Course: **Certificate in Automotive Maintenance (Auto Electrical Repairs - Level 1)**

Contact Hours: **30**

Pre-requisite: **Basic knowledge of Electrical and Electronics**

Abstract

This unit was designed for persons interested in automotive maintenance. This unit will focus on the principles of automotive electrical and electronic systems, their operation, diagnosis and repairs with emphasis being placed on the use of equipment and tools to diagnose engine performance and the technical training required to complete repairs in line with the manufacturer specifications.

In order to ensure that the learner fully understands the concepts relating to automotive maintenance, the course content was structured to maximize the contact hours allocated for practical work. Currently 80% of the course involves hands on, practical training.

Target Audience

This course is ideally suited for persons interested in automotive maintenance would like to become a qualified mechanic specializing in Auto-Electrical repairs.

Learning outcomes

On completion of this course, learners will be able to:

1. Understand the fundamentals of Automotive Electrical and Electronic Systems.
2. Carry out tests and repairs to the vehicle Ignition and starting systems.
3. Carry out tests and repairs to the vehicle battery and charging systems.
4. Use a scan tool to carry out system diagnosis and repairs.

Course Content

1. **Understand the fundamentals of Automotive Electrical and Electronic Systems.**

   Electrical Fundamentals: Components of a simple electric circuit and their function; Relationship between voltage, current and resistance. Comparison between direct current and alternating current. Compare the operating characteristics of series, parallel and series-parallel circuits.

   Electrical Components: Identify electrical components in use in a vehicle and explain their function and operation. Interpret electrical component ratings and values and recall their symbols and letter designations. Compare wire types and sizes. Explain the effect of wire size on resistance. Identify wire protection devices. Apply proper techniques to cut, strip and join wires.

   Electronic Components: Identify electronic components in use in a vehicle and explain their function and operation. Explain semiconductors and transistors. Classify integrated circuits as analog, digital, active, or passive.

   Tools and Test equipment: Identify tools that are commonly used during electrical repairs. Select the proper tool or tester for a particular job. Use a multimeter to measure circuit voltage, voltage drop, resistance and amperage. Test basic electronic components.

   Manufacturer Service Information: Interpret wiring diagrams found in vehicle service manuals. Select and use the appropriate wiring diagram to troubleshoot an electrical problem.

2. **Carry out tests and repairs to the vehicle Ignition and starting systems.**

   Ignition Systems: Describe the major components of a basic ignition system and explain its operation. Identify the firing order for four-cylinder engines. Compare various types of ignition systems and explain their operation. Describe the various methods used to control ignition system spark timing.

   Starting Systems: Describe the major components of a starting system and state their purpose. Explain the operation of the starting motor and compare the (3) main types of starting motor. Explain the operation of the starter solenoid and the purpose of the starter relay.

3. Carry out tests and repairs to the vehicle battery and charging systems.

Battery and Charging Systems: Explain the function, construction, and operation of an automotive battery. Compare various types of automotive batteries. Explain the battery rating system. Describe the components of a charging system and state their function. Explain the operation of an alternator and voltage regulator. Describe the function of an alternator vacuum pump.

4. Use a scan tool to carry out system diagnosis and repairs.

Diagnostics and Scanning codes: Explain the purpose and operation of on-board diagnostic systems. Explain how to use scan tools to simplify reading of trouble codes. Compare OBD I and OBD II system capabilities and procedures. Identify the data link connector on most makes and models of cars. Carry out on-board diagnostics and interpret trouble codes. Read a trouble code chart to determine the meaning of the trouble code. Use appropriate procedures to erase diagnostic trouble codes. Use data streaming and actuation test to further figure out and diagnose problems that may not appear easily as a trouble code.

Assessment Criteria

In order to achieve Learning Outcome…	The Learner must…
1 Understand the fundamentals of Automotive Electrical and Electronic Systems	1.1 Build series, parallel and series parallel circuits, by splicing and soldering wires, connectors, control devices (eg. switches, relays),protection devices(fuses) and determine the differences associated with each type of circuit. 1.2 Check voltages and voltage drops in electrical/electronic circuits; interpret readings and determine needed repairs. 1.3 Check current flow in electrical /electronic circuits; interpret readings and determine needed repairs. 1.4 Check continuity and resistances in electrical/electronic circuits and components; interpret readings and determine needed repairs. 1.5 Find shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine needed repairs. 1.6 Measure and diagnose the cause(s) of abnormal key-off battery drain (parasitic draw); determine needed repairs. 1.7 Inspect, test, and replace fusible links, circuit breakers, fuses, diodes, and current limiting devices. 1.8 Read and interpret electrical schematic diagrams and symbols.
2 Carry out tests and repairs to the vehicle Ignition and starting systems.	2.1 Perform starter current draw test; determine needed repairs. 2.2 Perform starter circuit voltage drop tests; determine needed repairs. 2.3 Inspect, test, repair and/or replace starter, relays, solenoids, modules, switches, connectors, and wires of starter circuits. 2.4 Differentiate between electrical and engine mechanical problems that cause a slow crank, no-crank, extended cranking, or a cranking noise condition. 2.5

3	Carry out tests and repairs to the vehicle battery and charging systems.	3.1	Perform battery state-of-charge test; determine needed service.
		3.2	Perform battery tests (load and capacitance); determine needed service.
		3.3	Perform battery charge in accordance with manufacturer's recommendations.
		3.4	Inspect, clean, repair and/or replace battery(ies), battery cables, connectors, clamps, hold-downs, trays, and vent tubes.
		3.5	Jump-start a vehicle using jumper cables, a booster battery or auxiliary power supply.
		3.6	Diagnose charging system problems that cause a no-charge, a low charge, or an overcharge condition; determine needed repairs.
		3.7	Inspect, reinstall and/or replace pulleys, tensioners, and drive belts; adjust belts and check alignment.
		3.8	Perform charging system voltage output test; determine needed repairs.
		3.9	Perform charging system current output test; determine needed repairs.
		3.10	Remove, inspect and replace the alternator.
4	Use a scan tool to carry out system diagnosis and repairs.	4.1	Use scan tool data, bidirectional controls, and/or diagnostic trouble codes (DTCs) to diagnose electronic systems; interpret readings and determine necessary action.

Essential Learning Resources:

Learners will have access to a fully equipped automotive workshop to carry out the various maintenance tasks. It should be noted that the following dress code will be in effect for all practical work.

Dress Code:

1. Flip flops or opened toed shoes are not allowed in the automotive workshop. Proper foot attire should be worn to protect your feet, leather work boots are recommended.
2. Coveralls must be worn for all practical activities.
3. Safety glasses must be worn at all times in the automotive workshop.

Note: If a student fails to comply with the above dress code, he or she will not be able to participate in the practical session.

Textbooks and Manuals

1. Owner's manuals (various vehicle models)