



COMPETENCY BASED CURRICULUM

AUTO ELECTRICAL

BQF CERTIFICATE 3



Technical Trainers Training and Resource Centre
Department of Workforce Planning and Skills Development
Ministry of Education and Skills Development

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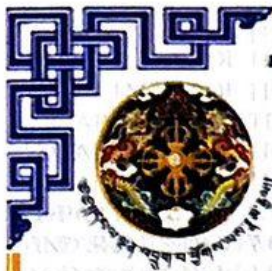
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Department of Workforce Planning and Skills Development

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Royal Government of Bhutan
Ministry of Education and Skills Development
Department of Workforce Planning and Skills
Development



Certificate No: DWPSD/CEC-AE/2025-26/013

Curriculum Endorsement Certificate

This is to certify that the curriculum for the following course(s) developed by
Technical Trainers Training and Resource Center
has been endorsed by the department.

Course	Level
Auto Electrical	BQF Certificate 3

Date of Endorsement: 13/01/2026



This certificate is valid till 12/01/2031 from the date of endorsement

Director General
Department of Workforce Planning and Skills Development

FOREWORD

Bhutan has seen a gradual increase in the requirement of skilled workers in recent years due to rapid growth of industries. However, an acute shortage of skilled workers has affected the growth of industries. Since the skilled workers are crucial for socio-economic development of the country, it is important to have adequately trained and certified workers. The “Auto Electricians” are not only the most significant occupation but also have high demand in the labour market. To meet the demand for skilled Auto Electricians, it is necessary to offer Competency Based Training on Auto Electrical trade to meet the requirements; in terms of number and level of competence of Auto Electricians.

Therefore, the Department of Workforce Planning and Skills Development (DWPSD) is pleased to present the revised edition of Competency Based Curriculum for Auto Electrical BQF Certificate III course developed based on National Competency Standard (NCS) following the standard curriculum development guidelines. Since it is a product of a more participatory process of curriculum development, it is expected to provide training delivery with reformed approaches having its content being directly related to labour market needs, focusing on imparting of skills and assessment based on industry work standards. Thus, bridging the skill gap between industry’s needs and training institutes whereby enhance the employability of its graduates.

The Department acknowledges the valuable contributions made by institutes, officials and experts from relevant stakeholders who were involved in the design and development of this curriculum. Further, we look forward for successful implementation of the Competency Based Curriculum. As curriculum is a dynamic document which has to be improved and revised timely based on the needs of the changing labour market and its users. The Department welcomes valuable feedbacks from the institutes and industries to further improve the design and the content of the curriculum that shall be pursued considering the change in labour market scenario.

A handwritten signature in blue ink, appearing to read 'Phub Rinzin', is written over a light blue rectangular background.

(Phub Rinzin)

Director General

Department of Workforce Planning and Skills Development

ACKNOWLEDGEMENT

Technical Trainers Training and Resource Center, DWPSD would like to express our appreciation to the following subject experts and facilitators who have participated in the revision and validation of curriculum for Auto electrical BQF Certificate 3:

Experts involved in the Revision of Auto electrical BQF Certificate 3 curriculum:

1. Mr. Pema, Kancha Automobile Workshop
2. Mr. Norbu Phuntsho, Kancha Automobile Workshop
3. Mr. Parbhat Biswa, EV Technician, Bhutan Hyundai
4. Mr. Tenzin Penjor, Asst. Instructor, TTI-Thimphu
5. Mr. Leki Dorji, Sr. Instructor, TTI-Thimphu
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Chief editor

1. Mr. Karma Dorji, Offtg. Chief Program Officer, TTTRC, DWPSD

Table of Contents

FOREWORD	I
ACKNOWLEDGEMENT	II
COMPETENCY PROFILE	III
COURSE INFORMATION	VI
COURSE STRUCTURE	VII
ASSESSMENT AND CERTIFICATION SYSTEM	VIII
MODULE INFORMATION:	1
MODULE 1	2
SERVICE ELECTRICAL COMPONENTS OF HEATING SYSTEM	4
SERVICE COMPONENTS OF VENTILATION SYSTEM	8
SERVICE ELECTRICAL COMPONENTS OF MAC	11
MODULE 2	16
MAINTAIN COMPONENTS OF CENTRAL LOCKING SYSTEM AND BURGLAR ALARM	19
MAINTAIN ADVANCED DRIVER ASSISTANCE SYSTEM (ADAS)	24
SERVICE SUPPLEMENTAL RESTRAINT SYSTEM (SRS)	28
SERVICE ENGINE IMMOBILIZER SYSTEM	33
SERVICE ANTI-LOCK BRAKING SYSTEM	36
PERFORM PREDICTIVE MAINTENANCE (IOT)	40
MODULE 3	43
SERVICE ELECTRONIC FUEL INJECTION (EFI) SYSTEM	45
MAINTAIN ELECTRONIC FUEL INJECTION (EFI) SENSORS	50
MAINTAIN COMMON RAIL DIRECT INJECTION (CRDI) SYSTEM	56
ANNEXURES	65
ANNEX II: MODULE RECOGNITION	68
ANNEX IV: LESSON PLAN	69
ANNEX V: COURSE PLAN	74

Competency Profile
Trade: Auto electrical BQF C3

Competency Area	Sub- Competency Area	Competencies/Tasks 			
A: Service heating and ventilation system (Electrical components)	A1 Service electrical components of heating system	A1.01 Service control panel assembly	A1.02 Service heater blower motor	A1.03 Replace heater core	A1.04 Replace heater control valve
		A1.05 Diagnose electrical heating system faults			
	A2 Service components of ventilation system	A2.01 Service air inlet/outlet damper control (actuator)	A2.02 Service blower unit	A2.03 Change air ducts	
	A3 Service electrical components of MAC	A3.01 Recover refrigerant	A3.02 Service AC pressure switch	A3.03 Change magnetic compressor clutch	A3.04 Perform leak test
		A3.05 Perform vacuuming	A3.06 Charge refrigerant	A3.07 Service condenser cooling fan motor	A3.08 Diagnose MAC system electrical faults
B: Service vehicle safety and security system	B1 Maintain components of central locking system and burglar alarm	B1.01 Install central locking system	B1.02 Check door actuator	B1.03 Replace central locking Electronic Control Module (ECM)	B1.04 Check courtesy door light switch
		B1.05 Perform remote setting	B1.06 Replace shock sensor	B1.07 Service burglar alarm horn	B1.08 Diagnose central locking system faults
	B2 Maintain Advanced Driver Assistance System (ADAS)	B2.01 Install reverse parking sensor unit	B2.02 Check ultrasonic sensor	B2.03 Check radar sensor	B2.04 Adjust radar sensor
		B2.05 Check LiDAR sensor			
	B3 Service Supplemental Restraint System	B3.01 Replace SRS air bag module/Air bag electronic crash unit	B3.02 Replace spiral cable	B3.03 Replace air bag impact sensor	B3.04 Check occupant detection sensor

Competency Area	Sub- Competency Area	Competencies/Tasks 			
		B3.05 Replace pre-tensioner seat belt assembly			
	B4 Service engine immobilizer system	B4.01 Replace Transponder chip	B4.02 Replace immobilizer key coil (Antenna)	B4.03 Diagnose immobilizer system faults	
	B5 Service anti-lock braking system	B5.01 Service wheel speed sensor	B5.02 Replace brake modulator unit	B5.03 Replace ABS Control Unit	B5.04 Replace brake pedal switch
		B5.05 Diagnose Anti-lock Brake System (ABS) faults			
	B6 Perform predictive maintenance (IOT)	B6.01 Replace TPMS	B6.02 Install Dashcam	B6.03 Replace brake pad wear sensor	
C: Service Electronic Fuel Injection (EFI) system	C1 Service Electronic Fuel Injection (EFI) system	C1.01 Check fuel system pressure	C1.02 Check fuel pressure regulator	C1.03 Service electric fuel pump	C1.04 Service Idle Air Control (IAC) valve
		C1.05 Check fuel injector	C1.06 Check VVT solenoid		
	C2 Maintain EFI Sensors	C2.01 Check temperature sensor (IAT and ECT)	C2.02 Check Manifold Absolute Pressure (MAP) sensor	C2.03 Check MAF sensor	C2.04 Check Throttle Position (TP) sensor
		C2.05 Check Oxygen (O ₂) sensor	C2.06 Check Vehicle Speed Sensor (VSS)	C2.07 Check accelerator pedal sensor	B2.08 Diagnose EFI system
	C3 Maintain Common Rail Direct Injection (CRDI) System	C3.01 Check common rail fuel pressure sensor	C3.02 Check fuel temperature sensor	C3.03 Check fuel filter water level sensor	C3.04 Check common rail pressure control valve
		C3.05 Check fuel metering control valve	C3.06 Check fuel injector	C3.07 Perform Fuel injector coding	

Competency Area	Sub- Competency Area	Competencies/Tasks			
	C4 Service emission control system (electrical components)	C4.01 Service canister purge solenoid	C4.02 Replace Exhaust Gas Recirculation (EGR) valve	C4.03 Replace EGR vacuum modulator	C4.04 Regenerate diesel particulate filter
		C4.05 Replace Lean NOx Trap (LNT)			

COURSE INFORMATION

COURSE TITLE	Auto electrical
LEVEL	BQF Certificate Level 3
COURSE OBJECTIVE	Upon completion of this training program, the trainees will be able to: • Service heating and ventilation system (Electrical components) • Service vehicle safety and security system; and • Service Electronic Fuel Injection (EFI) system
COURSE DESCRIPTION	This course is designed to provide learners with the knowledge, skills and attitudes required of an individual to become competent as Auto Electrician in accordance with industry standards. Upon completion of this course, the graduates will be able to work in Automobile Industries where they can perform duties like carryout servicing of electrical components in heating & ventilation system, vehicle safety & security system and electronic fuel injection system. To obtain the qualification of Auto Electrical BQF Certificate III, all learning outcomes prescribed for this qualification must be achieved.
COURSE DURATION	1179 Hours
TRAINER AND TRAINEE RATIO	1:12 (Practical) 1:20 (Theory)
ENTRY REQUIREMENT	Completed Auto electrical Certificate 2
TVET TRAINER REQUIREMENTS	• Must have a minimum qualification of Diploma in relevant field with three years of working experience in relevant field; • Must have undergone Training of Trainers-Technical Instruction and Pedagogy; • Must have at least 5 years job/industry experience if institute hires industry expert or guest lecturer

COURSE STRUCTURE

Sl. No	Subject /Module	Duration (Hours)	Content Competencies (Mapped)
1.	Core modules	461	CC
2.	OJT	420 (3 months)	CC
3.	Applied Dzongkha	42	SS
4.	ICT	48	SS
5.	Applied Mathematics	53	SS
6.	Technical English	51	SS
7.	Engineering Drawing	34	SS
8.	Assessment	70	
	Total Course Duration	1179	

Note: (*) This curriculum contains core modules which cover main competencies of Auto-electrical BQF Certificate-III and OJT component. There are separate curricula for subjects/modules for delivery of soft skills, professional development & values and environmental concern & safety. In order to achieve the qualification of Auto-electrical BQF Certificate-III, the subjects and modules listed must be accomplished as per the credit hours provided.

Content Competencies:

CC-Core Competencies

SS-Soft Skills

PD-Professional Development and Values

ES-Environmental concern and Safety

ASSESSMENT AND CERTIFICATION SYSTEM

ASSESSMENT

Diagnostic assessment of each skill will be conducted to identify areas where trainees may require additional support or intervention. This assessment will also evaluate their existing knowledge, skills, and understanding prior to a specific learning experience or unit of study. Methods such as pre-tests, concept mapping, KWL charts, and observations of student work will be utilized.

Formative assessment for every module and learning outcome will be conducted through assignments, project works, continuous assessment, demonstration of practical skills/observations, oral questioning and written test.

Summative assessment after completion of each national certificate level will be conducted by TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD as per the National Competency Standards and Guidelines for National Assessment and Certification System, provided the course is accredited with TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD.

CERTIFICATION

On successful completion of every module, the institute will award a certificate of achievement to the trainees. The TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD will award a National Certificate to the trainees upon the successful completion of NC level assessment.

COURSE DELIVERY

1. Modular
2. Demonstration
3. Lecture
4. Industrial training/attachment
5. Project work
6. Problem-based learning
7. Project-based learning

RESOURCES

Materials

- Heater core, blower motor, blower motor resistor, hoses, hose clamp, fuse, relay, gasket, seals, heater case, crocodile clips, control panel assembly, heater control valve, protective seat cover, insulation tape, battery, jumper wires, actuator, trims, clips, screws, blower unit, air ducts, zip lock, adhesive, AC pressure switch, wires, AC air filter, condenser cooling fan motor, probes, magnetic clutch assembly, bearing, AC belt, pulley, lead wire coupler, silicon grease, circlips, lead wire clamp, marking cloth, HP and LP pipe, wire connectors and terminals, cable tie, AC compressor, refrigerant, detergent, condenser fan, ECM, door switch, wire harness, heat shrink tube, wire shielding sleeve or tube, 9V battery, 12V battery, courtesy door light switch, shock sensor, burglar alarm, remote key, central locking system set, radar sensor, ultrasonic sensor, LiDAR sensor, reverse parking sensor unit, push lock bumper clip, SRS control module, pre-tensioner seat belt, air bag, occupant detection sensor, air bag impact sensor, nuts, spiral cable, masking tape, airbag inflator, ECU, transponder chip, immobilizer key coil set, immobilizer key set, modulator unit, brake fluid, brake pedal switch, wheel speed sensor, ABS control unit, dashcam, brake pad wear sensor, TPMS, petrol, lead acid battery, O-ring, fuel pressure regulator, electric fuel pump, IAC valve, cleaning solvent, VVT solenoid, fuel injector, IAT sensor, ECT sensor, MAP sensor, TP sensor, oxygen sensor, rust lubricant spray, VS sensor, MAF sensor, accelerator

pedal position sensor, common rail fuel pressure sensor, fuel, fuel temperature sensor, water, fuel filter water level sensor, common rail pressure control valve, fuel metering control valve, banjo washer, canister purge solenoid, EGR valve, gasket or adhesive sealant, emery paper, vacuum modulator, EGR modulator, LNT sensor, and diesel particulate filter.

Tools

- Socket set, wrench set, Allen key set, Torx screwdriver, tray, trim removal tool set, screwdriver set, impact wrench, pulley puller, double-ended (DE) or ring spanner set, pliers, nut wrench, vinyl tube, service wire, combination pliers, wire stripper, wrench, container, and O₂ sensor remover.

Instruments

- Multimeter, OBD scan tool, micron gauge, weighing scale, drive belt tension gauge, circuit tester, leak detector, manifold gauge, combination pliers, transponder chip reader, Vehicle Vital Diagnostic Interface (VVDI), yaw sensor, tyre pressure gauge, sound scope, fuel pressure gauge, thermometer, and oscilloscope

Equipment

- Vehicle, vacuum cleaner, recovery cylinder set, recovery machine, vacuum pump, air compressor, OBD scan tool, ADAS calibration tool set, jack, tyre changer, and petrol injector tester.

PPE

- Safety gloves, safety goggles, safety boots, working dress and face mask

Learning Materials

- Competency Based Learning Materials (CBLM)
- Reference books
- Hand-outs
- Audio visuals

Infrastructure and training facilities

- **Theory classroom size:** Minimum of 1 m² per trainee;
- **Practical Workshop size:** Minimum of 2.25 m² per trainee. Variables must be considered depending upon type of skills being taught and the number of trainees participating at a time.

MODULE INFORMATION:
AUTO ELECTRICAL BQF Certificate 3

MODULE 1
ON
SERVICING HEATING AND VENTILATION SYSTEM (ELECTRICAL
COMPONENTS)

MODULE INFORMATION

Occupation	Auto Electrician
Competency Area	Service heating and ventilation system (Electrical components)
Module Title	Servicing heating and ventilation system (Electrical components)
Module Code	7412- L3-M1
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to service electrical components of heating system, components of ventilation system and electrical components of Mobile Air Conditioning (MAC)
Nominal Duration	92.5 Hours
Certificate Level	BQF Certificate Level 3
Pre-requisite	Completed Auto Electrical Certificate Level 2
Learning Outcome	1. Service electrical components of heating system 2. Service components of ventilation system 3. Service electrical components of MAC

Module Title	Servicing heating and ventilation system (Electrical components)		
Module Code	7412- L3-M1		
Learning Outcome 1	Service electrical components of heating system		
Duration	Theory:7.5 hours	Practical:26 hours	Total: 33.5 hours
Assessment Criteria	- Control panel assembly is serviced as per standard procedure - Heater blower motor is serviced as per the standard procedure - Heater core is replaced as per standard procedure - Heater control valve is replaced as per standard procedure - Electrical heating system fault is diagnosed as per standard procedure		
Content	A1.00 Introductory knowledge - Scope and market trends of auto-electrician A1.01 Servicing control panel assembly Knowledge - Definition of heating and ventilation system - Types of HVAC system and its advantages - Construction and operation of heating and ventilation system - Function of control panel - Components and mechanisms of control panel assembly - Function of control switch - Types of control switch - Function of blower resistor - Blower motor resistor circuit Skills - Using multimeter - Interpreting circuit diagram - Using circuit tester - Analytical skills - Communication skills - Observation skills Attitude, safety and environmental concern - Being time conscious - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste A1.02 Servicing heater blower motor Knowledge - Function of blower motor - Types of blower motor Skills - Using multimeter - Using circuit tester - Interpreting circuit diagram		

	• Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of circuit A1.03 Replacing heater core <i>Knowledge</i> • Definition of Heater core • Function of heater core • Construction of heater core • Basic principle of heat transfer <i>Skills</i> • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environment concern</i> • Being time conscious • Being vigilant and patient • Having work ethics and integrity • Being team player • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper fitting of heater core in the system A1.04 Replacing heater control valve <i>Knowledge</i> • Function of heater control valve • Types of heater control valve • Construction and operation of heater control valve <i>Skills</i> • Using multimeter • Using circuit tester • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills
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	<i>Attitude, safety and environment concern</i> • Being time conscious • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal and fitting of dashboard A1.05 Diagnosing faults of electrical heating system <i>Knowledge</i> • Symptoms, causes and remedies of heating system failure <i>Skills</i> • Using multimeter • Using circuit tester • Interpreting circuit diagram • Using OBD scan tool • Analytical skills • Communication skills • Problem solving skills • Observation skills <i>Attitude, safety and environment concern</i> • Being time conscious • Being vigilant and patient • Having work ethics and integrity • Being team player • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM)/reference materials • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Heater core, blower motor, blower motor resistor, hoses, hose clamp, fuse, relay, gasket, seals, heater case, crocodile clips, control panel assembly,

	heater control valve, protective seat cover, insulation tape, battery and jumper wires Tools • Socket set, wrench set and screwdriver set Instrument • Multimeter, OBD scan tool and circuit tester Equipment • Vehicle PPE • Safety gloves, safety goggles, safety boots, working dress and face mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Servicing heating and ventilation system (Electrical components)		
Module Code	7412- L3-M1		
Learning Outcome 2	Service components of ventilation system		
Duration	Theory: 3hours	Practical:9 hours	Total:12 hours
Assessment Criteria	• Air inlet/outlet damper control is serviced as per standard procedure • Blower unit is serviced as per standard procedure • Air duct is changed as per standard procedure		
Content	A2.01 Servicing air inlet/outlet damper control (actuator) Knowledge • Function of damper(actuator) • Types of damper • Construction and operation of damper (actuator) Skills • Using multimeter • Using circuit tester • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Having work ethics and integrity • Being team player • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A2.02 Servicing blower unit Knowledge • Function of blower unit • Types of blower fan • Construction and operation of blower unit • Function of AC air filter • Interval of servicing of AC air filter Skills • Using multimeter • Using circuit tester • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills		

	<i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A2.03 Changing air ducts <i>Knowledge</i> • Function of air duct • Types of air duct • Modes of air flow in vehicle <i>Skills</i> • Using vacuum cleaner • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Having work ethics and integrity • Being team player • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM/ reference materials • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Actuator, trims, clips, screws, blower unit, air ducts, zip lock, protective seat cover and adhesive Tools • Socket set, screwdriver set (+, -), Allen key set, Trox, tray, trim removal tool set and wrench set

	Equipment • Vehicle and vacuum cleaner PPE • Safety gloves, safety goggles, safety boots, working dress and face mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Servicing heating and ventilation system (Electrical components)		
Module Code	7412-L3-M1		
Learning Outcome 3	Service electrical components of MAC		
Duration	Theory: 8.5 hours	Practical:38.5 hours	Total: 47 hours
Assessment Criteria	- Refrigerant is recovered as per the standard procedure - AC pressure switches are serviced as per the standard procedure - Magnetic compressor clutch is changed as per the standard procedure - Leak test is performed as per the standard procedure - Vacuumping is performed as per the standard procedure - Refrigerant is charged as per the standard procedure - Condenser cooling fan motor is serviced as per the standard procedure - MAC electrical faults are diagnosed as per the standard procedure		
Content	A3.01 Recovering refrigerant Knowledge - Introduction to MAC system - Components and function of MAC system - AC refrigeration cycle - Type of refrigerant used in automotive air conditioning - Properties of refrigerant - Purpose of refrigerant recovery Skills - Using recovery machine - Using manifold gauge - Using weighing scale - Analytical skills - Communication skills - Observation skills Attitude, safety and environmental concern - Being time conscious - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste A3.02 Servicing AC pressure switch Knowledge - Circuit diagram of AC system - Function of AC pressure switch - Types of AC pressure switch - Construction and operation of AC pressure switch Skills - Using multimeter		

	• Using circuit tester • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal and fitting of AC pressure switches • Ensuring proper disconnection of wire couplers A3.03 Changing magnetic compressor clutch <i>Knowledge</i> • Function of magnetic compressor clutch • Function of magnetic clutch coil • Construction and operation of magnetic clutch • Function of thermal switch <i>Skills</i> • Using multimeter • Using pulley puller • Using impact wrench • Using belt tension gauge • Using thermometer • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Being team player • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal and fitting of compressor clutch • Ensuring to adjust belt tension to its specification A3.04 Performing leak test <i>Knowledge</i> • Purpose of leak test
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	• Methods of leak test • Symptoms, causes and remedies of leakage Skills • Using manifold gauge • Using leak detector • Observation skills • Communication skills • Analytical skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.05 Performing vacuuming Knowledge • Purpose of vacuuming • Purpose of using micron gauge Skills • Using manifold gauge • Using micron gauge • Using vacuum pump • Observation skills • Communication skills • Analytical skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.06 Charging refrigerant Knowledge • Importance of maintaining refrigerant quantity • Effects of overcharging and undercharging • Importance of maintaining required engine rpm • Safety precautions while handling refrigerant Skills • Using manifold gauge
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	• Using weighing scale • Observation skills • Communication skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.07 Servicing condenser cooling fan motor <i>Knowledge</i> • Function of condenser cooling fan motor • Types of air flow and its purpose <i>Skills</i> • Using multimeter • Using circuit tester • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal of wire connector A3.08 Diagnosing MAC system electrical faults <i>Knowledge</i> • Symptoms, causes and remedies of MAC system electrical faults <i>Skills</i> • Using multimeter • Using circuit tester • Using OBD scan tool • Interpreting circuit diagram • Analytical skills • Communication skills • Problem solving skills
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	• Observation skills Attitude, safety and environment concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials, instrument and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to recover refrigerant safely
Learning Conditions	Learning Materials • CBLM/reference materials • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • AC pressure switch, screws, wires, AC air filter, condenser cooling fan motor, battery, crocodile clips, probes, magnetic clutch assembly, bearing, AC belt, pulley, lead wire coupler, silicon grease, circlips, lead wire clamp, markin cloth, HP & LP pipe, fuse, wire connectors & terminals, insulation tape, cable tie, AC compressor, blower motor, refrigerant, protective seat cover, detergent and condenser fan Tools • Socket set, impact wrench, pulley puller, Double Ended (DE)/ring spanner set, Trox screw driver, screwdriver set (+, -) and pliers Instruments • Multimeter, micron gauge, weighing scale, drive belt tension gauge, circuit tester, leak detector and manifold gauge Equipment • Vehicle, recovery cylinder set, recovery machine, vacuum pump and air compressor PPE • Safety gloves, safety boots, respiratory mask, working dress and safety goggles

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

MODULE 2

ON

SERVICING VEHICLE SAFETY AND SECURITY SYSTEM

MODULE INFORMATION

Occupation	Auto Electrician
Competency Area	Service vehicle safety and security system
Module Title	Servicing vehicle safety and security system
Module Code	7412- L3-M2
Module Description	This module is structured to provide the learners with knowledge, skills and right attitude required to maintain components of central locking system and burglar alarm, maintain ADAS, service Supplemental Restraint System (SRS), service engine immobilizer system and service anti-lock braking system
Nominal Duration	195.5 Hours
Qualification Level	BQF Certificate Level 3
Pre-requisite	Completed Module: 7412-L3-M1
Learning Outcome	1. Maintain components of central locking system and burglar alarm 2. Maintain Advanced Driver Assistance System (ADAS) 3. Service Supplemental Restraint System 4. Service engine immobilizer system 5. Service anti-lock braking system 6. Perform predictive maintenance

Module Title	Servicing vehicle safety and security		
Module Code	7412- L3-M2		
Learning Outcome 1	Maintain components of central locking system and burglar alarm		
Duration	Theory:8.5 hours	Practical:31 hours	Total: 39.5 hours
Assessment Criteria	- Central locking system is installed as per the circuit diagram following standard procedure - Door actuator is checked as per the standard procedure - ECU of central door locking system is replaced as per the standard procedure - Courtesy door light switch is checked and replaced as per standard procedure - Remote Setting is performed as per the standard procedure - Shock sensor is replaced as per the standard procedure - Burglar alarm is serviced as per the standard procedure - Fault in the Central Door locking system is diagnosed as per standard procedure		
Contents	B1.01 Installing central locking system Knowledge - Definition of central locking system - Types of central locking system - Purpose of central locking system - Components of central locking system - Circuit diagram of central locking system - Difference between key and keyless central locking system Skills - Interpreting circuit diagram - Using circuit tester - Using multimeter - Using portable drilling machine - Analytical skills - Communication skills - Observation skills Attitude, safety and environmental concern - Being time conscious - Being vigilant and patient - Being efficient in using resources - Having work ethics and integrity - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste B1.02 Checking door actuator Knowledge - Function of door actuator		

	• Mechanism of door actuator and locking system • Construction and operation of door actuator Skills • Using multimeter • Using circuit tester • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal of door clips B1.03 Replacing central locking Electronic Control Module (ECM) Knowledge • Function of ECM • Causes, symptoms and remedies of faulty ECM • Terminals of ECM • Definition of CAN (Controller Area Network) • Function of CAN Skills • Using multimeter • Using circuit tester • Analytical skills • Communication skills • Problem solving skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B1.04 Checking courtesy door light switch Knowledge • Function of courtesy door light switch • Function of courtesy light • Circuit diagram of central locking system with courtesy door light switch Skills • Using multimeter
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	• Using circuit tester • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper disconnection of wire connectors/couplers B1.05 Performing remote setting <i>Knowledge</i> • Buttons and function of remote key • Method of remote setting <i>Skills</i> • Using OBD scan tool • Using key fob frequency tester • Communication skills • Analytical skills • Problem solving skills • Observation skills <i>Attitude, safety and environmental concerns</i> • Being time conscious • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring correct use of PPE • Ensuring to perform remote setting properly B1.06 Replacing shock sensor <i>Knowledge</i> • Function of shock sensor • Working principle of shock sensor (Piezoelectric effect) • Circuit diagram of shock sensor • Operation of shock sensor • Purpose of adjusting alarm sensitivity knob <i>Skills</i> • Using multimeter • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious
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	• Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B1.07 Servicing burglar alarm Knowledge • Function of burglar alarm • Function of remote control • Parts of remote control and its functions • Purpose of resetting burglar alarm system • Types of burglar alarm system Skills • Using multimeter • Analytical skills • Communication skills • Problem solving skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection as per the circuit diagram B1.08 Diagnosing central locking system faults Knowledge • Symptoms, causes and remedies of central locking system faults Skills • Interpreting circuit diagram • Using multimeter • Using circuit tester • Using OBD scan tool • Analytical skills • Communication skills • Problem solving skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient
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	• Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal and fitting of wire connectors
Learning Conditions	Learning Materials • CBLM/Reference materials • Hand outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Actuator, ECM, door switch, wire harness, wires, insulation tape, heat shrink tube, wire shielding sleeve/tube, 9V battery, 12V battery, jumper wires, crocodile clips, relay, fuse, battery, cable tie, screws, markin cloth, courtesy door light switch, shock sensor, burglar alarm, remote key and central locking system set Tools • Screwdriver set, socket set and combination plier Instrument • Multimeter, key fob frequency tester and circuit tester Equipment • OBD scan tool and vehicle PPE • Safety gloves, safety boots, working dress and safety goggles
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment

	• Project work		
Module Title	Servicing vehicle safety and security		
Module Code	7412- L3-M2		
Learning Outcome 2	Maintain Advanced Driver Assistance System (ADAS)		
Duration	Theory: 7 hours	Practical:53 hours	Total:60 hours
Assessment Criteria	• Reverse parking sensor unit is installed as per standard procedure • Ultrasonic sensor is checked as per standard procedure • Radar sensor unit is checked and adjusted as per standard procedure • LiDAR sensor unit is checked as per standard procedure		
Contents	B2.01 Installing reverse parking sensor unit Knowledge • Introduction to Advanced Driver Assistance System (ADAS) • Application of ADAS • Ultrasonic principle • Function of reverse parking sensor • Components of reverse parking sensor unit • Methods of checking parking sensor Skills • Using multimeter • Interpreting circuit diagram • Analytical skills • Observation skills Attitude, safety and environmental concerns • Being time conscious • Having work ethics and integrity • Proper handling of laptop/interface tool • Ensuring to follow OHS rules and regulations • Ensuring correct use of PPE B2.02 Check ultrasonic Sensor Knowledge • Introduction to ultrasonic sensor • Function of ultrasonic sensor • Working principle of ultrasonic sensor • Detection range of ultrasonic sensor • Symptoms and causes of faulty ultrasonic sensor Skills • Using OBD scan tool • Analytical skill • Communication skills • Problem solving skill		

	• Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.03 Check radar Sensor <i>Knowledge</i> • Introduction to radar sensor • Function of radar sensor • Working principle of radar sensor • Symptoms and causes of faulty radar sensor <i>Skills</i> • Using OBD scan tool • Analytical skill • Communication skills • Problem solving skill • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.04 Adjust radar Sensor <i>Knowledge</i> • Purpose of adjusting radar sensor after installation • Modes of radar adjustment • Symptoms of radar misalignment <i>Skills</i> • Using OBD scan tool • Using ADAS calibration tool • Analytical skill • Communication skills • Problem solving skill • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious
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	• Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.05 Check LiDAR Sensor Knowledge • Function of LiDAR sensor • Working principle of LiDAR sensor • Difference between the radar sensor and LiDAR sensor • Symptoms and causes of faulty LiDAR sensor Skills • Using OBD scan tool • Analytical skill • Communication skills • Problem solving skill • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM/reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Radar sensor, ultrasonic sensor, LiDAR sensor, reverse parking sensor unit, wires, cable tie, screws, insulation tape and push lock bumper clip Instruments • OBD scan tool, multimeter and circuit tester

	Tools • Screwdriver set, mini socket set, Allen key set, trim removal tool set and Trox screwdriver Equipment • Vehicle and ADAS calibration tool set PPE • Safety gloves, safety boots and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Servicing vehicle safety and security		
Module Code	7412- L3-M2		
Learning Outcome 3	Service Supplemental Restraint System (SRS)		
Duration	Theory:9 hours	Practical:27 hours	Total:36 hours
Assessment Criteria	- SRS air bag module/Air bag electronic crash unit is replaced as per standard procedures - Spiral cable is replaced as per standard procedures - Air bag impact sensor is replaced as per standard procedures - Occupant detection sensor is checked as per standard procedures - Pre-tensioner seat belt assembly is replaced as per standard procedures		
Contents	B3.01 Replace SRS air bag module/Air bag electronic crash unit Knowledge - Definition of Supplemental Restraint System (SRS) - Purpose of SRS - Circuit diagram of SRS - Operation of SRS - Components of SRS and its functions - Terminals of SRS air bag module - Operation of airbag inflator - Purpose of resetting SRS after installation of airbag inflator - Methods of resetting SRS - Safety precautions while replacing SRS components - Importance of replacing SRS components Skills - Using OBD scan tool - Using multimeter - Interpreting circuit diagram - Analytical skills - Communication skills - Observation skills Attitude, safety and environmental concern - Being time conscious - Being vigilant and patient - Being efficient in using resources - Having work ethics and integrity - Proper handling of inflator		

	• Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B3.02 Replacing spiral cable Knowledge • Function of spiral cable • Construction and operation of spiral cable • Importance of steering wheel alignment after installation • Symptoms and causes of faulty spiral cable Skills • Using OBD scan tools • Using multimeter • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to tape the spiral cable prior to removal from steering column • Ensuring to snap the lock after installation of new spiral cable B3.03 Replacing air bag impact sensor Knowledge • Function of air bag impact sensor • Types of impact sensor • Construction and operation of air bag impact sensor Skills • Using OBD scan tools • Using multimeter • Analytical skill • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	• Ensuring proper handling of scan tools • Ensuring to avoid using multimeter to check resistance of air bag impact sensor B3.04 Checking occupant detection sensor Knowledge • Function of occupant detection sensor • Types of occupant detection sensor • Construction and operation of occupant detection sensor • Methods of activating occupant detection sensor Skills • Using multimeter • Using OBD scan tools • Using circuit tester • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring appropriate handling of scan tools • Ensuring proper disconnection of occupant detection sensor B3.05 Replacing pre-tensioner seat belt assembly Knowledge • Function of pre-tensioner • Types of pre-tensioners • Construction and operation of pre-tensioner • Function of Emergency Fastening Devices (EFD) • Symptoms and causes of faulty pre-tensioner Skills • Using OBD scan tool • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE
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	• Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM/Reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • SRS control module, pre-tensioner seat belt, air bag, occupant detection sensor, air bag impact sensor, nuts, screws, wires, spiral cable, masking tape, insulation tape and airbag inflator Tools • Screwdriver set, Allen key set, Trox screwdriver, socket set, pliers, trim removal tool set and DE/ring spanner Instrument • OBD scan tool, multimeter and circuit tester Equipment • Vehicle PPE • Safety gloves, safety boots and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Servicing vehicle safety and security		
Module Code	7412- L3-M2		
Learning Outcome 4	Service engine immobilizer system		
Duration	Theory:4 hours	Practical:11 hours	Total: 15 hours
Assessment Criteria	• Transponder chip is replaced as per the standard procedure • Immobilizer key coil is replaced as per the standard procedure • Faulty immobilizer system is diagnosed as per the standard procedure		
Content	B4.01 Replacing Transponder chip Knowledge • Definition of immobilizer • Purpose of immobilizer system • Components of immobilizer system and its functions • Operation of immobilizer system • Types of transponder chip • Purpose of generating transponder ID • Purpose of key programming and its code Skills • Using OBD scan tool • Using transponder chip reader • Using Vehicle Vital Diagnostic Interface (VVDI) tools (mini/max Pro) • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B4.02 Replacing immobilizer key coil (Antena) Knowledge • Function of immobilizer key coil • Types of immobilizer key coil • Principle of Radio Frequency Identification (RFID) • Construction and operation of immobilizer key coil • Definition of chip cloning • Purpose of generating transponder code Skills • Using OBD scan tool • Using multimeter • Analytical skills • Communication skills		

	• Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE B4.03 Diagnosing faulty immobilizer system <i>Knowledge</i> • Symptoms, causes and remedies for immobilizer system failures <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE
Learning Conditions	Learning Materials • CBLM/Reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Markin cloth, ECU, transponder chip, immobilizer key coil set and immobilizer key set Tools • Screwdriver set, socket set, pliers and wrench set Instruments • OBD scan tool, transponder chip reader, Vehicle Vital Diagnostic Interface (VVDI) and multimeter

	Equipment • Vehicle PPE • Safety gloves, safety boots and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Servicing vehicle safety and security system		
Module Code	7412- L3-M2		
Learning Outcome 5	Service anti-lock braking system		
Duration	Theory: 8 hours	Practical: 21 hours	Total: 29 hours
Assessment Criteria	• Wheel speed sensor is serviced as per the standard procedures • Brake modulator unit is replaced as per the standard procedure • ABS Control Unit is replaced following the standard procedure • Brake pedal switch is replaced as per the standard procedure • Faulty ABS is diagnosed as per the standard procedure		
Contents	B5.01 Servicing wheel speed sensor Knowledge • Definition of Anti-lock Braking System (ABS) • Purpose of ABS • Types of ABS • ABS components and its function • Operation of ABS • Electromagnetic induction principle and hall effect principle • Construction and operation of wheel speed sensor • Types of wheel speed sensor • Purpose of Yaw rate sensor (stability control sensor) • MEMS Gyroscope principle (Micro Electro Mechanical system Gyro) Skills • Using multimeter • Using circuit tester • Interpreting circuit diagram • Using OBD scan tool • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE B5.02 Replacing brake modulator unit Knowledge • Function of ABS modulator unit • Types of ABS modulator unit • Construction and operation of brake modulator unit • Terminals of brake modulator unit		

	Skills • Using OBD scan tool • Using multimeter • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of electrical connector B5.03 Replacing ABS Control unit Knowledge • Function of ABS control unit/stability control unit • Terminals of ABS control unit Skills • Interpreting ECU terminal diagrams • Using multimeter • Analytical skills • Communication skills • Problem solving skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE B5.04 Replacing brake pedal switch Knowledge • Function of brake pedal switch • Types of brake pedal switch • Construction of brake pedal switch • Operation of brake pedal switch Skills • Using multimeter • Using OBD scan tool • Interpreting circuit diagram • Analytical skills
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	• Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Being team player • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE B5.05 Diagnosing ABS system faults <i>Knowledge</i> • Symptoms, causes and remedies of faulty ABS <i>Skills</i> • Using multimeter • Using OBD scan tool • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Being team player • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE
Learning Conditions	Learning Materials • CBLM/reference materials • Hand outs • Audio-visuals • Reference books • Manual Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Modulator unit, brake fluid, brake pedal switch, fuse, wheel speed sensor, jumper wires, insulation tape, markin cloth and ABS control unit Tools • Screwdriver set, socket set, pliers, DE/ring spanner, flare nut wrench and vinyl tube

	Instruments • Multimeter, circuit tester, Yaw sensor and OBD scan tool Equipment • Vehicle PPE • Safety gloves, safety boots, safety goggles and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Servicing vehicle safety and security system		
Module Code	7412- L3-M2		
Learning Outcome 6	Perform predictive maintenance (IOT)		
Duration	Theory: 3 hours	Practical: 13 hours	Total: 16 hours
Assessment Criteria	• TPMS is replaced as per the standard procedures • Dashcam is installed as per the standard procedure • Brake pad wear sensor is replaced following the standard procedure		
Contents	B6.01 Replacing TPMS <i>Knowledge</i> • Function of TPMS • Purpose of calibrating TPMS • Symptoms and causes of faulty TPMS <i>Skills</i> • Using VVDI • Using OBD scan tool • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE B6.02 Installing Dashcam <i>Knowledge</i> • Function of dashcam • Construction and operation of Dashcam • Causes, symptoms and remedies of faulty dashcam <i>Skills</i> • Using multimeter • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources		

	• Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of electrical connector B6.03 Replacing brake pad wear sensor Knowledge • Function of brake pad wear sensor • Types of brake pad wear sensor • Construction and operation of brake pad wear sensor • Causes and symptoms of faulty brake pad wear sensor Skills • Using OBD scan tool • Analytical skills • Communication skills • Problem solving skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE
Learning Conditions	Learning Materials • CBLM/reference materials • Hand outs • Audio-visuals • Reference books • Manual Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Markin clothes, dashcam, brake pad wear sensor, TPMS, wires and insulation tape Tools • Screwdriver set, socket set, pliers, inflating nozzles, wheel wrench and DE/ring spanner Instruments • Multimeter, tyre pressure gauge and OBD scan tool Equipment

	• Vehicle, tyre changer, jack and air compressor PPE • Safety gloves, safety boots, safety goggles and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

MODULE 3
ON
SERVICING ELECTRONIC FUEL INJECTION (EFI) SYSTEM

Occupation	Auto electrician
MODULE INFORMATION	
Module Title	Servicing electronic fuel injection system
Module Code	7412- L3-M3
Module Description	This module is structured to provide the learners with knowledge, skills and right attitude required to service Electronic Fuel Injection (EFI) System, maintain EFI Sensor, maintain CRDI System and service electrical components of emission control system
Nominal Duration	173 Hours
Qualification Level	BQF Certificate Level 3
Pre-requisite	Completed Module: 7412-L3-M2
Learning Outcome	1. Service Electronic Fuel Injection (EFI) 2. Maintain EFI Sensor 3. Maintain CRDI System 4. Service emission control system (electrical components)

Module Title	Servicing electronic fuel injection system		
Module Code	7412- L3-M3		
Learning Outcome 1	Service Electronic Fuel Injection (EFI) system		
Duration	Theory:9 hours	Practical:37 hours	Total: 46 hours
Assessment Criteria	- Fuel system pressure is checked and interpreted as per the standard procedure - Fuel pressure regulator is checked as per the service manual following standard procedure - Electric fuel pump is serviced as per the service manual following standard procedure - Idle Air Control (IAC) valve is serviced as per the standard procedure - Fuel injector is checked as per the standard procedure - VVT solenoid is checked as per the standard procedure		
Contents	C1.01 Checking fuel system pressure Knowledge - Definition of EFI system - Function of EFI system - Types of EFI - Construction of EFI system - Components of fuel system and their functions - Operation of fuel flow system - Purpose of maintaining fuel pressure - Causes and effect of low fuel pressure in the system Skills - Using fuel pressure gauge - Analytical skills - Communication skills - Observation skills Attitude, safety and environmental concern - Being time conscious - Being vigilant and patient - Being efficient in using resources - Having work ethics and integrity - Proper handling of pressure gauge - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste C1.02 Servicing fuel pressure regulator Knowledge - Function of fuel pressure regulator - Construction of fuel pressure regulator		

	• Operation of fuel pressure regulator • Purpose of replacing 'O' Ring Skills • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.03 Servicing electric fuel pump Knowledge • Function of electric fuel pump • Types of electric fuel pump • Components of electric fuel pump and its function • Operation of electric fuel pump • Symptoms, causes and effect of faulty electric fuel pump Skills • Using multimeter • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Being team player • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to avoid open flames and smoking when fuel filler cap is removed • Ensuring to release the fuel pressure prior to disconnecting fuel lines C1.04 Servicing Idle Air Control (IAC) valve Knowledge • Function of IAC valve • Construction and operation of IAC valve • Symptoms, causes and remedies of faulty IAC valve Skills • Using multimeter • Using OBD scan tool
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	• Using circuit tester • Interpreting circuit diagram • Analytical skills • Communication skills • Problem solving skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Proper handling of throttle body • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.05 Checking fuel injector <i>Knowledge</i> • Function of fuel injector • Classification of fuel injector • Construction and operation of fuel injector • Types of injector nozzle • Fuel injector spray pattern and its interpretation • Symptoms, causes and remedies of faulty fuel injector <i>Skills</i> • Using multimeter • Using OBD scan tool • Using sound Scope • Using injector tester (petrol) • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE C1.06 Servicing VVT solenoid <i>Knowledge</i> • Definition of Variable Valve Timing (VVT) • Function of VVT solenoid • Construction and operation of VVT solenoid • Symptoms, causes and remedies of faulty VVT solenoid
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	Skills • Using multimeter • Using OBD scan tool • Interpreting circuit diagram • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE
Learning Conditions	Learning Materials • CBLM/reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Petrol, lead acid battery, markin cloth, relay, hose clamp, 'O' ring, fuel pressure regulator, electric fuel pump, jumper wires, crocodile clips, IAC valve, cleaning solvent, ECU, VVT solenoid and fuel injector Tools • Socket set, screwdriver set, tray, service wire, combination pliers, wire stripper and wrench Instrument • OBD scan tool, sound scope, fuel pressure gauge, circuit tester and multimeter Equipment • Vehicle and petrol injector tester PPE • Safety gloves, safety boots and working dress

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Servicing electronic fuel injection system		
Module Code	7412- L3-M3		
Learning Outcome 2	Maintain Electronic Fuel Injection (EFI) Sensors		
Duration	Theory:13 hours	Practical:41 hours	Total: 54 hours
Assessment Criteria	• Temperature (IAT and ECT) sensor is checked as per the standard procedure • Manifold Absolute Pressure (MAP) sensor is checked as per the standard procedure • MAF sensor is checked as per standard procedure • Throttle Position (TP) sensor is checked as per the standard procedure • Oxygen (O₂) sensor is checked as per the service manual following standard procedure • Vehicle Speed (VS) sensor is checked as per standard procedure • Accelerator pedal sensor is checked as per service manual following standard procedure • EFI system is diagnosed as per the standard procedure		
Contents	C2.01 Checking Temperature sensor (IAT and ECT) Knowledge • Function of IAT sensor • Working principle of thermistor • Construction and operation of IAT sensor • Introduction to temperature resistance graph • Symptoms and causes of faulty IAT sensor • Function of ECT sensor • Construction and operation of ECT sensor • Symptoms and causes of faulty ECT sensor Skills • Using multimeter • Using OBD scan tool • Using thermometer • Using circuit tester • Interpreting temperature resistance graph • Interpreting circuit diagram • Analytical skills • Communication skills		

	• Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.02 Checking Manifold Absolute Pressure (MAP) sensor <i>Knowledge</i> • Function of MAP sensor • Construction and operation of MAP sensor • Introduction to manifold-pressure diagram (Voltage and Pressure graph) • Symptoms and causes of faulty MAP sensor • Function of boost sensor • Construction and operation of boost sensor <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Using hand help vacuum pump • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.03 Checking Mass Air Flow (MAF) Sensor <i>Knowledge</i> • Function of MAF sensor • Types of MAF sensor • Construction and operation of MAF sensor • Symptoms and causes of faulty MAF sensor <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using circuit tester • Using OBD scan tool • Analytical skills
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	• Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.04 Checking Throttle Position (TP) sensor <i>Knowledge</i> • Introduction to motorized Throttle body • Function of TP sensor • Types of TP sensor • Construction and working principle of TP sensor • Symptoms and causes of faulty TP sensor <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.04 Checking Oxygen (O₂) sensor <i>Knowledge</i> • Function of O₂ sensor • Construction and operation of O₂ sensor • Symptoms, causes and remedies of faulty O₂ sensor • Purpose of up-stream and down-stream O₂ sensor <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using oscilloscope • Using OBD scan tool • Analytical skills • Communication skills • Observation skills
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	<i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to cool the engine before removing the O₂ sensor C2.06 Checking Vehicle Speed Sensor (VSS) <i>Knowledge</i> • Function of VS sensor • Types of VS sensor • Construction and operation of VS sensor • Symptoms, causes and remedies of faulty VS sensor <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.07 Checking Accelerator Pedal Position Sensor (APPS) <i>Knowledge</i> • Difference between mechanical linkage and drive by wire • Function of APPS • Construction and operation of APPS • Symptoms and causes of faulty APPS <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious
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	• Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.08 Diagnose EFI system Knowledge • Definition of OBD • Types of DLC • Terminals of Data Link Connector (DLC) • Difference between OBD-I and OBD-II • Causes, symptoms and remedies of faulty EFI system Skills • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Interpreting Diagnostic Trouble Code (DTC) • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM/Reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • IAT sensor, ECT sensor, MAP sensor, wires, crocodile clips, TP sensor, oxygen sensor, rust lubricant spray, VS sensor, markin cloth, MAF sensor, Lead acid battery, accelerator pedal position sensor and screws

	Tools • Socket set, screwdriver set, container, service wire, wrench, torx screw driver, allen key set and O₂ sensor remover Instruments • Multimeter, thermometer, OBD scan tool and oscilloscope Equipment • Vehicle and vacuum pump PPE • Safety gloves, safety boots, safety goggles and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Servicing electronic fuel injection system		
Module Code	7412- L3-M3		
Learning Outcome 3	Maintain Common Rail Direct Injection (CRDI) system		
Duration	Theory:10 hours	Practical: 29 hours	Total: 39 hours
Assessment Criteria	• Common rail fuel pressure sensor is checked as per standard procedure • Fuel temperature sensor is checked as per standard procedure • Fuel filter water level sensor is checked as per standard procedure • Common rail pressure control valve is checked as per the standard procedure • Fuel metering control valve is checked as per standard procedure • Fuel injector is checked as per standard procedure • Fuel injector coding is performed as per standard procedure • Fuel cut off switch is checked as per standard procedure		
Contents	C3.01 Checking common rail fuel pressure sensor <i>Knowledge</i> • Definition of CRDI system • Types of CRDI system • Construction and operation of CRDI system • Advantages and limitations of CRDI system • Function of common rail fuel pressure sensor • Construction and operation of common rail fuel pressure sensor • Symptoms and causes of faulty common rail fuel pressure sensor <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Using circuit tester • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C3.02 Checking fuel temperature sensor <i>Knowledge</i> • Function of fuel temperature sensor • Construction and operation of fuel temperature sensor • Symptoms and causes of faulty fuel temperature sensor <i>Skills</i> • Interpreting circuit diagram		

	• Using multimeter • Using OBD scan tool • Using circuit tester • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C3.03 Checking fuel filter water level sensor <i>Knowledge</i> • Function of fuel filter water level sensor • Construction and operation of fuel filter water level sensor • Symptoms, causes and remedies of faulty fuel filter water level sensor <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using circuit tester • Using OBD scan tool • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C3.04 Checking common rail pressure control valve <i>Knowledge</i> • Function of common rail pressure control valve • Construction and operation of common rail pressure control valve • Symptoms, causes and remedies of faulty common rail pressure control valve <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool
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- Using circuit tester
- Analytical skills
- Communication skills
- Observation skills

Attitude, safety and environmental concern

- Being time conscious
- Being vigilant and patient
- Being efficient in using resources
- Having work ethics and integrity
- Ensuring to follow OHS rules and regulations
- Ensuring appropriate use of PPE
- Ensuring proper disposal of waste

C3.05 Checking fuel metering control valve

Knowledge

- Function of fuel metering control valve
- Construction and operation of fuel metering control valve
- Symptoms and causes of faulty fuel metering control valve

Skills

- Interpreting circuit diagram
- Using multimeter
- Using OBD scan tool
- Using circuit tester
- Analytical skills
- Communication skills
- Observation skills

Attitude, safety and environmental concern

- Being time conscious
- Being vigilant and patient
- Being efficient in using resources
- Having work ethics and integrity
- Ensuring to follow OHS rules and regulations
- Ensuring appropriate use of PPE
- Ensuring proper disposal of waste

C3.06 Checking fuel injector

Knowledge

- Function of fuel injector
- Types of fuel injector
- Construction and operation of fuel injector
- Three phases of injections (pilot, main and post)
- Purpose of three phase injection
- Symptoms, causes and remedies of faulty fuel injector

Skills

- Interpreting circuit diagram
- Using multimeter
- Using injector tester (Diesel)

	• Using OBD scan tool • Using circuit tester • Using sound scope • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C3.07 Perform fuel injector coding <i>Knowledge</i> • Definition of injector coding • Purpose of injector coding • Types of injector codes <i>Skills</i> • Using OBD scan tool • Interpreting injector code • Analytical skills • Communication skills • Observation skills <i>Attitude, safety and environmental concerns</i> • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM/reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop

	Materials - Common rail fuel pressure sensor, battery, fuel, fuel temperature sensor, water, fuel filter water level sensor, markin cloth, crocodile clips, jumper wires, common rail pressure control valve, O-ring, fuel metering control valve, fuel injector, banjo washer and wires Tools - DE spanner set, tray, screwdriver set, wrench set, socket set, flare nut spanner and fuel injector puller Instrument - Multimeter, OBD scan tool, sound scope, circuit tester and thermometer Equipment - Vehicle and injector tester PPE - Safety gloves, safety boots, safety goggles and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Guided practice - Group practice with project-based learning - Individual practice with problem-based learning - Industrial visit/training - Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: - Practical observation - Oral/viva-voce - Written test - Assignment - Project work

Module Title	Servicing electronic fuel injection system		
Module Code	7412- L3-M3		
Learning Outcome 4	Service emission control system (Electrical components)		
Duration	Theory:10 hours	Practical:24 hours	Total: 34 hours
Assessment Criteria	• Canister purge solenoid is serviced as per standard procedure • EGR valve is replaced as per standard procedure • Vacuum modulator is serviced as per the standard procedure • Diesel particulate filter is regenerated as per the standard procedure • LNT is replaced as per the standard procedure		
Contents	C4.01 Replacing canister purge solenoid Knowledge • Definition of emission control system • Purpose of emission control system • Function of canister purge solenoid • Construction and operation of canister purge solenoid • Symptoms and causes of faulty canister purge solenoid Skills • Using OBD scan tool • Interpreting circuit diagram • Using multimeter • Using hand-held vacuum pump • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C4.02 Replacing Exhaust Gas Recirculation (EGR) valve Knowledge • Definition of Exhaust Gas Recirculation (EGR) system • Purpose of EGR system • Construction and operation of EGR system • Function of EGR valve • Types of EGR valve • Construction and operation of EGR valve • Symptoms, causes and remedies of faulty EGR valve		

	Skills • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Using hand-held vacuum pump • Using circuit tester • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C4.03 Replacing EGR vacuum modulator Knowledge • Function of EGR vacuum modulator • Construction and operation of EGR vacuum modulator • Symptoms and causes of faulty EGR vacuum modulator Skills • Using OBD scan tool • Interpreting circuit diagram • Using multimeter • Analytical skills • Communication skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C4.04 Regenerate Diesel Particulate Filter (DPF) Knowledge • Definition of DPF • Function of DPF • Construction and operation of DPF system • Methods of DPF regeneration • Difference between BS4 and BS6
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	• Symptoms, causes and remedies of faulty DPF Skills • Interpreting circuit diagram • Using OBD scan tool • Communication skills • Analytical skills • Observation skills Attitude, Safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring continues observation of dashboard while regenerating diesel particulate filter C4.05 Replace LNT (Lean NO_x Trap) Knowledge • Function of LNT • Construction and operation of LNT • Symptoms, causes and remedies of faulty LNT • Definition of Selective Catalytic Reduction (SCR) • Function of SCR • Construction and operation of SCR • Definition of Diesel Exhaust Fluid (DEF) • Function of NO_x sensor • Symptoms, causes and remedies of SCR system Skills • Interpreting circuit diagram • Using OBD scan tool • Using multimeter • Using circuit tester • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being vigilant and patient • Being efficient in using resources • Having work ethics and integrity • Ensuring to follow OHS rules and regulations • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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Learning Conditions	Learning Materials • CBLM/reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Canister purge solenoid, jumper wires, EGR valve, gasket/adhesive sealant, battery, fuel, emery paper, wire harness, markin cloth, hoses, vacuum modulator, EGR modulator, LNT sensor and Diesel particulate filter Tools • Socket set, screwdriver set, Allen key set, Trox and DE spanner set Instruments • Multimeter, circuit tester and OBD scan tool Equipment • Vehicle and hand-held vacuum pump PPE • Safety gloves, safety boots and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning • Industrial visit/training • Universal Design Learning (UDL)
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

ANNEXURES

Annexes I: Time Distribution

Auto Electrical BQF Certificate 3					
Module Title	Learning outcomes	Tasks	Theory (Hours)	Practical (Hours)	Total (hours)
A: Carrying out servicing of heating and ventilation system (Electrical components)	A1: Service electrical components of heating system	A1.00 Introductory knowledge	1	0	2
		A1.01 Service control panel assembly	3	4	7
		A1.02 Service heater blower motor	0.5	3	3.5
		A1.03 Replace heater core	1	11	12
		A1.04 Replace heater control valve	1	3	4
		A1.05 Diagnose electrical heating system faults	1	5	6
	Sub Total Duration		7.5	26	33.5
	A2: Service components of ventilation system	A2.01 Service air inlet/outlet damper control (actuator)	1	3	4
		A2.02 Service blower unit	1	3	4
		A2.03 Change air duct	1	3	4
	Sub Total Duration		3	9	12
	A3: Service electrical components of MAC	A3.01 Recover refrigerant	3	9	12
		A3.02 Service AC pressure switch	1	2	3
		A3.03 Change magnetic compressor clutch	1	5	6
		A3.04 Perform leak test	1	3	4
		A3.05 Perform vacuuming	0.5	5.5	6
		A3.06 Charge refrigerant	0.5	5.5	6
		A3.07 Service condenser cooling fan motor	0.5	3.5	4
		A3.08 Diagnose MAC system faults	1	5	6
	Sub Total		8.5	38.5	47
	Total Duration (A)		19	73.5	92.5
B: Carrying out servicing of vehicle safety and security system	B1: Maintain components of central locking system and burglar alarm	B1.01 Install central locking system	2	10	12
		B1.02 Check door actuator	1	2	3
		B1.03 Replace Electronic Control Module (ECM)	0.5	3	3.5
		B1.04 Check courtesy door light switch	1	2	3
		B1.05 Perform remote setting	1	5	6
		B1.06 Replace shock sensor	1	2	3
		B1.07 Service burglar alarm	1	2	3
		B1.08 Diagnose central locking system faults	1	5	6
	Sub Total Duration		8.5	31	39.5
	B2: Maintain Advanced Driver Assistance System (ADAS)	B2.01 Install reverse parking sensor unit	1	11	12
		B2.02 Check ultrasonic sensor	2	10	12
		B2.03 Check radar sensor	2	10	12
		B2.04 Adjust radar sensor	1	11	12
		B2.05 Check LiDAR sensor	1	11	12
	Sub Total Duration		7	53	60

	B3: Service Supplemental Restraint System	B3.01 Replace SRS air bag module/Air bag electronic crash unit	4	6	10
		B3.02 Replace spiral cable	2	6	8
		B3.03 Replace air bag impact sensor	1	5	6
		B3.04 Check occupant detection sensor	1	5	6
		B3.05 Service pre-tensioner seat belt assembly	1	5	6
	Sub Total Duration		9	27	36
	B4: Service engine immobilizer system	B4.01 Replace transponder chip	2	6	8
		B4.02 Replace immobilizer key coil	1	3	4
		B4.03 Diagnose immobilizer system faults	1	2	3
	Sub Total Duration		4	11	15
	B5: Service anti-lock braking system	B5.01 Replace wheel speed sensor	3	5	8
		B5.02 Replace brake modulator unit	2	6	8
		B5.03 Replace ABS control unit	1	5	6
		B5.04 Replace brake pedal switch	1	3	4
		B5.05 Diagnose faults of ABS system	1	2	3
	Sub Total Duration		8	21	29
	B6: Perform predictive maintenance (IOT)	B6.01 Replace TPMS	1	5	6
		B6.02 Install Dashcam	1	3	4
		B6.03 Replace brake pad wear sensor	1	5	6
	Sub Total Duration		3	13	16
	Total Duration (B)		39.5	156	195.5
C: Carrying out servicing of electronic fuel injection system	C1: Service electronic fuel injection (EFI) system	C1.01 Check fuel system pressure	3	6	9
		C1.02 Check fuel pressure regulator	1	5	6
		C1.03 Service electric fuel pump	2	12	14
		C1.04 Check idle air control valve	1	5	6
		C1.05 Check fuel injector	1	6	7
		C1.06 Service VVT solenoid	1	3	4
	Sub Total Duration		9	37	46
	C2: Maintain EFI sensor	C2.01 Check temperature sensor (IAT and ECT)	4	6	10
		C2.02 Check MAP sensor	1	3	4
		C2.03 Check MAF sensor	1	5	6
		C2.04 Check TP sensor	2	4	6
		C2.05 Check oxygen sensor	2	10	12
		C2.06 Check VS sensor	1	3	4
		C2.07 Check accelerator pedal sensor	1	5	6
		C2.07 Diagnose EFI system	1	5	6
	Sub Total Duration		13	41	54
	C3: Maintain CRDI system	C3.01 Check common rail pressure sensor	3	3	6
		C3.02 Check fuel temperature sensor	1	4	5
		C3.03 Check fuel filter water level sensor	1	3	4
		C3.04 Check common rail pressure control valve	1	5	6
		C3.05 Check fuel metering control valve	1	3	4
		C3.06 Check fuel injector	2	6	8
		C3.07 Perform fuel injector coding	1	5	6

	Sub Total Duration		10	29	39
	C4: Service emission control system (Electrical components)	C4.01 Replace canister purge solenoid	2	2	4
		C4.02 Replace EGR valve	2	10	12
		C4.03 Service EGR vacuum modulator	1	4	5
		C4.04 Regenerate diesel particulate filter	2	4	6
		C4.05 Check LNT	3	4	7
	Sub Total Duration		10	24	34
	Total Duration (C)		42	131	173
Grand Total Duration (Hours)			100.5	360.5	461

Annex II: Module Recognition

This is to verify that

Mr/Ms.....

has completed module on

.....

Covering following learning outcomes:

1.
2.
3.

Instructor:

Head of the Department:

.....

.....

Signature:

Signature:

Date: / / (dd/mm/yyyy)
.....(dd/mm/yyyy)

Date: / /

Head of the Institute:

Trained Assessor (Institute)/Exam OC:

.....

.....

Signature:

Signature:

Date: / ... / (dd/mm/yyyy)

Date: / /(dd/mm/yyyy)

Annex IV: Lesson Plan
Lesson Plan

Course Title:		NC Level:
Module Code:		Duration:
Module Title:		
Learning Outcome:		
Skill/Task/Topic:		
Terminal Performance Objective:		
<i>(Note: Write narrative statement extracted from TPO of Task Sheet)</i>		
Enabling Objectives (Related knowledge):		
<i>By the end of the lesson learners will be able to:</i>		
i) ii) iii)		
What (Content/Activity)	Who (T/L)	How (Methods/ Media)
Duration (Min.)	Questions	
Introduction:		
Main body		
Conclusion		
Projects/Problems:		

Instructional Resources Plan				
Skills/Task/Topic:				
No. of Trainees:				
Sl. No.:	Instructional materials/resources	Specifications	Qty.	Remarks
Prepared by :		Signature	Date:	
Revised by:		Signature	Date:	
Approved by:		Signature	Date:	

Task sheet

TS-1/4: Practical Plan

TS-1/4: Practical Plan			
Course Title:		N C Level:	
Module code:		Duration:	
Module Title			
Learning outcome			
Skills/Task Title:		Task no:	
Terminal Performance Objective: <i>Given:</i> <i>Cue:</i> <i>Who:</i> <i>What:</i> <i>Within:</i> <i>How well:</i> - - -			
Enabling Objectives (Related Skills): <i>By the end of a lesson, the learners will be able to:</i> i) ii) iii) iv)			
Activities	Who (T/L)	How (methods/ media)	Duration
Project/Assignment: 			

TS-2/4: Tool and Equipment required:						
Sl no.	Particulars	Specifications	Qty.	Remarks		
Training Materials required:						
Sl no.	Particulars	Specifications	Qty.	Rate	Amount	Remarks
TS-3/4: Performance Guide						
Skill/Task:					Date:	
Directions: Use the following performances criteria to rate the learner. Check YES/NO to indicate whether the learner performed each step as indicated or not?						
Sl. No:	Steps				Yes	No
Note: Critical steps: All * marked steps should be carried out very carefully. For a quality performance guide, all items should be checked "YES"						

TS-4/4: Instruction and Drawing
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General Instructions for Trainees

- i)
- ii)
- iii)
- iv)

Drawing (if any)**Safety Precaution**

- i)
- ii)
- iii)

Prepared by:**Signature****Date:****Revised By:****Signature****Date:****Approved by:****Signature****Date:**

Annex V: Course Plan
Institutes letter head and Logo

(Trade)YEAR PLAN- _____ Semester_____ (Year)

Trade: NC Level:			Schedule																																								Total Hours																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Module Code	Module Title	Learning Outcome	Feb.				March				April				May				June				July				Aug.				Sept				Oct.				Nov.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Prepared by:

Verified & Approved by:

Date:

Monthly/Weekly Plan

Month: Trade: Trainer:

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 01							
Week 02							
Week 03							
Week 04							
Week 05							

Developed by:

Approved by:

Date



For more information please contact:
Technical Trainers Training and Resource Center
Email Id: dwpsd@moesd.gov.bt/tttrd@moesd.gov.bt