****

**THE REPUBLIC OF KENYA**

**COMPETENCY BASED MODULAR CURRICULUM**

**FOR**

**MOTOR VEHICLE ELECTRICS**

**KNQF LEVEL 4**

**PROGRAMME CODE: 0716 354A**

**©2025**

All rights reserved. No part of this Curriculum may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods without the prior written permission of …….., except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law. For permission requests, write to the Council Secretary/CEO/Chief Principal at the address below:

# **FOREWORD**

The provision of quality education and training is fundamental to the Government’s overall strategy for social and economic development. Quality education and training contribute to the achievement of Kenya’s development blueprint and sustainable development goals.

Reforms in the education sector are necessary to achieve Kenya Vision 2030 and meet the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution, and this resulted in the formulation of the Policy Framework for Reforming Education and Training in Kenya (Sessional Paper No. 14 of 2012). A key feature of this policy is the radical change in the design and delivery of TVET training. This policy document requires that training in TVET be competency-based, curriculum development be industry-led, certification be based on demonstration of competence, and the mode of delivery allow for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed. For trainees to build their skills on foundational hands-on activities of the occupation, units of learning are grouped in modules. This has eliminated duplication of content and streamlined exemptions based on skills acquired as a trainee progresses in the up-skilling process, while at the same time allowing trainees to be employable in the shortest time possible through the acquisition of part qualifications.

It is my conviction that this curriculum will play a great role in developing competent human resources for the Automotive Engineering Sector’s growth and development.

**PRINCIPAL SECRETARY**

**STATE DEPARTMENT FOR TVET**

**MINISTRY OF EDUCATION**

# **PREFACE**

Kenya Vision 2030 aims to transform Kenya into a newly industrializing middle-income country, providing high-quality life to all its citizens by the year 2030. Kenya intends to create globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through lifelong education and training. TVET has a responsibility to facilitate the process of inculcating knowledge, skills, and worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

TVET Act, CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This curriculum has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards into this competency-based modular curriculum.

# **ACKNOWLEDGMENT**

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support were received from expert trainers, institutions and organizations.

I recognize with appreciation the role of the Engineering and Manufacturing National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the Automotive sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the Automotive Sector acquire competencies to perform their work more efficiently and effectively.

TABLE OF CONTENTS

[FOREWORD iii](#_Toc196982799)

[PREFACE iv](#_Toc196982800)

[ACKNOWLEDGMENT v](#_Toc196982801)

[ABBREVIATIONS AND ACRONYMS vii](#_Toc196982802)

[KEY TO ISCED UNIT CODE viii](#_Toc196982803)

[MODULE I 1](#_Toc196982804)

[VEHICLE STARTING SYSTEMS MAINTENANCE 2](#_Toc196982805)

[VEHICLE CHARGING SYSTEM MAINTENANCE 8](#_Toc196982806)

[VEHICLE LIGHTING SYSTEM MAINTENANCE 15](#_Toc196982807)

[MODULE II 20](#_Toc196982808)

[MOTOR VEHICLE ENGINE MAINTAINANCE 21](#_Toc196982809)

[VEHICLE IGNITION SYSTEM MAINTENANCE 34](#_Toc196982810)

[CAR ON BOARD SYSTEM DIAGNOSIS 41](#_Toc196982811)

# **ABBREVIATIONS AND ACRONYMS**

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualification Authority

OBD On-board diagnostics

PPE Personal protective equipment

TVET Technical and Vocational Education and Training

DC Direct Current

# **KEY TO ISCED UNIT CODE**



# **COURSE OVERVIEW**

The Motor Vehicle Electrics Level 4 curriculum consists of units of learning that a person must achieve to enable him/her to service and maintain motor vehicle electrical systems. It includes motor vehicle engines maintenance, vehicle ignition systems maintenance, car on board system diagnosis.

The units of competency comprising Motor Vehicle Electrics certificate Level 4 qualification include the following units of learning:

**SUMMARY OF UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Units Title** | **Unit Duration (Hours)** | **Credit Factor** |
| **MODULE I** | | | |
| 0716 251 01A | Vehicle Starting Systems Maintenance | 130 | 13.0 |
| 0716 251 02A | Vehicle Charging System Maintenance | 110 | 11.0 |
| 0716 251 03A | Vehicle Lighting System Maintenance | 110 | 11.0 |
| **MODULE II** | | | |
| 0716 351 04A | Motor Vehicle Engines Maintenance | 180 | 18 |
| 0716 351 05A | Vehicle Ignition Systems Maintenance | 90 | 9 |
| 0716 351 06A | Car on Board System Diagnosis | 80 | 8 |
| Industrial Attachment | | 320 | 32 |
| **GRAND TOTAL** | | **1020** | **102.0** |

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Primary level qualification, junior secondary qualification, Kenya Certificate of Secondary Education (KCSE) Mean Grade E

Or

1. Completion of motor vehicle electrician KNQA Level 3

Or

1. Any other equivalent qualification as determined by TVETA

**Trainer qualifications**

A trainer for any of the Units of Competency in this course must:

1. Have a minimum of KNQF level 5 certificate in Motor Vehicle Electrician or its equivalent
2. Licensed by TVETA.
3. Registered by Engineer Board of Kenya (E.B.K) or Kenya Engineering Technology Registration Board (KETRB).

**Industrial Training**

An individual enrolled in this course will be required to undergo a field attachment for a minimum period of 320 hours in an Automotive sector. The industrial training may be taken after completion of all units for those pursuing the full qualification or be distributed equally in each unit for those pursuing part qualification. In the case of dual training model, industrial training shall be as guided by the dual training policy.

**Assessment**

The course shall be assessed formatively and summatively:

1. During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
2. Number of formative assessments shall minimally be equal to the number of elements in a unit of competency
3. Assessment of basic and common competencies shall be integrated in the core units
4. Theoretical assessment shall be integrated in practical assessment and conducted orally in both formative and summative assessments.
5. Theoretical and practical weight shall be as follows
   * 1. 10:90 for the units in modules I and Module II.
6. Formative and summative assessments shall be weighted at 60% and 40% respectively in the overall unit of learning score
7. Assessment performance rating for each unit of competency shall be as follows:

|  |  |
| --- | --- |
| **MARKS** | **COMPETENCE RATING** |
| 80 -100 | Attained Mastery |
| 65 - 79 | Proficient |
| 50 - 64 | Competent |
| 49 and below | Not Yet Competent |
| Y | Assessment Malpractice/irregularities |

1. Assessment for Recognition of Prior Learning (RPL) may lead to award of part and/or full qualification.

**Certification**

A candidate will be issued with a Certificate of Competency upon demonstration of competence in a core Unit of Competency. To be issued with KenyaNational TVET Certificate in Motor Vehicle Electrics level 4 candidate must demonstrate competence in all the Units of Competency as given in the qualification pack. A Statement of Attainment certificate may be issued upon demonstration of competence in a certifiable element within a unit.

The certificates will be issued by the Qualification Awarding Institution

# MODULE I

# **VEHICLE STARTING SYSTEMS MAINTENANCE**

**UNIT CODE: 0716 251 01A**

**UNIT DURATION: 130**Hours

**Unit Description**

This unit specifies competencies required to service vehicle starting system. It involves repairing starting system, servicing ignition system, testing ignition system and performing housekeeping.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply basic concepts of electrical quantities | 20 |
|  | Motor vehicle Battery Service | 40 |
|  | Starting system Repair | 60 |
|  | Perform housekeeping | 10 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Apply basic concepts of electrical quantities | 1. SI units    * 1. Voltage      2. Current      3. Resistance      4. Power      5. Capacitance      6. Inductance 2. Electrical quantities 3. Voltage 4. Current 5. Resistance 6. Power 7. Capacitance 8. Inductance 9. Ohms law    * 1. Definition and application 10. Power 11. Resistivity 12. Measuring instruments for electrical quantities 13. Multimeter 14. Ammeter 15. Voltmeter | * Oral questioning * Practical tests * Supervised exercises * Written tests * Projects * Learner portfolio of evidence. |
| * + - 1. Motor vehicle Battery Service | * 1. Workshop safety and organization      1. Workshop safety      2. Waste disposal      3. Use of PPE’s   2. Tools and equipment      1. Screw driver      2. Ratchet and socket set      3. Wrench      4. Multi-meters      5. Hydrometer      6. High-rate discharge tester      7. Battery charger      8. Test lamp   3. Battery types      1. Lead acid batteries      2. Maintenance-free      3. Electric Vehicle batteries   4. Battery construction   5. Battery charging and discharging   6. Battery testing      1. Hydrometer test      2. High-rate discharge test   7. Battery maintenance      1. Battery terminals      2. Cell topping up | * Oral questioning * Practical tests * Supervised exercises * Written tests * Projects * Learner portfolio of evidence. |
| * + - 1. Starting System Repair | * 1. Workshop safety and organization      1. Workshop safety      2. Waste disposal      3. Use of PPE’s   2. Tools and equipment      1. Screw driver      2. Ratchet and socket set      3. Wrench      4. Multi-meters      5. Hydrometer      6. High-rate discharge tester      7. Battery charger      8. Growler      9. Test lamp   3. Types of starter motors      1. Pre-engaged      2. Inertia engaged      3. Axial starter motors      4. Co axial motor      5. Gear reduction-single   4. Starting system components      1. Starter motor      2. Solenoid      3. Ignition switch   5. Starter motor electrical checks      1. Battery Terminals      2. Battery Cables      3. Starter Motor      4. Ignition switch   6. Wiring connections | * Oral questioning * Practical tests * Supervised exercises * Written tests * Projects * Learner portfolio of evidence. |
| * + - 1. Perform house keeping | * 1. Waste disposal      1. Old ignition coil      2. Old spark plugs      3. Re-use old cables      4. Recycle old batteries   2. Tools and equipment cleaning   3. Tools and equipment storage   4. General work area organization | * Assignments * Oral questioning * Practical tests * Written tests * Projects * Learner portfolio of evidence. |

**Suggested Methods of Instruction**

* Practical
* Projects
* Demonstrations
* Group discussions
* Direct instructions

The delivery may also be supplimented and ehanced by the following , if the opportunity allows;

* + Visiting trainer from the motor vehicle service and repair sector
  + Industrial visits

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio** (Item:Trainee) |
| **A** | **Learning Materials** |  |  |  |
| 1 | Textbooks | -Comprehensive texts on automotive electrical service.  -Manuals | 5 pcs | 1:5 |
| 2 | Charts | Visual aids covering braking and safety protocols | 10 pcs | 1:2.5 |
| 3 | Power Point Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
| 1 | Lecture/Theory Room | Equipped with projectors and seating for 25 trainees, ~60 sqm | 1 | 1:25 |
| 2 | Workshop | Hands-on training area with workbenches, tools, and safety equipment, ~80 sqm | 1 | 1:25 |
| 3 | Computer Laboratory | Equipped with internet access | 5 | 1:5 |
| **C** | **Consumable Materials** |  |  |  |
|  | First aid kit |  | 5 pieces | 1:5 |
|  | Battery sulphuric acid | For replacing during service | 10 litres | 2:5 |
|  | Distilled water | For replacing during service | 10 litres | 2:5 |
|  | Insulating tape | For repairing components |  |  |
|  | Soldering wire | For repairing components |  |  |
|  | Paraffin | For cleaning components during services | 10 litres | 2:5 |
|  | Cable ties |  |  |  |
|  | Switches | For replacing during service | 5 pcs | 1:5 |
|  | Cotton waste | For cleaning components | 1 bag |  |
|  |  |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Complete vehicle | For servicing electrical components | 1 | 1:25 |
|  | Vehicle starting system model | For demonstrations | 1 | 1:25 |
|  | Test lamp/multimeter | For testing | 5 | 1:5 |
|  | Battery charger | For charging battery | 2 | 1:13 |
|  | Complete combination cabinet toolbox | Assorted sets for various applications | 5 cabinets | 1:5 |
|  | Trolley jacks | For lifting the vehicle | 2 | 1:12.5 |
| **E** | **PPE (Personal Protective Equipment)** |  |  |  |
| 1 | PPE Sets | Includes gloves, safety boot, and overall/ dust bin | 25 sets | 1:1 |
| 2 | Safety Signs and Barriers | For simulating safety zones and hazards | 10 sets | 1:2.5 |
| 3 | Wheel chokes | For choking wheels while servicing | 8 pieces | 1:3 |
|  |  |  |  |  |
| **F** | **Reference Materials** |  |  |  |
| 1 | Vehicle manuals | Covering principles and practices in vehicle electrical system | 25 pcs | 1:1 |
| 3 | Technical Handbooks | On vehicle fuel service | 25 pcs | 1:1 |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 5 | Multimedia Learning Modules | Digital licenses for videos and tutorials | 25 pcs | 1:1 |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

# **VEHICLE CHARGING SYSTEM MAINTENANCE**

**UNIT CODE: 0716 251 02A**

**UNIT DURATION: 110** Hours

**UNIT DESCRIPTION**

This unit specifies competences required to maintain vehicle charging system. It involves inspecting charging system, servicing charging system, testing vehicle charging system and performing workshop housekeeping.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Apply Workshop Safety | 10 |
|  | Inspect Charging System | 30 |
|  | Service vehicle charging system | 30 |
|  | Test Vehicle charging system | 30 |
|  | Perform housekeeping | 10 |
| TOTAL | | 110 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply Workshop Safety | * 1. Workshop safety      1. Definition      2. Types and uses of PPE’s   2. Emergence responses steps      1. Common emergencies         1. Fire         2. Chemical spills         3. Injury response   3. Fire safety      1. Fire extinguishers types and uses      2. Flammable materials identification      3. Fire prevention   4. Safe handling and disposal of chemicals and materials      1. Chemical hazard identification      2. Safe handling procedure      3. Storage and labelling of chemicals      4. Chemical disposal procedures      5. Emergency response for chemical exposure   5. Identifying and marking hazardous zones      1. Common hazardous zones         1. Flammable zones         2. High traffic zones         3. Electrical hazard zones         4. Chemical storage areas   6. Work area organization and maintenance      1. Setting up      2. Proper storage and labelling of tools and equipment   7. Workplace hazards      1. Physical hazards         1. Noises         2. Vibration         3. Heat         4. Sharp object      2. Chemical hazards         1. Fuels         2. Oils         3. Cleaning agents      3. Electric hazards         1. Live wires         2. Batteries         3. Electrical systems   8. Workshop accidents, causes and responses      1. Slip, strips and falls      2. Cuts and abrasion      3. Burns      4. Electrical shocks | * Written tests. * Practical * Project * Portfolio of evidence   Third party report |
| 1. Inspect charging system | 1.1 Safety precautions in the vehicle charging system  1.1.1 Use of PPE’s  1.2 Tools and equipment  1.2.1 Multimeter  1.2.4. Wire stripper  1.3 Charging system inspection  1.3.1 Alternator  1.3.2 Battery  1.3.3 Electrical Cables  1.3.4 Fuses  1.3.5 Drive Belt  1.3.6 Wiring  1.3.7 Brushes  1.3.8 Relay | * Oral questioning * Practical tests * Supervised exercises * Written tests * projects * Learner portfolio of evidence. |
| 1. Service vehicle charging system | 2.1 Charging system service  2.1.2 Ignition Switch  2.2.3 Warning light circuit  2.2.4 Rectifier-9 diode type  2.2.5 Voltage Regulator  2.2.5.1. Mechanical  2.2.5.2. Electronic  2.3 Alternator service  2.3.1 Dismantling  2.3.2 Parts identification  2.3.3 Alternator tests  2.3.3.1 Continuity test  2.3.3.2 Ground test  2.3.4 Brush replacement  2.3.5 Alternator assembly | * Oral questioning * Practical tests * Supervised exercises * Written tests * Projects * Learner portfolio of evidence. |
| 1. Test vehicle charging system | * 1. Charging system test  1. Voltage Output Test 2. Regulator Tests 3. AC Leakage Test 4. Current Output Test 5. Diode Checks | * Written test * Observation * Oral questioning * Learner portfolio of evidence. |
| 1. Perform house keeping | 4 1. Waste disposal   * + 1. Waste battery acid     2. Waste alternator belt   4.2 Tools and equipment cleaning  4.3 Tools and equipment storage  4.4 Workplace area organization | * Oral questioning * Practical tests * Written tests * Projects * Learner portfolio of evidence. |

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio** (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
| 1 | Textbooks | -Comprehensive texts on automotive electrical service.  -Manuals | 5 pcs | 1:5 |
| 2 | Charts | Visual aids covering braking and safety protocols | 10 pcs | 1:2.5 |
| 3 | Power Point Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
| 1 | Lecture/Theory Room | Equipped with projectors and seating for 25 trainees, ~60 sqm | 1 | 1:25 |
| 2 | Workshop | Hands-on training area with workbenches, tools, and safety equipment, ~80 sqm | 1 | 1:25 |
| 3 | Computer Laboratory | Equipped with internet access | 5 | 1:5 |
|  |  |  |  |  |
| **C** | **Consumable Materials** |  |  |  |
|  | First aid kit |  | 5 pieces | 1:5 |
|  | Battery sulphuric acid | For replacing during service | 10 litres | 2:5 |
|  | Distilled water | For replacing during service | 10 litres | 2:5 |
|  | Insulating tape | For repairing components |  |  |
|  | Soldering wire | For repairing components |  |  |
|  | Paraffin | For cleaning components during services | 10 litres | 2:5 |
|  | Cable ties |  |  |  |
|  | Switches | For replacing during service | 5 pcs | 1:5 |
|  | Cotton waste | For cleaning components | 1 bag |  |
|  |  |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Complete vehicle | For servicing electrical components | 1 | 1:25 |
|  | Vehicle starting system model | For demonstrations | 1 | 1:25 |
|  | Vehicle ignition system model | For demonstrations | 1 | 1:25 |
|  | Test lamp/multimeter | For testing | 5 | 1:5 |
|  | Battery charger | For charging battery | 2 | 1:13 |
|  | Spark plug testing machine | For testing spark plug functionality | 2 | 1:13 |
|  | OBD II scanner | For diagnosis | 5 | 1:5 |
|  | Oscilloscope | For diagnosis | 5 | 1:5 |
|  | Complete combination cabinet toolbox | Assorted sets for various applications | 5 cabinets | 1:5 |
|  | Trolley jacks | For lifting the vehicle | 2 | 1:13 |
| **E** | **PPE (Personal Protective Equipment)** |  |  |  |
| 1 | PPE Sets | Includes gloves, safety boot, and overall/ dust bin | 25 sets | 1:1 |
| 2 | Safety Signs and Barriers | For simulating safety zones and hazards | 10 sets | 1:2.5 |
| 3 | Wheel chokes | For choking wheels while servicing | 8 pieces | 1:3 |
|  |  |  |  |  |
| **F** | **Reference Materials** |  |  |  |
| 1 | Vehicle manuals | Covering principles and practices in vehicle electrical system | 25 pcs | 1:1 |
| 3 | Technical Handbooks | On vehicle fuel service | 25 pcs | 1:1 |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 5 | Multimedia Learning Modules | Digital licenses for videos and tutorials | 25 pcs | 1:1 |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

# **VEHICLE LIGHTING SYSTEM MAINTENANCE**

**UNIT CODE: 0716 251 03A**

**UNIT DURATION:** 110Hours

**UNIT DESCRIPTION**

This unit specifies competences required to maintain vehicle lighting system. It involves inspecting lighting system, servicing lighting system, testing vehicle lighting system and performing workshop housekeeping.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Inspect lighting system | 20 |
|  | Service vehicle lighting system | 50 |
|  | Test vehicle lighting system | 30 |
|  | Perform housekeeping | 10 |
| TOTAL | | 110 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Inspect lighting system | 1.1. PPEs for lighting system  1.2. Lighting system inspection Tools and equipment  1.2.1. Multimeter  1.2.2. Test lamp  1.2.3. Battery charger  1.2.4. Beam setter  1.2.5. Assorted workshop tools  1.3. Lighting system physical checks   1. Cracks, damage or moisture 2. Bulbs 3. Wiring 4. Terminals 5. Connectors | * Oral questioning * Practical tests * Supervised exercises * Written tests * projects * Learner portfolio of evidence. |
| 2. Service vehicle lighting system | 2.1 Lighting system components  2.1.1 Head Lamps  2.1.2 Lamp types  2.1.3 Light fixtures  2.1.4 Switches  2.1.5 Flasher unit  2.1.6 Relays  2.1.7 Fuses  2.2 Lighting circuits  2.2.1 Main/dip beam  2.2.2 Reverse  2.2.3 Direction indicators  2.2.4 Hazard  2.2.5 Fog light  2.2.6 Day running light  2.3 Beam setting  2.3.1 Beam setting equipment  2.3.2 Beam setting  2.4 Lighting system diagnose  2.4.1 Connectors  2.4.2 Switches  2.4.2 Fuses  2.4.3 Relays | * Oral questioning * Practical tests * Supervised exercises * Written tests * Projects * Learner portfolio of evidence. |
| 3. Test vehicle lighting system | * 1. Lighting system assessment   3.1.1 Circuit continuity  3.1.3 Bulb functionality  3.1.4 Switches and controls  3.1.5 Voltage drop | * Written test * Observation * Oral questioning * Learner portfolio of evidence. |
| 4. Perform house keeping | 4. 1 Waste disposal  4.1.1 Waste bulbs  4.1.2 Re-use cables  4.2 Tools and equipment cleaning  4.3 Tools and equipment storage  4.4 Workplace area organization | * Assignments * Oral questioning * Practical tests * Written tests * Projects * Learner portfolio of evidence. |

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio** (Item:Trainee) |
| **A** | **Learning Materials** |  |  |  |
| 1 | Textbooks | -Comprehensive texts on automotive electrical service.  -Manuals | 5 pcs | 1:5 |
| 2 | Charts | Visual aids covering braking and safety protocols | 10 pcs | 1:2.5 |
| 3 | Power Point Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
| 1 | Lecture/Theory Room | Equipped with projectors and seating for 25 trainees, ~60 sqm | 1 | 1:25 |
| 2 | Workshop | Hands-on training area with workbenches, tools, and safety equipment, ~80 sqm | 1 | 1:25 |
| 3 | Computer Laboratory | Equipped with internet access | 5 | 1:5 |
|  |  |  |  |  |
| **C** | **Consumable Materials** |  |  |  |
|  | First aid kit |  | 5 pieces | 1:5 |
|  | Battery sulphuric acid | For replacing during service | 10 litres | 2:5 |
|  | Distilled water | For replacing during service | 10 litres | 2:5 |
|  | Insulating tape | For repairing components |  |  |
|  | Soldering wire | For repairing components |  |  |
|  | Paraffin | For cleaning components during services | 10 litres | 2:5 |
|  | Cable ties |  |  |  |
|  | Switches | For replacing during service | 5 pcs | 1:5 |
|  | Cotton waste | For cleaning components | 1 bag |  |
|  |  |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Complete vehicle | For servicing electrical components | 1 | 1:25 |
|  | Vehicle starting system model | For demonstrations | 1 | 1:25 |
|  | Vehicle ignition system model | For demonstrations | 1 | 1:25 |
|  | Test lamp/multimeter | For testing | 5 | 1:5 |
|  | Battery charger | For charging battery | 2 | 1:12.5 |
|  | Spark plug testing machine | For testing spark plug functionality | 2 | 1:12.5 |
|  | OBD II scanner | For diagnosis | 5 | 1:5 |
|  | Oscilloscope | For diagnosis | 5 | 1:5 |
|  | Complete combination cabinet toolbox | Assorted sets for various applications | 5 cabinets | 1:5 |
|  | Trolley jacks | For lifting the vehicle | 2 | 1:12.5 |
| **E** | **PPE (Personal Protective Equipment)** |  |  |  |
| 1 | PPE Sets | Includes gloves, safety boot, and overall/ dust bin | 25 sets | 1:1 |
| 2 | Safety Signs and Barriers | For simulating safety zones and hazards | 10 sets | 1:2.5 |
| 3 | Wheel chokes | For choking wheels while servicing | 8 pieces | 1:3 |
|  |  |  |  |  |
| **F** | **Reference Materials** |  |  |  |
| 1 | Vehicle manuals | Covering principles and practices in vehicle electrical system | 25 pcs | 1:1 |
| 3 | Technical Handbooks | On vehicle fuel service | 25 pcs | 1:1 |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 5 | Multimedia Learning Modules | Digital licenses for videos and tutorials | 25 pcs | 1:1 |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

# **MODULE II**

# **MOTOR VEHICLE ENGINE MAINTAINANCE**

**UNIT CODE:** 0716 351 04A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Maintain vehicle engine.

**Duration of Unit:** 180 hours

**Unit Description**

This unit of learning covers the learning outcomes, content, assessment methods, methods of delivery and resources required to train motor vehicle engine maintenance. The learning outcomes involve performing vehicle engine overhaul, servicing vehicle engine cooling system, service vehicle fuel system and service vehicle lubricating system.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Perform engine overhaul | 80 |
|  | Service vehicle engine cooling system | 40 |
|  | Service vehicle engine lubrication system | 20 |
|  | Service Vehicle Fuel system | 40 |
| TOTAL | | 180 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Perform Vehicle engine overhaul | * 1. Work area organization and safety measures      1. Importance of a well-organized work area      2. Safety measures      3. Emergency procedures      4. Housekeeping practices      5. Waste disposal   2. Engine classification      1. Operating cycles         1. 4 stroke cycle-petrol and diesel engine      2. Valve arrangements         1. Overhead valve         2. Overhead camshaft         3. Double overhead camshaft      3. Engine configuration         1. Inline         2. V-configuration   3. Engine construction      1. Engine components and their functions         1. Cylinder head components         2. Engine block components         3. Valve assembly components         4. Exhaust components         5. Cooling components         6. Lubrication components   4. Engine Diagnosis and remedies      1. Fuel system      2. Ignition system      3. Air intake and exhaust system      4. Cooling system   5. Engine Overhaul tools, equipment and materials      1. Uses and maintenance practices         1. Assorted tools         2. Torque wrench         3. Engine stand         4. Ring compressor         5. Feeler gauge         6. Valve spring compressor         7. Micrometer         8. Dial gauge         9. Compression tester   6. Engine Dismantling      1. Purpose for dismantling      2. Dismantling procedure      3. Cleaning parts   7. Engine parts inspection      1. Leak detection      2. Crack detection      3. Measurements      4. Warping   8. Engine parts service/replacement      1. Cylinder block and cylinder walls      2. Piston and piston rings      3. Crankshaft and bearing      4. Cylinder head and valves      5. Connecting rod      6. Camshaft and timing components      7. Gasket and seals   9. Engine parts assembly      1. Assembly procedure      2. Timing      3. Engine tune up   10. Engine fitting and mounting       1. Fitting procedure       2. Engine mounting   11. Re installation check       1. Visual checks       2. Fluid checks       3. Alignment and clearance checks       4. Exhaust system checks       5. Cooling system checks       6. Fuel system pressure check |  |
| * Practical * Project * Portfolio of evidence * Third party report * Written tests |
| 1. Service vehicle engine cooling system | * 1. Work area organization and safety measures      1. Importance of a well-organized work area      2. Safety measures      3. Emergency procedures      4. Housekeeping practices      5. Waste disposal   2. Vehicle cooling system      1. Purpose and importance      2. Components of cooling system and their functions      3. Cooling system operation   3. Types of cooling system      1. Liquid cooling systems   4. Engine cooling system diagnosis and remedies      1. Low coolant      2. Overheating      3. Heater malfunction      4. Coolant contamination      5. Abnormal noises      6. Radiator fan failure   5. Cooling system tools, equipment and materials      1. Uses and maintenance   6. Cooling system inspection      1. Radiator cap      2. Radiator      3. Hoses      4. Water pump      5. Thermostat      6. Cooling fan      7. Sensor   7. Engine cooling system service/replacement      1. Fan belt      2. Thermostat      3. Radiator      4. Pressure cap      5. Coolant      6. Hoses      7. Water pump   8. Cooling system parts installation      1. Parts installation      2. Bleeding      3. Operation testing | * Practical * Project * Portfolio of evidence * Third party report * Written tests |
| 1. Service vehicle engine lubrication system | * 1. Work area organization and safety measures      1. Importance of a well-organized work area      2. Safety measures      3. Emergency procedures      4. Housekeeping practices      5. Waste disposal   2. Lubrication system      1. Functions      2. Lubrication system construction and operation      3. Types of lubricants   3. Filtration methods      1. Full flow      2. By pass   4. Types of lubrication system      1. Wet sump      2. Force feed      3. Dry sump   5. Engine lubrication system diagnosis and remedies      1. Low oil pressure      2. Excessive oil consumption      3. Oil leaks      4. Oil contamination   6. Engine lubrication system service tools, equipment and materials      1. Uses and maintenance   7. Engine lubrication system inspection      1. Leakage      2. Oil pump operation      3. Oil levels      4. Oil seals      5. Oil filter   8. Engine lubrication system service/replacement      1. Leakage      2. Oil pump operation      3. Lubricating oil      4. Oil seals      5. Oil filter      6. Gaskets   9. Lubrication system parts installation      1. Components fitting      2. Reinstallation checks   10. Lubrication system operation tests       1. Oil pressure test       2. Leak inspection       3. Oil level check | * Practical * Project * Portfolio of evidence * Third party report * Written tests |
| 1. Service Vehicle Fuel system | * 1. Work area organization and safety measures      1. Importance of a well-organized work area      2. Safety measures      3. Emergency procedures      4. Housekeeping practices      5. Waste disposal   2. Fuel system operation      1. Petrol fuel system      2. Diesel fuel system   3. Layout      1. Throttle body injection system      2. Multipoint injection system      3. Direct petrol injection (GDI)   4. Diesel injection systems      1. Direct injection      2. Indirect injection   5. Fuel system service tools and equipment      1. Uses and maintenance practices   6. Fuel system diagnosis and remedies      1. Short circuit      2. Open circuits   7. Fuel system inspection      1. Serviceability      2. Leakages      3. Clogging      4. Spray pattern   8. Fuel system components service/replacement      1. Fuel filter      2. Fuel injector      3. Fuel pump      4. Blockage      5. Injector nozzles   9. Fuel system re installation checks      1. Fuel lines      2. Pressure check      3. Injector functionality      4. Leak checks | * Practical * Project * Portfolio of evidence * Third party report * Written tests |

**Suggested Methods of Instruction**

* + Demonstrations
  + Practical
  + Projects
  + Group Discussion
  + Direct instructions

The delivery may also be supplimented and enhanced by the following , if the opportunity allows;

* Visiting lecturer/trainer from the motor vehicle service and repair sector
  + Industrial visits

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |  |  |  |
| 1 | Textbooks | Comprehensive texts on engine service. | 5 pcs | 1:5 |
| 2 | Charts | Visual aids covering engine and safety protocols | 10 pcs | 1:2.5 |
| 3 | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
| 1 | Lecture/Theory Room | Equipped with projectors and seating for 25 trainees, ~60 sqm | 1 | 1:25 |
| 2 | Workshop | Hands-on training area with workbenches, tools, and safety equipment, ~80 sqm | 1 | 1:25 |
| 3 | Computer Laboratory | Equipped with internet access | 5 | 1:5 |
|  |  |  |  |  |
| **C** | **Consumable Materials** |  |  |  |
|  | First aid kit |  | 5 pieces | 1:5 |
|  | Lubricating oil | For replacing during overhaul | 10 litres | 2:5 |
|  | Petrol fuel | For testing and running engine | 10 litres | 2:5 |
|  | diesel fuel | For testing and running engine | 10 litres | 2:5 |
|  | Paraffin | For cleaning components during overhaul | 10 litres | 2:5 |
|  | Anti rust solution | For cleaning rusted parts | 5 pcs | 1:5 |
|  | Cotton waste | For cleaning components | 1 bag |  |
|  | Valve grinding paste | For grinding valves | 10 pieces | 2:5 |
|  | Oil filter | For replacement during service | 2 |  |
|  | Fuel filter | For replacement during service | 2 |  |
|  | Air filters | For replacement during service | 2 |  |
|  | Coolant | For replacement during service | 10 liters | 2:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Diesel vehicle | For servicing engine | 1 | 1:25 |
|  | Petrol vehicle | For servicing engine | 1 | 1:25 |
|  | Petrol engines | For overhauling | 5 | 1:5 |
|  | Diesel engines | For overhauling | 5 | 1:5 |
|  | Complete combination cabinet toolbox | Assorted sets for various applications | 5 cabinets | 1:5 |
|  | Engine stand | For mounting engines | 10 | 2:5 |
|  | Trolley jacks | For lifting engines | 2 | 1:13 |
|  | Valve spring compressors | For removing engine valves | 5 | 1:5 |
|  | Piston ring squeezers | For fitting piston rings | 5 | 1:5 |
|  | Cooling system test kit | For testing cooling system components | 2 | 1:13 |
|  | Petrol engine compression gauge | For testing | 1 | 1:25 |
|  | Diesel engine compression gauge | For testing | 1 | 1:25 |
|  | Cylinder bore gauge | For testing | 2 sets | 1:13 |
|  | Vacuum gauge | For testing engine vacuum | 2 | 1:13 |
|  | Air compressor | For compressed air supply | 1 | 1:25 |
|  | Multimeter | For testing | 5 | 1:25 |
|  | OBD II scanner | For diagnosis | 5 | 1:25 |
|  | Hydraulic press | For pressing | 1 | 1:25 |
|  | Diesel pump Calibration machine | For testing phasing and calibration | 1 | 1:25 |
|  | Injector testing machine | For testing injection pressure | 1 | 1:25 |
|  | Spark plug testing machine | For testing spark plug functionality | 1 | 1:25 |
|  | Work tables with vices |  | 5 | 1:5 |
|  | Dust bin | For dust collecting | 3 | 1:9 |
|  | Waste oil tank | For collecting waste oil | 1 | 1:25 |
| **E** | **PPE (Personal Protective Equipment)** |  |  |  |
| 1 | PPE Sets | Includes gloves, safety boot, and overall/ dust bin | 25 sets | 1:1 |
| 2 | Safety Signs and Barriers | For simulating safety zones and hazards | 10 sets | 1:2.5 |
| 3 | Wheel chokes | For choking wheels while servicing | 8 pieces | 1:3 |
|  |  |  |  |  |
| **F** | **Reference Materials** |  |  |  |
| 1 | Engine manuals | Covering principles and practices in automation | 25 pcs | 1:1 |
| 3 | Technical Handbooks | On vehicle engine service | 25 pcs | 1:1 |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 5 | Multimedia Learning Modules | Digital licenses for videos and tutorials | 25 pcs | 1:1 |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

# VEHICLE IGNITION SYSTEM **MAINTENANCE**

**UNIT CODE:** 0716 351 05A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency service motor vehicle electrical systems.

**Duration of Unit:** 90 hours

**Unit Description**

This unit of learning covers the learning outcomes, content, assessment methods, methods of delivery and resources required to train motor vehicle electrical systems maintenance. The learning outcomes involve repairing ignition system, repairing starting system, repairing charging system, repairing lighting system.

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Assess vehicle ignition system | 20 |
|  | Repair ignition system | 60 |
|  | Perform house keeping | 10 |
| TOTAL | | 90 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Assess vehicle ignition system | 1. Tools and equipment use and maintenance    * 1. Multimeter      2. Pliers      3. Screw driver      4. Wire strippers      5. Test lamps      6. Spark plug spanner      7. Multi-meters      8. Ignition test equipment.      9. Feeler gauge      10. Battery charger      11. Glower      12. Ratchet and socket set      13. Wrench      14. Tools kit 2. Ignition system service safety measures    * 1. Personal protective equipment      2. Electrical safety precautions      3. Handling ignition components      4. Work area safety protocols      5. Tools and equipment safety      6. Waste disposal    1. Tools and equipment       1. Uses and maintenance          1. Ignition Coil Tester          2. Spark Plug Tester          3. Diagnostic tool          4. Multimeter    2. Ignition system construction and operations       1. Ignition system function       2. Components and their functions       3. Principle of operation    3. Types of ignition system       1. Coil ignition       2. Transistorised ignition       3. Electronic ignition    4. Ignition system diagnosis       1. Common faults          1. Engine misfiring          2. Rough idling          3. Hard start          4. Poor acceleration          5. Backfire    5. Ignition system components sketch/inspection       1. Battery       2. Sparkplugs       3. Distributor       4. Ignition coil       5. Wiring       6. Ignition system testing       7. Coil output       8. Spark intensity |  |
| * Practical * Project * Portfolio of evidence * Third party report * Written tests. |
| 1. Repair ignition system | * 1. Ignition system components service/replacement      1. Battery      2. Sparkplugs      3. Distributor      4. Ignition coil      5. Wiring      6. Ignition system testing      7. Coil output      8. Spark intensity   2. Ignition system testing      1. Spark plug      2. Ignition coil      3. Spark plug cables      4. Distributor      5. Battery Terminals      6. Battery Cables   3. Ignition system reinstallation and timing adjustment      1. Installation procedure      2. Timing adjustment   4. Ignition system service documentation      1. Service report preparation | * Practical * Project * Portfolio of evidence * Third party report * Written tests. |
| 1. Perform Housekeeping | * 1. Waste disposal      1. Old ignition coil      2. Old spark plugs      3. Re-use old cables      4. Recycle old batteries   2. Tools and equipment cleaning   3. Tools and equipment storage   4. General work area organization | * Assignments * Oral questioning * Practical tests * Written tests * Projects * Learner portfolio of evidence |

**Suggested Methods of Instruction**

* + Demonstrations
  + Practical
  + Projects
  + Group Discussion
  + Direct instructions

The delivery may also be supplimented and enhanced by the following , if the opportunity allows;

* Visiting lecturer/trainer from the motor vehicle service and repair sector
* Industrial visits

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** |
| **A** | **Learning Materials** |  |  |  |
| 1 | Textbooks | Comprehensive texts on automotive electrical service. | 5 pcs | 1:5 |
| 2 | Charts | Visual aids covering braking and safety protocols | 10 pcs | 1:2.5 |
| 3 | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:25 |
| **B** | **Learning Facilities & Infrastructure** |  |  |  |
| 1 | Lecture/Theory Room | Equipped with projectors and seating for 25 trainees, ~60 sqm | 1 | 1:25 |
| 2 | Workshop | Hands-on training area with workbenches, tools, and safety equipment, ~80 sqm | 1 | 1:25 |
| 3 | Computer Laboratory | Equipped with internet access | 5 | 1:5 |
|  |  |  |  |  |
| **C** | **Consumable Materials** |  |  |  |
|  | First aid kit |  | 5 pieces | 1:5 |
|  | Battery sulphuric acid | For replacing during service | 10 litres | 2:5 |
|  | Insulating tape | For repairing components | Enough |  |
|  | Soldering wire | For repairing components | Enough |  |
|  | Paraffin | For cleaning components during services | 10 litres | 2:5 |
|  | Cable ties | For securing components during services | Enough |  |
|  | Switches | For replacing during service | 5 pcs | 1:5 |
|  | Cotton waste | For cleaning components | 1 bag |  |
|  |  |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Complete vehicle | For servicing electrical components | 1 | 1:25 |
|  | Vehicle ignition system model | For demonstrations | 1 | 1:25 |
|  | Test lamp/multimeter | For testing | 5 | 1:5 |
|  | Battery charger | For charging battery | 2 | 1:13 |
|  | Spark plug testing machine | For testing spark plug functionality | 2 | 1:13 |
|  | OBD II scanner | For diagnosis | 5 | 1:5 |
|  | Complete combination cabinet toolbox | Assorted sets for various applications | 5 cabinets | 1:5 |
|  | Timing light | For diagnosis | 5 | 1:5 |
|  | Trolley jacks | For lifting the vehicle | 2 | 1:13 |
| **E** | **PPE (Personal Protective Equipment)** |  |  |  |
| 1 | PPE Sets | Includes gloves, safety boot, and overall/ dust bin | 25 sets | 1:1 |
| 2 | Safety Signs and Barriers | For simulating safety zones and hazards | 10 sets | 1:2.5 |
| 3 | Wheel chokes | For choking wheels while servicing | 8 pieces | 1:3 |
|  |  |  |  |  |
| **F** | **Reference Materials** |  |  |  |
| 1 | vehicle manuals | Covering principles and practices in vehicle electrical system | 25 pcs | 1:1 |
| 3 | Technical Handbooks | On vehicle fuel service | 25 pcs | 1:1 |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 |
| 5 | Multimedia Learning Modules | Digital licenses for videos and tutorials | 25 pcs | 1:1 |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 |

# **CAR ON BOARD SYSTEM DIAGNOSIS**

**UNIT CODE:** 0716 351 06A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency diagnose car on board system.

**Duration of Unit:** 80 hours

**Unit Description**

This unit of learning covers the learning outcomes, content, assessment methods, methods of delivery and resources required to train car on board system diagnosis. The learning outcomes involve launching OBD-II Scanners, diagnosing using OBD-II scanners, reading and interpreting fault codes, fixing faults using OBD-II scanners

**Summary of Learning Outcomes**

|  |  |  |
| --- | --- | --- |
| **S/No.** | **Learning Outcomes** | **Duration (Hours)** |
|  | Launch OBD-II scanners | 10 |
|  | Diagnose using OBD-II scanners | 10 |
|  | Read and interpret fault codes | 20 |
|  | Fix faults using OBD-II scanners | 40 |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Launch OBD-II scanners | * 1. Work area organization and safety measures      1. Importance of a well-organized work area      2. Safety measures      3. Emergency procedures      4. Housekeeping practices      5. Waste disposal   2. Powering scanners  1. Hand held OBD II 2. Wireless OBD II Scanner 3. Finger Operations 4. Adjust Brightness 5. Vehicle connection    1. Module to OBD-II port connection 6. Power on/off 7. Network Setup 8. Automotive Sensors and Actuators    1. Types of Sensors 9. Mass air flow (MAF) rate 10. Exhaust gas oxygen concentration (possibly heated) 11. Throttle plate angular position 12. Crankshaft angular position/RPM 13. Coolant temperature 14. Intake air temperature 15. Manifold absolute pressure (MAP) 16. Differential exhaust gas pressure 17. Vehicle speed 18. Transmission gear selector position     1. Car engine powering on 19. Launch Car-Set Database 20. Security Diagnosis Access 21. Launch Truck-Set Database 22. Bluetooth Multimeter     1. Module and monitor pairing 23. OBD-II monitors using smartphone 24. Software implementation 25. Bluetooth module |  |
| * Practical * Portfolio of evidence * Third party report * Written tests. |
| 1. Diagnose using OBD-II scanners | 1. Vehicle origin identification and scanning 2. Read Vehicle Identification 3. Control of On-board System 4. Emission Related DTC 5. Permanent Status 6. Vehicle model identification and scanning 7. Chassis 8. Gear system 9. Steering 10. Engine 11. Transmission 12. Fuel/power system 13. Brake system 14. Wheels & tires 15. Vehicle engine type identification and scanning 16. Internal petrol combustion engine (ESS) 17. V8- Engine Layout 18. V6 Engine Layout 19. Mild hybrid electric vehicle (MHEV) 20. Vehicle health report identification and scanning | * Practical * Portfolio of evidence * Third party report * Written tests. |
| 1. Read and interpret fault codes | 1. Reading and recording Codes 2. P Series 3. B Series 4. N series 5. C series 6. Interpreting Codes 7. P0100 – P0199; Fuel and air metering 8. P0300-P0399; Ignition system 9. P0400-P0499; Auxiliary emissions controls 10. P0500-P0599; Vehicle speed controls and idle control system 11. P0600-P0699; Computer output circuit 12. P0604: Internal Control Module RAM Error 13. Car engine switching off 14. Vehicle diagnostics 15. Used car check 16. Additional maintenance services | * Practical * Portfolio of evidence * Third party report * Written tests. |
| 1. Fix faults using OBD-II scanners | 1. Faults detection and repairing 2. Common Codes interpretation 3. P0135: O2 Sensor heater circuit malfunction 4. P0200: Injector circuit malfunction 5. P0300: Random/multiple cylinder misfire 6. P0401: Exhaust gas recirculation flow insufficient detected 7. P0602: Control module programming error 8. P0702: Transmission control system electrical 9. Clearing recorded data 10. Data recording 11. Viewing recorded data 12. Export Recorded Data 13. Car engine connection 14. Erase Codes 15. Read Codes 16. Live Data | * Practical * Project * Portfolio of evidence * Third party report * Written tests. |

**Suggested Methods of Instruction**

* + Demonstrations
  + Practical
  + Projects
  + Group Discussion
  + Direct instructions

The delivery may also be supplimented and enhanced by the following , if the opportunity allows;

* Visiting lecturer/trainer from the motor vehicle service and repair sector
* Industrial visits

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/Specifications** | **Quantity** | **Recommended Ratio (Item: Trainee)** | |
| **A** | **Learning Materials** | | | | |
| 1 | Textbooks | Comprehensive texts on automotive electrical service. | 5 pcs | 1:5 | |
| 2 | Charts | Visual aids covering braking and safety protocols | 10 pcs | 1:2.5 | |
| 3 | PowerPoint Presentations | For trainer’s use, covering course content and practical applications | 1 | 1:25 | |
| **B** | **Learning Facilities & Infrastructure** | | | | |
| 1 | Lecture/Theory Room | Equipped with projectors and seating for 25 trainees, ~60 sqm | 1 | 1:25 | |
| 2 | Workshop | Hands-on training area with workbenches, tools, and safety equipment, ~80 sqm | 1 | 1:25 | |
| 3 | Computer Laboratory | Equipped with internet access | 5 | 1:5 | |
| **C** | **Consumable Materials** | | | | |
|  | First aid kit |  | 5 pieces | 1:5 | |
|  | Insulating tape | For repairing components |  |  | |
|  | Soldering wire | For repairing components |  |  | |
|  | Paraffin | For cleaning components during services | 10 litres | 2:5 | |
|  | Cable ties | For wire harnessing |  |  | |
|  | Switches | For replacing during service | 5 pcs | 1:5 | |
|  | Cotton waste | For cleaning components | 1 bag |  | |
| **D** | **Tools and Equipment** | | | | |
|  | Complete vehicle | For servicing electrical components | 1 | | 1:25 |
|  | Vehicle starting system model | For demonstrations | 1 | | 1:25 |
|  | Vehicle lighting system model | For demonstrations | 1 | | 1:25 |
|  | Vehicle charging system model | For demonstrations | 1 | | 1:25 |
|  | Vehicle ignition system model | For demonstrations | 1 | | 1:25 |
|  | Test lamp/multimeter | For testing | 5 | | 1:5 |
|  | OBD II scanner | For diagnosis | 5 | | 1:5 |
|  | Complete combination cabinet toolbox | Assorted sets for various applications | 5 cabinets | | 1:5 |
|  | Trolley jacks | For lifting the vehicle | 2 | | 1:13 |
| **E** | **PPE (Personal Protective Equipment)** |  |  |  | |
| 1 | PPE Sets | Includes gloves, safety boot, and overall/ dust bin | 25 sets | 1:1 | |
| 2 | Safety Signs and Barriers | For simulating safety zones and hazards | 10 sets | 1:2.5 | |
| 3 | Wheel chokes | For choking wheels while servicing | 8 pieces | 1:3 | |
| **F** | **Reference Materials** |  |  |  | |
| 1 | Vehicle manuals | Covering principles and practices in vehicle electrical system | 25 pcs | 1:1 | |
| 3 | Technical Handbooks | On vehicle fuel service | 25 pcs | 1:1 | |
| 4 | Training Presentations/Slides | Digital format for shared access among trainees | 1 | 1:25 | |
| 5 | Multimedia Learning Modules | Digital licenses for videos and tutorials | 25 pcs | 1:1 | |
| 6 | Practical Assessment Guides | Worksheets for practical assessments | 25 pcs | 1:1 | |