamic).
- 08.14 Dismount, inspect, repair, and remount tire on wheel.
- 08.15 Check master cylinder for internal and external leaks and proper operation.
- 08.16 Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or wear; tighten loose fittings and supports.
- 08.17 Inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear; tighten loose fittings and supports.
- 08.18 Select, handle, store, and install brake fluids to proper level.
- 08.19 Fill master cylinder with recommended fluid and seat pads.
- 08.20 Inspect, clean, fill, and replace battery.
- 08.21 Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.
- 08.22 Start a vehicle using jumper cables with a battery and auxiliary power supply.
- 08.23 Perform slow/fast battery charge.
- 08.24 Observe dash warning lamps during bulb check.
- 08.25 Locate and interpret vehicle and major component identification numbers (VIN, vehicle labels and calibration decals).
- 08.26 Practice recommended precautions when handling static sensitive devices.
- 08.27 Inspect and test positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; service or replace as needed.

**OCCUPATIONAL COMPLETION POINT - DATA CODE - B**

- 08.28 Inspect, replace, and adjust drive belts and pulleys.
- 08.29 Inspect and replace engine cooling and heating system hoses.
- 08.30 Inspect, test, and replace thermostat and housing.

- 08.31 Perform cooling system pressure tests; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; service or replace as needed.
- 08.32 Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; service or replace as needed.
- 08.33 Determine coolant condition; drain, flush, recover and refill cooling system with recommended coolant and bleed air as required.
- 08.34 Inspect, test, remove, and replace water pump.
- 08.35 Identify and describe typical automotive lubricants and lubricant properties.
- 08.36 Check parking brake operation; adjust as needed.
- 08.37 Use wiring diagrams of electrical circuit problems.
- 08.38 Check electrical circuits with a test light; determine needed repairs.
- 08.39 Check voltage and voltage drop in electrical circuits using a digital multimeter (DMM).
- 08.40 Check current flow in electrical/electronic circuits and components using an ammeter.
- 08.41 Check electrical circuits using jumper wires.
- 08.42 Measure and diagnose the cause(s) of abnormal key-off battery drain.
- 08.43 Inspect and test fusible links, circuit breakers, and fuses; replace as needed.
- 08.44 Perform battery capacity (load, high-rate discharge) test; determine needed service.
- 08.45 Maintain or restore electronic memory functions.
- 08.46 Perform starter current draw and circuit voltage drop test; determine needed repairs.
- 08.47 Remove and replace/reinstall starter.
- 08.48 Perform charging system test.
- 08.49 Remove, inspect, and replace/reinstall alternator.
- 08.50 Demonstrate retrieving stored diagnostic trouble codes.
- 08.51 Obtain and interpret digital multimeter (DMM) readings.
- 08.52 Inspect fuel tank and fuel cap; inspect and replace fuel lines, fittings, and hoses.
- 08.53 Replace fuel filters.
- 08.54 Inspect exhaust manifold, exhaust pipes, mufflers, resonators, tail pipes, and heat shields; repair or replace as needed.
- 08.55 Adjust valves on engines with mechanical lifters.
- 08.56 Remove and replace valve cover gaskets (ASE).
- 08.57 Return cores for rebuilt and exchange items.
- 08.58 Inspect passenger restraint system, repair if needed.

**OCCUPATIONAL COMPLETION POINT - DATA CODE - C**

09.0 DEMONSTRATE A WORKING KNOWLEDGE OF LABORATORY PRACTICES--The student will be able to:

- 09.01 Apply proper Occupational Safety Health Administration safety standards.
- 09.02 Make electrical connections.
- 09.03 Identify and use hand tools properly.
- 09.04 Identify and use power tools properly.
- 09.05 Demonstrate acceptable soldering and desoldering techniques.
- 09.06 Identify components of computer system consisting of central processing unit, monitor, keyboard, data storage devices and peripherals.
- 09.07 Initialize computer and operate keyboard.

- 10.0 DEMONSTRATE A WORKING KNOWLEDGE OF DIRECT CURRENT CIRCUITS--The student will be able to:
- 10.01 Solve problems in electronic units utilizing metric prefixes.
  - 10.02 Relate electricity to the nature of matter.
  - 10.03 Identify sources of electricity.
  - 10.04 Define voltage, current, resistance, power and energy.
  - 10.05 Read and interpret color codes and symbols to identify electrical components and values.
  - 10.06 Measure properties of a circuit using volt-ohm meter and digital volt-ohm meter meters and oscilloscopes.
  - 10.07 Apply Ohm's law to series circuits.
  - 10.08 Construct and verify operation of series circuits.
  - 10.09 Analyze and troubleshoot series circuits.
  - 10.10 Apply Ohm's law to parallel circuits.
  - 10.11 Verify the operation of parallel circuits.
  - 10.12 Analyze and troubleshoot parallel circuits.
  - 10.13 Apply Ohm's law to parallel circuits.
  - 10.14 Construct and verify the operation of combination circuits.
  - 10.15 Troubleshoot combination circuits.
  - 10.16 Describe magnetic properties of circuits and devices.
  - 10.17 Determine the physical and electrical characteristics of capacitors and inductors.
- 11.0 DEMONSTRATE A WORKING KNOWLEDGE OF ALTERNATING CURRENT (AC) CIRCUITS--The student will be able to:
- 11.01 Identify properties of an AC signal.
  - 11.02 Identify AC sources.
  - 11.03 Analyze and measure AC signals utilizing VOM, DVM, oscilloscope, frequency counter and function generator.
  - 11.04 Define the characteristics of AC capacitive circuits.
  - 11.05 Define the characteristics of AC inductive circuits.
  - 11.06 Define basic motor theory and operation.
  - 11.07 Define basic generator theory and operation.
- 12.0 DEMONSTRATE A WORKING KNOWLEDGE OF DUAL TRACE OSCILLOSCOPES--The student will be able to:
- 12.01 Demonstrate proper operation and use of dual trace oscilloscope.
- 23.0 DEMONSTRATE A WORKING KNOWLEDGE OF SYSTEM DIAGNOSIS AND REPAIR--The student will be able to:
- 23.01 Describe system check.
  - 23.02 Diagnose and differentiate between mechanical and electrical problems.
  - 23.03 Diagnose shifting problems related to engine performance.
  - 23.04 Identify driver habits effecting engine/transmission related diagnosis.
  - 23.05 Describe stored code removal.
- 40.0 DEMONSTRATE A WORKING KNOWLEDGE OF ELECTRONICALLY CONTROLLED CHARGING SYSTEM--The student will be able to:
- 40.01 System operation.
  - 40.02 System diagnosis and repair.

**OCCUPATIONAL COMPLETION POINT - DATA CODE - D**

- 13.0 DEMONSTRATE A WORKING KNOWLEDGE OF SEMI-CONDUCTOR DEVICES--The student will be able to:
- 13.01 Overview of semi-conductor materials.
  - 13.02 List types of diodes.
  - 13.03 Explain application operation and characteristics of diodes.
  - 13.04 explain construction, applications and use of silicon controlled rectifiers.
  - 13.05 Describe transistor construction.
  - 13.06 Explain characteristics of PNP/NPN transistors.
  - 13.07 Measure current flow and calculate amplifier gain.
  - 13.08 Explain construction and use of Darlington pair.
  - 13.09 Explain concept of open collector operation.
  - 13.10 Identify and define operating characteristics and applications of junction diodes.
  - 13.11 Construct, analyze and troubleshoot diode circuits (basic breadboard).
  - 13.12 Identify and define operating characteristics and applications of bipolar transistors.
  - 13.13 Identify and define operating characteristics and applications of field effect transistors.
  - 13.14 Identify and define operating characteristics and applications of single-stage amplifiers.
  - 13.15 Construct, analyze and troubleshoot single-stage amplifiers.
- 14.0 DEMONSTRATE A WORKING KNOWLEDGE OF INTEGRATED CIRCUITS--The student will be able to:
- 14.01 Identify and define operating characteristics and applications of linear integrated circuits.
  - 14.02 Construct linear integrated circuits.
  - 14.03 Analyze and troubleshoot linear integrated circuits.
  - 14.04 Identify and define operating characteristics and applications of power supply regulator circuits.
  - 14.05 Explain positive logic concepts.
  - 14.06 Explain Schmidt trigger concept.
  - 14.07 Explain inverter concepts.
  - 14.08 Explain logic gates.
  - 14.09 Explain quad driver and its use.
  - 14.10 Analyze and troubleshoot power supply regulator circuits.
  - 14.11 Identify and define operating characteristics and applications of opto-electronic devices.
  - 14.12 Set up and operate measuring instruments for analog circuits and computer's diagnosis of auto system (emphasis volt meter).
- 15.0 DEMONSTRATE A WORKING KNOWLEDGE OF DIGITAL CIRCUITS--The student will be able to:
- 15.01 Set up and operate logic probes for digital circuits.
  - 15.02 Identify types of logic gates and their truth tables.
  - 15.03 Construct combinational logic circuits using integrated circuits.
  - 15.04 Analyze types of flip-flops and their truth tables.
  - 15.05 Troubleshoot flip-flops.
  - 15.06 Identify, define and measure characteristics of integrated circuit (IC) logic families.
  - 15.07 Identify types of registers and counters.
  - 15.08 Identify types of memory circuits.

- 15.09 Relate the uses of digital-to-analog and analog-to-digital conversions.
  - 15.10 Troubleshoot digital-to-analog and analog-to digital circuits.
  - 15.11 Identify types of digital displays.
  - 15.12 Construct digital display circuits.
  - 15.13 Troubleshoot digital display circuits.
- 16.0 DEMONSTRATE A WORKING KNOWLEDGE OF MICROPROCESSOR FUNDAMENTALS--The student will be able to:
- 16.01 Explain fundamentals of microprocessor operation.
  - 16.02 Analyze and measure properties of analog and digital signals utilizing VOM, DVM and oscilloscope.
  - 16.03 Describe differences between analog and digital signals.
  - 16.04 Explain type of memory(s).
  - 16.05 Explain central processing unit operation.
  - 16.06 Describe function of clock generator.
  - 16.07 Explain function of analog to digital and digital to analog convertors (interface).
  - 16.08 Explain binary code.
  - 16.09 Explain pulse width modulation (duty cycle).
  - 16.10 Explain sensor information processing.
  - 16.11 Explain serial/parallel data processing.
  - 16.12 Describe function of multiplexing.
- 17.0 DEMONSTRATE A WORKING KNOWLEDGE OF ELECTRONIC ENGINE CONTROLS--The student will be able to:
- 17.01 Describe stoichiometric air/fuel ratio.
  - 17.02 Describe computer control of air fuel ratio using concept of open loop/closed loop.
  - 17.03 Describe adaptive memory, integrator, block learn.
  - 17.04 Describe effect of air/fuel ratio, timing and exhaust gas recirculating system operation.
  - 17.05 Describe function of three-way catalyst.
  - 17.06 Describe methods of controlling air/fuel ratio.
- 18.0 DEMONSTRATE A WORKING KNOWLEDGE OF ELECTRONIC CONTROL MODULE INPUT AND OUTPUT DEVICES AND THEIR FUNCTIONS--The student will be able to:
- 18.01 Demonstrate an understanding of the operation and use of dual trace oscilloscope.
  - 18.02 Describe temperature sensor operation.
  - 18.03 Describe manifold and barometric sensors operation.
  - 18.04 Describe exhaust gas oxygen sensor operation.
  - 18.05 Describe switch and timer circuit operation.
  - 18.06 Explain construction and operation of Hall effect switch.
  - 18.07 Perform testing of Hall effect switches.
  - 18.08 Describe engine speed sensor operation.
  - 18.09 Describe vehicle speed sensor(s) operation.
  - 18.10 Describe throttle position sensor operation.
  - 18.11 Perform testing of electronic timing controls including knock sensor.
  - 18.12 Utilize oscilloscope to test pick-up coil, Hall-effect switch, EST circuits, reference circuits.
  - 18.13 Describe detonation control (electronic spark control).
  - 18.14 Demonstrate an understanding of electronic spark timing operation.
  - 18.15 Describe mass airflow sensor operation.
  - 18.16 Describe electronic control module control of fuel evaporative system.

- 18.17 Describe crankshaft position sensor operation.
  - 18.18 Describe electronic control module control of air-management system.
  - 18.19 Describe electronic control module control of early fuel evaporation (EFE).
  - 18.20 Describe electronic control module control of spark timing.
  - 18.21 Describe electronic control module control of carbureted fuel mixture.
  - 18.22 Describe type of fuel injection systems.
  - 18.23 Describe components of throttle-body injection systems.
  - 18.24 Describe components of port fuel injection systems.
- 19.0 DEMONSTRATE A WORKING KNOWLEDGE OF TROUBLESHOOTING ELECTRONIC CONTROL MODULE SYSTEMS--The student will be able to:
- 19.01 Describe procedures for troubleshooting electronic control module systems.
  - 19.02 Describe type and use of trouble code(s).
  - 19.03 Demonstrate use of generic and manufacturers' test equipment.
  - 19.04 Describe difference between hard failure/soft failure.
  - 19.05 Perform trouble code retrieval procedures.
  - 19.06 Perform pin-out check on electronic control module input and output devices.
  - 19.07 Remove/replace electronic control module/calibration unit.
  - 19.08 Demonstrate ability to troubleshoot electronic control module systems utilizing manufacturers' diagnostic charts.
  - 19.09 Demonstrate general knowledge of electronic systems for major imports.
- 20.0 DEMONSTRATE A WORKING KNOWLEDGE OF SYSTEM OPERATION--The student will be able to:
- 20.01 Explain the operation of computer shifted automatic transmission systems.
  - 20.02 Explain viscous converter clutch.
  - 20.03 Describe control module's effect on shifting patterns.
  - 20.04 Explain the function and operation of engine load sensors.
- 21.0 DEMONSTRATE A WORKING KNOWLEDGE OF SYSTEM INPUT DEVICES--The student will be able to:
- 21.01 Explain neutral safety/backup light switch.
  - 21.02 Explain throttle position sensor (potentiometer).
  - 21.03 Explain vehicle speed sensor.
  - 21.04 Explain function of brake release switch.
  - 21.05 Explain engine coolant temperature sensor.
  - 21.06 Explain function of air conditioning pressure switches.
  - 21.07 Explain cold inhibit switch.
  - 21.08 Explain operation of vacuum switches.
  - 21.09 Explain thermal vacuum valve.
  - 21.10 Explain vacuum regulator valve.
  - 21.11 Explain vehicle speed sensor tripper module.
- 22.0 DEMONSTRATE A WORKING KNOWLEDGE OF SYSTEM OUTPUT DEVICES--The student will be able to:
- 22.01 Explain operation of valve body/solenoid valve.
  - 22.02 Explain function of gear switches.
  - 22.03 Explain torque converter clutch apply valve.
  - 22.04 Explain torque converter clutch delay valve.

- 22.05 Explain engine coolant fan temperature switch.
  - 22.06 Explain governor pressure control switch.
  - 22.07 Explain function of pulse relay.
- 41.0 DEMONSTRATE A WORKING KNOWLEDGE OF DERIVABILITY LAB--The student will be able to:
- 41.01 Demonstrate knowledge of current technology in electronic engine control systems.
  - 41.02 Interpret vehicle identification numbers.
  - 41.03 Perform comprehensive engine performance analysis using oscilloscope and other appropriate equipment.
  - 41.04 Perform a diagnostic circuit check of on-board microprocessor systems (self-test).
  - 41.05 Define and determine open and closed loop system operation.
  - 41.06 Explain and service an air injection system.
  - 41.07 Explain and service thermal systems.
  - 41.08 Explain and service charcoal canister purge systems.
  - 41.09 Service pollution control valve systems.
  - 41.10 Service exhaust gas-type fuel evaporative systems.
  - 41.11 Service electric type fuel evaporative systems.
  - 41.12 Explain, diagnose and demonstrate the servicing of the service exhaust gas recirculating systems.
  - 41.13 Test vacuum switch.
  - 41.14 Test solenoid operated vacuum switch.
  - 41.15 Service and repair engine cooling fan systems.
  - 41.16 Perform non-scan tool tests on inputs and controls of microprocessor systems.
  - 41.17 Perform scan tool diagnostics on inputs and controls of microprocessor systems.
  - 41.18 Test, service and repair microprocessor input sensors and control devices.
  - 41.19 Demonstrate the use of manufacturers' diagnostic charts.
  - 41.20 Perform system performance checks on electronic engine control systems.
  - 41.21 Diagnose cold derivability problems.
  - 41.22 Diagnose warm derivability problems.
  - 41.23 Perform sensor adjustment.
  - 41.24 Perform exhaust gas backpressure test.
  - 41.25 Check and reset ignition timing and idle speed settings as per vehicle emission control information label.
  - 41.26 Perform internal and external adjustments on electronic carburetors.
  - 41.27 Test and adjust minimum air flow.
  - 41.28 Analyze exhaust gases for proper emissions.
  - 41.29 Test electronic idle air control.
  - 41.30 Check idle stop solenoid.
  - 41.31 Repair circuits with the use of wiring diagrams and component locator manuals.
  - 41.32 Perform field repairs to wiring and connectors.
  - 41.33 Test and service electronic ignition systems.
  - 41.34 Test and service anti-detonation (knock sensor) devices.
  - 41.35 Perform pin out tests and interpret readings.
  - 41.36 Check engine vacuum systems for proper routing and connections.
  - 41.37 Service air inlet systems.
  - 41.38 Test and/or replace ignition coils.
  - 41.39 Demonstrate the procedure for electronic control module.
  - 41.40 Perform diagnostic test on torque converter clutch circuit and components.

- 41.41 Perform fuel pump pressure test on vehicles equipped with electronic fuel injection.
- 41.42 Test specific gravity of fuel, analyze and check for contaminants.
- 41.43 Perform fuel injector balance test on vehicles equipped with individual fuel injectors.
- 41.44 Perform fuel system diagnosis and performance checks.
- 41.45 Perform fuel pressure level tests.
- 41.46 Disassemble/reassemble throttle body unit.
- 41.47 Perform fuel injector cleaning procedures.
- 41.48 Test mass air flow sensor.
- 41.49 Remove, test, adjust and/or replace fuel injector.
- 41.50 Demonstrate understanding of system components.
- 41.51 Repair vehicles displaying various service codes as they would be encountered in a service situation.

**OCCUPATIONAL COMPLETION POINT - DATA CODE - E**

- 24.0 DEMONSTRATE A WORKING KNOWLEDGE OF COMPUTER OUTPUT DISPLAYS--The student will be able to:
  - 24.01 Describe, diagnose and repair service engine lights/emission lights.
  - 24.02 Describe, diagnose and replace liquid crystal displays.
  - 24.03 Describe, diagnose and replace vacuum tube fluorescent displays.
  - 24.04 Describe, diagnose and repair/replace electronic speedometer system.
  - 24.05 Describe, diagnose, and replace quartz-electric cluster.
  - 24.06 Describe, diagnose and replace digital cluster.
  - 24.07 Describe, diagnose and repair/replace odometer.
- 25.0 DEMONSTRATE A WORKING KNOWLEDGE OF ELECTRONIC INSTRUMENTATION SYSTEMS--The student will be able to:
  - 25.01 Explain electronic instrumentation.
  - 25.02 Diagnose and replace light emitting diode.
- 26.0 DEMONSTRATE A WORKING KNOWLEDGE OF THEFT DETERRENT SYSTEMS--The student will be able to:
  - 26.01 Describe theft deterrent system operation.
  - 26.02 Diagnose and repair the theft deterrent system
- 27.0 DEMONSTRATE A WORKING KNOWLEDGE OF TRIP COMPUTER AND TRIP MONITOR SYSTEMS--The student will be able to:
  - 27.01 Describe trip computer and trip monitor operations.
  - 27.02 Diagnose and repair trip computer and trip monitor.
- 28.0 DEMONSTRATE A WORKING KNOWLEDGE OF WINDSHIELD WIPER AND WASHER SYSTEMS--The student will be able to:
  - 28.01 Describe windshield wiper and washer system operation.
  - 28.02 Diagnose and repair trip computer and trip monitor.
- 29.0 DEMONSTRATE A WORKING KNOWLEDGE OF CRUISE CONTROL SYSTEMS--The student will be able to:
  - 29.01 Describe cruise control operation.
  - 29.02 Diagnose and repair cruise control system.

- 30.0 DEMONSTRATE A WORKING KNOWLEDGE OF VOICE ALERT SYSTEMS--The student will be able to:
- 30.01 Describe voice alert system operation.
  - 30.02 Diagnose and replace audio system components.
  - 30.03 Perform on-car adjustment of audio system.
- 31.0 DEMONSTRATE A WORKING KNOWLEDGE OF AUDIO SYSTEMS--The student will be able to:
- 31.01 Describe radio system operation.
  - 31.02 Diagnose and replace audio system components.
  - 31.03 Perform on-car adjustments of audio system.
- 32.0 DEMONSTRATE A WORKING KNOWLEDGE OF GUIDE-MATIC AND TWILIGHT SENTINEL SYSTEMS--The student will be able to:
- 32.01 Describe the dimmer system operation.
  - 32.02 Diagnose and repair guide-matic and twilight sentinel systems.
  - 32.03 Perform on-car adjustment of guide-matic and twilight sentinel systems.
- 33.0 DEMONSTRATE A WORKING KNOWLEDGE OF CLIMATE CONTROL SYSTEMS--The student will be able to:
- 33.01 Describe operation of climate control systems.
  - 33.02 Diagnose and repair electronic system.
  - 33.03 Perform on car adjustment of system
- 34.0 DEMONSTRATE A WORKING KNOWLEDGE OF ELECTRONIC SEATS WITH MEMORY--The student will be able to:
- 34.01 Describe operation of memory system.
  - 34.02 Diagnose and repair electronic seats.
  - 34.03 Perform on-car adjustment of system.
- 35.0 DEMONSTRATE A WORKING KNOWLEDGE OF FIBER OPTICS--The student will be able to:
- 35.01 Explain the theory of fiber optics.
  - 35.02 Explain applications of fiber optics.
  - 35.03 Describe and identify fiber optic systems.
  - 35.04 Diagnose and repair fiber optic systems.
- 36.0 DEMONSTRATE A WORKING KNOWLEDGE OF AUTOMATIC BRAKE SYSTEMS OPERATION--The student will be able to:
- 36.01 Describe two-wheel and four-wheel anti-lock brake systems.
  - 36.02 Identify anti-lock brake system components, electrical circuits and controls.
  - 36.03 Explain brake modulation.
  - 36.04 Explain built-in diagnosis on anti-lock brake system control module.
  - 36.05 Explain use and location of skid control sensor.
  - 36.06 Describe, diagnose and replace control module, if equipped.
- 37.0 DEMONSTRATE A WORKING KNOWLEDGE OF ANTI-LOCK BRAKE SYSTEM DIAGNOSIS AND REPAIR--The student will be able to:

- 37.01 Perform basic diagnosis and testing using manufacturers' test equipment.
  - 37.02 Diagnose problems with master cylinder, hydraulic booster, electric pump accumulator and valve body assembly.
  - 37.03 Diagnose problems with fluid level warning switches.
  - 37.04 Test electronic wheel sensors.
  - 37.05 Perform system self diagnostic test.
  - 37.06 Perform trouble code diagnostic procedures using manufacturers' diagnostic charts.
  - 37.07 Perform pin-out checks.
  - 37.08 Describe, diagnose and replace control module if equipped.
- 38.0 DEMONSTRATE A WORKING KNOWLEDGE OF ELECTRONIC LEVEL CONTROL SYSTEMS--The student will be able to:
- 38.01 Describe operation of electronic leveling control system.
  - 38.02 Demonstrate the correct vehicle raising and lowering operation.
  - 38.03 Explain the air replenishment system.
  - 38.04 Describe a height adjuster sensor.
  - 38.05 Perform diagnostic procedures using manufacturers' diagnostic charts.
  - 38.06 Perform electrical circuit diagnosis.
  - 38.07 Test system for correct performance.
  - 38.08 Test compressor operation.
  - 38.09 Test height sensor operation.
  - 38.10 Test compressor current draw.
  - 38.11 Test residual pressure.
  - 38.12 Test system for air leaks.
  - 38.13 Describe, diagnose and replace control module if equipped.
- 39.0 DEMONSTRATE A WORKING KNOWLEDGE OF ELECTRONIC STEERING SYSTEMS--The student will be able to:
- 39.01 System operation.
  - 39.02 System diagnosis and repair.