

## **AUTO ELECTRICAL WORK**

### **1. PREAMBLE**

This examination syllabus has been evolved from the Senior Secondary School Trade Curriculum. The examination syllabus does not replace the curriculum.

The syllabus has been arranged to subsume six themes: battery, starting, ignition, charging, lighting and auxiliary systems.

### **2. OBJECTIVE**

The objective of the syllabus is to test candidates' knowledge, skills and attitude in the field of Auto Electrical Works. Specifically, candidates are to:

- (i) understand the concepts in auto electrical works;
- (ii) use tools and equipment to carry out maintenance and repair on motor vehicles;
- (iii) understand the safety practices and observe them in the work environment.

### **3. EXAMINATION SCHEME**

There will be three papers, Papers 1, 2 and 3, all of which are to be taken. Papers 1 and 2 shall be a composite paper to be taken at one sitting.

**PAPER 1:** will consist of forty multiple-choice objective questions all of which are to be answered in 45 minutes for 40 marks.

**PAPER 2:** will consist of six short-structured questions. Candidates will be required to answer any four in 1 hour for 60 marks.

**PAPER 3:** will be a practical test of 2 hours duration. It will consist of three skill-based questions out of which candidates will answer two for 90 marks.

A list of materials for the test shall be made available to schools not less than two weeks before the paper is taken for materials procurement and relevant preparations.

Alternative to Practical Test:

Alternatively, in the event that materials for the actual practical test cannot be acquired, the Council may consider testing theoretically, candidates' level of acquisition of the practical skills prescribed in the syllabus. For this alternative test, there will be two compulsory essay questions to be answered in 2 hours for 100 marks.

Industrial Attachment

This should be done by the candidates during the long vacation between their SS II and SS III course. It will be supervised and assessed by their subject teachers. It will carry 10 marks.

**4. DETAILED SYLLABUS**

TOPIC	NOTES
<p><b>1. <u>BATTERY</u></b></p> <p>1.1 Concept of battery</p> <p>1.2 Uses of battery</p> <p>1.3 Types, Constructional details and ratings</p> <p>1.4 Charging</p> <p>1.5 Testing and Maintenance</p>	<p>Definition, distinction between motor vehicle battery and other batteries</p> <p>Treatment should include vehicle battery assembly and as power source in soldering</p> <p>Lead-acid and Nickel-alkaline types</p> <p>Safety rules Electrolyte preparation Battery cleaning and connection Charging mode State of charge Treatment should include electrolyte testing</p> <p>Specific gravity test of electrolyte Cell voltage and polarity tests Tools and equipment Treatment should include electrolyte topping up, hydrometer reading and interpretation, over-charging symptoms and idle-battery safe-keeping hint</p>

<p><b><u>2. STARTING SYSTEM</u></b></p>	
2.1 Purpose and components of starting system	Treatment should include battery, flywheel, starter motor, switch and solenoid
2.2 Circuit diagram	Drawing and reading of circuit diagram Treatment should include the location of the components and their sequential arrangement in a vehicle.
2.3 Types of starter motor	Axial and Inertia.
2.4 Repair of starter motors	Treatment should include pinion engagements  Dismantling and assembling Bushing and brush replacement Commutator soldering/repair Trouble shooting and rectification  Treatment should include armature servicing, diagnosis and repairs/restoration
<p><b><u>3. IGNITION SYSTEM</u></b></p>	
3.1 Purpose and components of ignition system	Ignition system assembly Treatment should include circuit cables, ignition switch, battery, coil, distributor, capacitor, high tension leads and sparking plugs
3.2 Circuit diagram	Drawing and reading of circuit diagram Treatment should include line diagram and conventional symbols
3.3 Construction and operation of ignition coil	Circuit diagram Treatment should include the internal construction of the coil
3.4 Types of Ignition System	Conventional contact breaker and electronic ignition systems
3.5 Timing	Concept and timing faults such as retarded ignition and over-advanced ignition.
3.6 Faults and repairs	

<p><b>4. <u>CHARGING SYSTEM</u></b></p> <p>4.1 Purpose and components of charging system</p> <p>4.2 Alternator</p> <p>4.3 Circuit diagram</p> <p>4.4 Faults and repairs</p>	<p>Hard starting Jerking Back firing etc. Emphasize the use of multimeter, scanner, test lamps etc.</p> <p>Charging system assembly as a sub-system in a motor vehicle Treatment should include switch, battery, cables, alternators, voltage regulators.</p> <p>Constructional details Conversion of a.c. to d.c.(rectification) Function of each part of an alternator</p> <p>Drawing and reading of circuit diagram Treatment should include graphical and pictorial representation, need for diagrammatic representation and how to remove and fix the charging system units</p> <p>Brush and Bearing replacement Diode testing, repair and replacement Treatment should include bearing seizure, charging failure etc.</p>
<p><b>5. <u>LIGHTING SYSTEM</u></b></p> <p>5.1 Purpose and classification of lighting in a motor vehicle</p> <p>5.2 Head lamps</p> <p>5.3 Circuit diagram</p>	<p>Obligatory and non-obligatory lights</p> <p>Types Features Setting of head lamps</p> <p>Classification, drawing and reading of circuit diagram</p> <p>Trouble shooting</p>

5.4 Maintenance and repairs	Treatment should include tools, equipment and procedures for repairing faults such as broken headlamp lens, bulb failure, non-aligned headlamps, open and short circuits etc.
<b>6. <u>AUXILIARY SYSTEM</u></b>	Definition, uses and units
6.1 Concept and components of auxiliary system	Treatment should include needs for auxiliary system
6.2 Constructional details and operation of auxiliary system component	Treatment should include water temperature gauge, oil pressure gauge, fuel gauge, horn relay, wiper switch, screen washer pump, indicator and door switch
6.3 Maintenance and repairs of auxiliary Components	Troubleshooting Treatment should include tools and equipment and Procedures for repairs of faults such as the failure of horn, screen wiper, oil pressure gauge, fuel gauge etc.

**LIST OF FACILITIES AND MAJOR EQUIPMENT/MATERIALS REQUIRED:**

- (1) Motor batteries
- (2) Battery head moulder set
- (3) A complete tool box
- (4) Polythene hand gloves sets
- (5) Ammeter, voltmeter, multimeter
- (6) High rate discharge tester
- (7) Spanners, hand drilling machine
- (8) Vice
- (9) Bench/Table
- (10) Wire brush, bearing extractor, pulley extractor
- (11) Feeler gauge, soldering iron and lead
- (12) Emery cloth, wooden file, aprons
- (13) Jumper cable, magnetic pick-up
- (14) Goggles, plastic trays

- (15) Hydrometer
- (16) Tester (Screw driver type)
- (17) Battery charger, testing lamp, cable stripper, insulation tape