



COMPETENCY BASED CURRICULUM AUTO ELECTRICAL BQF CERTIFICATE 2

**Department of Workforce Planning and Skills Development
Ministry of Education and Skills Development**



Course Curriculum
Auto Electrical BQF Certificate 2

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

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Department of Workforce Planning and Skills Development

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FOREWORD

Bhutan has seen a gradual increase in the requirement of skilled workers in recent years due to growth of industries. However, supply of skilled workforce that are responsive to the needs of the industry has not been able to keep in pace with the industry demand. Since the skilled workers are crucial ingredient for socio-economic development of the country, it is important to have adequate number of trained and certified workers. With growing industries, the “Auto Electrician” are not only the most significant occupation but also have high demand in the labour market. In an effort to meet the skilled human resources requirement in the area of Auto Industry, it is imperative to deliver training based on Competency Based Training system in Auto Electrical to ensure quality and adequate number of workforces in this sector.

To this end, 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 2 course developed based on National Competency Standards (NCS) and using standard curriculum development guidelines. Since it is an outcome 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. We believe that the Competency Based Curriculum will help in bridging the skill gap between industry’s needs and training institutes thereby enhance the employability of the technical graduates.

The Department acknowledges the valuable contributions made by institutes, officials, and experts from relevant industries who were involved in the design and development of this curriculum. As it is a dynamic document which may require revision based on the needs of the changing labour market, the Department look forward to receiving valuable feedbacks from the institutes and the industries to further improve and refine the curriculum

The Department hope that this document will help advance Competency Based Learning in most of the TVET Institutions.



(Sangay Dorji)

Offtg. Director

Department of Workforce Planning and Skills Development

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Competency Profile
Trade: Auto Electrical BQF CERTIFICATE 2

Competency Area	Sub- Competency Area	Competencies/Tasks 			
A: Apply fundamentals of electricity	A1: Construct electrical circuits	A1.01 Perform wire crimping	A1.02 Perform wire jointing	A1.03 Perform soldering	A1.04 Construct series circuit
		A1.05 Construct parallel circuits	A1.06 Construct compound circuit		
	A2: Verify AC and DC circuits	A2.01 Verify characteristics of AC and DC circuit	A2.02 Measure IVR	A2.03 Verify Ohm's Law	A2.04 Verify Kirchhoff's current Law
		A2.05 Verify Kirchhoff's voltage law			
	A3: Test basic electronic components	A3.01 Test resistor	A3.02 Test capacitor	A3.03 Test diodes	A3.04 Test transistor
		A3.05 Test thyristor	A3.06 Test fuse	A3.07 Test relays	A3.08 Inspect PCB
B: Maintain Automobile batteries, charging & lighting system	B1: Service lead acid battery	B1.01 Replace battery	B1.02 Test cell voltage	B1.03 Check specific gravity of electrolyte	B1.04 Service battery
		B1.05 Repair battery pole	B1.06 Charge Battery	B1.07 Perform jump start	B1.08 Replace battery sensor
		B1.09 Diagnose battery fault			

	B2: Service charging system	B2.01 Construct charging system circuit	B2.02 Replace alternator	B2.03 Dismantle alternator	B2.04 Service alternator components
		B2.05 Assemble alternator	B2.06 Test alternator	B2.07 Diagnose charging system fault	
	B3: Service lighting system	B3.01 Construct stop/brake lamp circuit	B3.02 Construct reverse lamp circuit	B3.03 Construct fog light circuit	B3.04 Construct side lamp circuit
		B3.05 Construct head lamp circuit	B3.06 Construct turn signal circuit	B3.07 Construct emergency lamp circuit	B3.08 Replace combination switch
		B3.09 Replace headlight motor and lamp	B3.10 Adjust headlight	B3.11 Service wire harness	B3.12 Diagnose lighting system fault
C: Maintain ignition and starting system	C1: Service ignition system	C1.01 Construct ignition circuit	C1.02 Service spark plug	C1.03 Replace ignition coil	C1.04 Replace distributor
		C1.05 Replace ignition control module (ICM)	C1.06 Replace ignition switch	C1.07 Replace cam-shaft position sensor	C1.08 Replace crank-shaft position sensor
		C1.09 Set ignition timing	C1.10 Diagnose ignition system fault		
	C2: Service starting system	C2.01 Construct starter system circuit	C2.02 Replace starter motor	C2.03 Dismantle starter motor	C2.04 Service starter motor components

		C2.05 Assemble starter motor	C2.06 Perform starter motor test	C2.07 Replace starting safety switch (Clutch safety switch)	C2.08 Replace start stop button switch
		C2.09 Diagnose starting system fault			
	C3: Service preheating system	C3.01 Replace glow plug	C3.02 Replace glow plug timer	C3.03 Diagnose preheating system fault	
D: Maintain electrical accessories	D1: Service meter and gauges	D1.01 Service instrument cluster assembly	D1.02 Replace Tire Pressure Monitoring System (TPMS)	D1.03 Service temperature switch	D1.04 Service oil pressure switch
		D1.05 Replace fuel sender unit			
	D2: Service audio visual system	D2.01 Install audio unit	D2.02 Install video unit	D2.03 Install camera	
	D3: Service wiper and washer system	D3.01 Construct wiper motor circuit	D3.02 Service wiper motor	D3.03 Replace wiper arm linkages	D3.04 Replace washer motor
		D3.05 Replace wiper switch	D3.06 Replace rain sensor	D3.07 Diagnose wiper and washer system fault	
	D4: Service Horn	D4.01 Construct horn circuit	D4.02 Replace horn	D4.03 Replace horn switch	D4.04 Replace spiral cable

		D4.05 Install siren	D1.06 Diagnose horn system fault		
	D5: Service power mirror system	D5.01 Replace power mirror motor	D5.02 Replace power mirror switch	D5.03 Diagnose power mirror system fault	
	D6: Service power window system	D6.01 Service power window motor	D6.02 Service power window switch	D6.03 Service power window regulator	D6.04 Diagnose power window system fault
	D7: Service sun roof system	D7.01 Service sun roof motor	D7.02 Service sunroof switch	D7.03 Diagnose sun roof system fault	
	D8: Service power seat system	D8.01 Service power seat motor	D8.02 Service power seat switches	D8.03 Diagnose power seat system fault	
	D9: Service power steering system	D9.01 Service Electric Power Steering (EPS) motor	D9.02 Replace EPS Control Unit	D9.03 Replace EPS sensors	D9.04 Diagnose Electric Power Steering (EPS) system fault

COURSE INFORMATION

COURSE TITLE	Auto Electrical
LEVEL	BQF Certificate (NC) Level 2
COURSE OBJECTIVE	Upon completion of this training program, the trainees will be able to: • Apply fundamentals of electricity; • Maintain automobile batteries, charging and lighting system; • Maintain ignition and starting system; and • Maintain electrical accessories
COURSE DESCRIPTION	This curriculum is designed to provide knowledge, skills and right attitude of an individual to be a competent auto electrician in accordance with industry. This course is based on practical exposure in different areas as required in the real world of work in the industry. Upon completion of the course, graduates will be able to perform basic electrical works such as: applying fundamentals of electricity, maintaining automobile batteries, charging & lighting system, maintaining ignition & starting system and maintaining electrical accessories. In addition, this course will also prepare the graduates to comply with regulatory and organizational requirements for practicing Occupational Health and Safety procedures. This course also includes the soft skills components such as basic computer application, entrepreneurship, numeracy, communication and value education to supplement core competencies and enhance practical skills.
COURSE DURATION	1851 Hours
TRAINER AND TRAINEE RATIO	1:12 (Practical) 1:20 (Theory)
ENTRY REQUIREMENT	• Completed class X
TVET TRAINER REQUIREMENTS	• Must have a minimum qualification of diploma in Mechanical/Automotive Engineering OR NC3 graduate in Auto Electrical with five years of working experience; • Must have undergone Training of Trainers-Technical Instruction and Pedagogy; • Must¹ have at least 5 years job/industry experience

¹ Applicable only if institutes hire instructor or guest lecturer from industry

COURSE OUTLINE

Sl. No	Subject /Module	Duration (Hours)	Content Competencies (Mapped)
1.	Core modules	847	CC
2.	OJT	420	CC
3.	Applied Dzongkha	42	SS
4.	Engineering drawing Module excluding AutoCAD	54	SS
5.	ICT	68	SS
6.	Applied Mathematics	60	SS
7.	Technical English	82	SS
8.	Entrepreneurship	70	SS
9.	Occupational Health and Safety (OHS)	34	ES
10.	Sustainable Consumption and Production (SCP)	36	ES
11.	Professional Ethics	68	PD
12.	Assessment	70	
	Total Course Duration	1851	

Note: (*) This curriculum contains core modules which cover main competencies of Auto Electrical BQF Certificate 2 and OJT component. There are separate curricula for subjects/modules for delivery of academic skills, professional development & values and environmental concern & safety. In order to achieve the qualification of Auto Electrical BQF Certificate 2, 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

COURSE STRUCTURE FOR CORE COMPETENCIES

Training Modality	Module Title	Learning Outcomes	Duration (Hours)
Institute Training	1. Applying fundamentals of electricity	1.01 Construct basic electrical circuits 1.02 Verify DC circuits 1.03 Test basic electronic components	107
	2. Maintaining automobile batteries, charging and lighting system	2.01 Service automobile batteries 2.02 Service charging system 2.03 Service lighting system	239.5
	3. Maintaining lighting and starting system	3.01 Service ignition system 3.02 Service starting system 3.03 Service pre-heating system	220
	4. Maintaining electrical accessories	4.01 Service meter and gauges 4.02 Service audio visual system 4.03 Service wiper and washer system 4.04 Service horn 4.05 Service power mirror system 4.06 Service power window system 4.07 Service sun roof system 4.08 Service power seat system 4.09 Service power steering system	280.5
OJT	1. Maintaining automobile batteries, charging and lighting system	1.01 Service automobile batteries 1.02 Service charging system 1.03 Service lighting system	420
	2. Maintaining lighting and starting system	2.01 Service ignition system 2.02 Service starting system 2.03 Service pre-heating system	
	3. Maintaining electrical accessories	3.01 Service meter and gauges 3.02 Service audio visual system 3.03 Service wiper and washer system 3.04 Service horn 3.05 Service power mirror system 3.06 Service power window system 3.07 Service sun roof system 3.08 Service power seat system 3.09 Service power steering system	

ASSESSMENT AND CERTIFICATION SYSTEM

ASSESSMENT

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. Discussion with problem-based learning
5. Industrial training/attachment
6. Project work

RESOURCES

Materials

- Wires/jumper wires/connectors/probes, battery, battery terminal end, insulation tape, Markin cloth, hydraulic acid, soldering lead & flux, fuse, load, resistors, ignition switch, safety switch, solenoid switch, combination switch, Power mirror motor & switch, lockout switch, diodes, capacitors, distilled water, warm water, water paper, baking soda, petroleum jelly, clamps, alternator, nuts, bolts & thru bolts, sand paper, voltage regulator, stator, rotor, rectifier, slip rings, grease, varnish, bamboo/fiber, petrol, copper coil, rope, crocodile clip, clutch starter motor, starter relay, contact plate, carbon brush & spring, armature, commutator, bush, bearing, wiper motor, wiper blade, wiper arm, wiper linkages, washer motor, safety pin, marker, horn, horn relay, spiral cable, relay, alligator clip, power mirror, wire harness, power lock, power window regulator, push lock connectors, door trim, sunroof motor, EPS motor, ECU, torque sensor and EPS sensors

Tools

- Wire stripper, combination plier, long-nose plier, pliers, poly grip plier, screwdriver set, wire brush/file, soldering stand, fuse puller, crimping tool, socket set, mini-socket set, spanner set, marker, mallet, pulley puller, chisel, centre-punch, Allen key set, soft brush, spark plug socket, de-spanner set, SST, plastic hammer, test lamp and ignition timing light

Equipment

- Soldering iron, power supply, trainer board, battery charger, battery booster charger, charging bench, work bench, wheel wedge, bench vice, hydraulic jack, OBD scan tool and safety stand

Instruments

- Multimeter, hydrometer and Vernier calliper

PPE

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

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 2

MODULE 1
ON
APPLYING FUNDAMENTALS OF ELECTRICITY

MODULE INFORMATION

Occupation	Auto Electrician
Competency Area	Apply fundamentals of electricity
Module Title	Applying fundamentals of electricity
Module Code	7412-L2-M1
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to construct basic electrical circuits, verify AC and DC circuit and test basic electronic components
Nominal Duration	107 Hours
Certificate Level	BQF Certificate Level-2
Pre-requisite	Class X passed
Learning Outcome	1. Construct basic electrical circuits 2. Verify AC and DC circuit 3. Test basic electronic components

Module Title	Applying fundamentals of electricity		
Module Code	7412-L2-M1		
Learning Outcome 1	Construct basic electrical circuits		
Duration	Theory: 10 hours	Practical: 24.5 hours	Total: 34.5 hours
Assessment Criteria	• Wire is crimped as per the standard procedure • Wire jointing is performed as per the standard procedure • Soldering is performed as per the standard procedure • Series circuit is constructed as per the standard procedure • Parallel circuit is constructed as per the standard procedure • Compound circuit is constructed as per the standard procedure		
Content	A1.00 Introductory Knowledge • Introduction to Auto Mobile industry • Trends and scopes of Auto electrician • Introduction to automotive tools, instruments and equipment A1.01 Performing wire crimping Knowledge • Introduction to wire crimping • Types of wire and its application • Wire colour coding • Wire sizes and their applications • Types of terminals and connectors Skills • Using wire stripper • Using combination plier • Using crimping tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.02 Performing wire jointing Knowledge • Definition of wire joint • Types of wire joints • Application of wire joints • Importance of insulation • Types of insulation		

	<i>Skills</i> • Using wire stripper • Using cutting plier • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.02 Performing soldering <i>Knowledge</i> • Definition of soldering • Types of soldering lead and its sizes • Purpose of applying flux • Application of soldering • Purpose of removing the varnish <i>Skills</i> • Using soldering iron • Using PCB holder stand • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.04 Constructing series circuit <i>Knowledge</i> • Definition of circuit • Types of circuit • Characteristic of series circuit • Application of series circuit <i>Skills</i> • Interpreting circuit diagram • Using multimeter
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	• Using test lamp • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Short circuit due to wrong connection A1.05 Constructing parallel circuit <i>Knowledge</i> • Characteristics of parallel circuit • Application of parallel circuit • Differences between parallel and series circuit <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using test lamp • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make proper connection of circuit A1.06 Constructing compound circuit <i>Knowledge</i> • Characteristics of compound circuit • Advantage and disadvantage of compound circuit • Application of compound circuit <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using test lamp • Using circuit tester
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	• Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Short circuit due to wrong connection
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, pencil, notebook, wires, connectors, probes, battery, insulation tape, Markin cloth, soldering lead and soldering flux Tools • Wire stripper, combination plier, long nose plier, screwdriver set, wire brush/file, soldering stand, PCB holder stand, soldering sucker, crimping tool and test lamp Instruments • Multimeter Equipment • Soldering iron and trainer board PPE • Safety boots working dress, safety goggles, mouth mask and safety gloves

Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
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	Applying fundamentals of electricity		
Module Code	7412-L2-M1		
Learning Outcome 2	Verify DC circuits		
Duration	Theory: 12 hours	Practical: 24 hours	Total: 36 hours
Assessment Criteria	• Characteristic of AC and DC source is verified as per standard procedure • IVR is measured as per the standard procedure • Ohm's Law is verified as per the standard procedure • Kirchhoff's current Law is verified as per the standard procedure • Kirchhoff's voltage Law is verified as per the standard procedure		
Content	A2.01 Verifying characteristics of AC and DC circuit Knowledge • Types of electricity • Introduction to AC and DC source • Difference between AC and DC source • Application of AC and DC Skills • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make proper connection of circuit A2.02 Measuring IVR Knowledge • Definition of current, voltage and resistance • Unit and symbol of IVR Skills • Interpreting circuit diagram • Using multimeter • Using ammeter • Using voltmeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity		

	• Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make proper connection of circuit A2.03 Verifying Ohm's law Knowledge • Statement of Ohm's Law • Calculation of Ohm's law • Application of Ohm's Law • Limitations of Ohm's Law Skills • Interpreting circuit diagram • Using multimeter • Using ammeter • Using voltmeter • Numeracy skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make proper connection of circuit A2.04 Verifying Kirchhoff's current law Knowledge • Statement of Kirchhoff's current law • Sign convention of KCL • Calculation related to Kirchhoff's current law • Application of Kirchhoff's current law Skills • Interpreting circuit diagram • Using multimeter • Using ammeter • Numeracy skills • Observation skills
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	- Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensure to make proper connection of circuit 2.05 Verifying Kirchhoff's voltage law <i>Knowledge</i> - Statement of Kirchhoff's voltage law - Sign convention of KVL - Calculation related to Kirchhoff's voltage law - Application of Kirchhoff's voltage law <i>Skills</i> - Interpreting circuit diagram - Using multimeter - Using voltmeter - Numeracy skills - Observation skills - Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensure to make proper connection of circuit
Learning Conditions	Learning Materials - CBLM - Hand-outs - Audio Visuals - Reference books - Manuals Learning Facilities and infrastructure - Classroom with adequate facilities - Information Technology (IT) lab - Library - Workshop

	Materials • Pen, pencil, notebook, wires/probes, insulation tape, batteries, fuse, switch, load and resistors Tools • Pliers, screwdriver set and wire stripper Instrument • Multimeter, ammeter, ohmmeter and voltmeter Equipment • Power supply and trainer board PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
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	Applying basic fundamentals of electricity		
Module Code	7412-L2-M1		
Learning Outcome 3	Test basic electronic components		
Duration	Theory: 18.5 hours	Practical: 18 hours	Total: 36.5 hours
Assessment Criteria	• Resistor is tested as per the standard procedure • Capacitor is tested as per the standard procedure • Diode is tested as per the standard procedure • Transistor is tested as per the standard procedure • Thyristor is tested as per the standard procedure • Fuse is tested as per the standard procedure • Relay is tested as per the standard procedure • PCB is inspected as per the standard procedure		
Content	A3.01 Testing resistor Knowledge • Definition of resistor • Types of resistors • Colour coding of resistors • Calculation of resistance • Application of resistors • Factors affecting resistance Skills • Using multimeter • Using ohmmeter • Observation skills • Numeracy skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.02 Testing capacitor Knowledge • Purpose of capacitor • Unit of capacitance • Specification of capacitor • Types of capacitors and its application • Construction of capacitor • Working principle of capacitor		

	• Importance of discharging capacitor Skills • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.03 Testing diodes Knowledge • Definition of semi-conductor • Types of semi-conductor • Purpose of semi-conductor • Characteristics of semi-conductor • Types of diodes • Characteristics of diode • Structure of p-n junction • Application of diode • Characteristics of Zener diode Skills • Using multimeter • Using ohmmeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.04 Testing transistor Knowledge • Purpose of transistor • Types of transistors • Operation of PNP and NPN transistor in circuit
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	• Characteristics of transistor • Application of transistor <i>Skills</i> • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.05 Testing thyristor <i>Knowledge</i> • Purpose of thyristor • Characteristics of thyristor • Construction of thyristor • Working of thyristor • Application of thyristor <i>Skills</i> • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.06 Testing fuse <i>Knowledge</i> • Purpose of fuse • Types of fuses and its application • Fuse ratings • Causes and symptoms of fuse failure <i>Skills</i> • Using multimeter • Using test lamp
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	• Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to do appropriate amperage selection of fuse A3.07 Testing relays <i>Knowledge</i> • Definition of relay • Purpose of relay • Types of relays • Construction and operation of relay • Application of relay <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.08 Inspecting Printed Circuit Board (PCB) <i>Knowledge</i> • Purpose of PCB • Types of PCB • Application of PCB <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i>
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	• Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, pencil, notebook, Markin cloth, resistors, diodes, capacitors, relay, fuse, wire, terminal, transistor, thyristor, PCB and insulation tape Instrument • Multimeter and relay tester Tool • Fuse puller, wire stripper, test lamp and long nose plier PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
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
MAINTAINING AUTOMOBILE BATTERIES, CHARGING AND LIGHTING
SYSTEM

MODULE INFORMATION

Occupation	Auto Electrician
Competency Area	Maintain automobile batteries, charging and lighting system
Module Title	Maintaining automobile batteries, charging and lighting system
Module Code	7412-L2-M2
Module Description	This module is structured to provide learners the knowledge, skills and right attitude required to service automobile batteries, charging system and lighting system
Nominal Duration	239.5 Hours
Certificate Level	National Certificate Level-2
Pre-requisite	Completed 7412-L2-M1
Learning Outcome	1. Service lead acid batteries 2. Service charging system 3. Service lighting system

Module Title	Maintaining automobile batteries, charging and lighting system		
Module Code	7412-L2-M2		
Learning Outcome 1	Service lead acid batteries		
Duration	Theory: 11 hours	Practical: 27hours	Total: 38 hours
Assessment Criteria	- Battery is replaced as per standard procedure - Cell voltage is tested as per standard procedure - Specific gravity of electrolyte is checked as per the standard procedure - Battery is serviced as per standard procedure - Battery pole is replaced as per the standard procedure - Battery is charged as per standard procedure - Jump start is performed as per standard procedure - Battery sensor is replaced as per standard procedure - Battery fault is diagnosed as per standard procedure		
Content	B1.01 Replacing battery Knowledge - Definition of battery - Function of battery - Types of battery - Purpose of disconnecting the negative terminal prior to positive terminal and vice versa Skills - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to connect the battery as per the battery polarity B1.02 Testing cell voltage Knowledge - Components of battery and its function - Function of battery load tester - Function of refractometer Skills - Using multimeter - Using battery load tester - Using cell tester		

	• Using refractometer • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools, materials and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to connect the battery as per the battery polarity B1.03 Check specific gravity of electrolyte <i>Knowledge</i> • Definition of electrolyte • Function of electrolyte • Process of electrolysis • Specific gravity of electrolyte • Function of hydrometer <i>Skills</i> • Using hydrometer • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools, materials and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to connect the battery as per the battery polarity B1.04 Servicing battery <i>Knowledge</i> • Specification and rating of battery • Symptoms and causes of battery failure • Purpose of cleaning battery • Purpose of using distilled water • Purpose of applying petroleum jelly on battery terminals <i>Skills</i> • Using multimeter • Observation skills
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	- Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools, materials and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste B1.05 Repairing battery pole <i>Knowledge</i> - Construction of battery pole - Size of battery pole - Types of battery pole <i>Skills</i> - Using battery head die - Using multimeter - Observation skills - Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste B1.06 Charging battery <i>Knowledge</i> - Importance of charging battery - Types of battery charger - Methods of charging battery - Effects of overcharging and undercharging of battery - Safety precautions while charging battery - Time and current calculation for charging battery <i>Skills</i> - Using battery charger - Using multimeter - Observation skills - Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity
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	• Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of battery terminals • Ensuring to open the vent caps while charging B1.07 Performing jump start <i>Knowledge</i> • Methods of jump start • Purpose of jump starting a battery • Disadvantage of jump starting • Safety precaution for jump starting <i>Skills</i> • Using battery booster charger • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of jumper cables to battery terminals B1.08 Replacing battery sensor <i>Knowledge</i> • Function of battery sensor • Consequences of defective battery sensor • Introduction to OBD Scan tool <i>Skills</i> • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment
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	• Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B1.07 Diagnosing battery fault Knowledge • Symptoms, causes and remedies of battery failure Skills • Using multimeter • Using hydrometer • Using refractometer • Using battery load tester • Using battery booster • Using OBD scan tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • 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) • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, pencil, notebook, battery, distilled water, warm water, baking soda, battery terminal end, petroleum jelly, emery paper, clamps, nuts & bolts, jumper cable, battery sensor, lead, flux and Markin cloth Tools • Socket set, spanner set, wire brush, combination plier and wheel wedge

	Instruments • Multimeter, refractometer and hydrometer Equipment • Battery charger, battery booster charger, battery load tester, OBD scan tool, soldering iron and work bench PPE • Safety gloves, safety boots, safety goggles, apron, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visits/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
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	Maintaining automobile batteries, charging and lighting system		
Module Code	7412-L2-M2		
Learning Outcome 2	Service charging system		
Duration	Theory: 15.5 hours	Practical: 66.5 hours	Total: 82 hours
Assessment Criteria	- Charging system circuit is constructed as per the circuit diagram following standard procedure - Alternator is replaced as per the standard procedure - Alternator is dismantled as per the standard procedure - Alternator components are serviced as per the standard procedure - Alternator is assembled as per the standard procedure - Alternator is tested as per the job requirement following standard procedure - Charging system fault is diagnosed as per the standard procedure		
Content	B2.01 Constructing charging system circuit Knowledge - Function of charging system - Circuit diagram of charging system - Components of charging system and their functions - Terminal number of alternator Skills - Interpreting circuit diagram - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste B2.02 Replacing alternator Knowledge - Definition of alternator - Function of alternator - Types of alternator - Function of alternator drive belt and pulley - Types of alternator drive belt and pulley - Effect of overtightening or loose drive belt tension Skills - Interpreting circuit diagram		

	• Adjusting drive belt tension • Using drive belt tension gauge • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to tighten the thru bolt to its specific torque B2.03 Dismantling alternator <i>Knowledge</i> • Components of alternator and their functions • Working principle of alternator <i>Skills</i> • Using soldering iron • Using SST (pulley puller) • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.04 Servicing alternator components <i>Knowledge</i> • Working principle of voltage regulator • Working principle of IC regulator • Construction and working principle of rotor and slipping • Construction of stator • Types of stator winding and their advantages • Construction of brush holder • Definition of short, open and ground circuit • Half wave rectification and full wave rectification • DC rectification in the three-phase alternator
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	<i>Skills</i> • Using multimeter • Using soldering iron • Using SST (pulley puller) • Using Vernier calliper • Using magnetic dial gauge • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.05 Assembling alternator <i>Knowledge</i> • Application of alternator • Purpose of Motor Unit/ISG • Difference between alternator and motor unit/Integrated Starter Generator (ISG) <i>Skills</i> • Using multimeter • Using soldering iron • Using SST (pulley puller) • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to assemble the alternator in proper sequence • Ensuring to tighten the nuts & bolts to its specific torque B2.07 Testing alternator <i>Knowledge</i> • Purpose of testing alternator • Methods of testing alternator
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	<i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper circuit connection B2.07 Diagnosing charging system fault <i>Knowledge</i> • Symptoms, causes and remedies of charging system failure <i>Skills</i> • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop

	Materials • Pen, pencil, notebook, battery, alternator, Markin cloth, wires, connectors, terminal, fuse, ignition switch, insulation tape, nuts, bolts & thru bolts, soldering lead, flux, water paper, voltage regulator, carbon brush, stator, rotor, rectifier, slip rings, MP grease, bearing, petrol and crocodile clip Tools • Screwdriver set, pliers, socket set, DE spanner set, ring spanner set, marker, mallet, soldering stand, pulley puller, Allen key set, paint brush, wire brush, long-nose plier, test lamp, locking pin and wire stripper Instruments • Multimeter, dial gauge and Vernier Caliper Equipment • Soldering iron, work bench, OBD scan tool and bench vice PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visits/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
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	Maintaining automobile batteries, charging and lighting system		
Module Code	7412-L2-M2		
Learning Outcome 3	Service lighting system		
Duration	Theory: 19 hours	Practical: 100.5 hours	Total: 119.5 hours
Assessment Criteria	• Stop/brake lamp circuit is constructed as per the circuit diagram following standard procedure • Reverse lamp circuit is constructed as per the circuit diagram following standard procedure • Fog lamp circuit is constructed as per the circuit diagram following standard procedure • Side lamp and head lamp circuit is constructed as per the circuit diagram following standard procedure • Head lamp circuit is constructed as per the circuit diagram following standard procedure • Turn signal circuit is constructed as per the circuit diagram following standard procedure • Emergency lamp circuit is constructed as per the circuit diagram following standard procedure • Combination switch is replaced as per the standard procedure • Headlight motor and lamp is replaced as per the standard procedure • Headlight is adjusted as per the standard procedure • Wire harness is serviced as per the circuit diagram following standard procedure • Lighting system fault is diagnosed as per the standard procedure		
Contents	B3.01 Constructing stop/brake lamp circuit Knowledge • Introduction to automotive lighting system • Types of lighting system • Types of bulbs and its construction • Classification of bulb • Bulb numbering and power rating of bulb • Operation of stop/brake circuit • Purpose of stop/brake lamp • Construction and operation of brake lamp switch Skills • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials		

	• Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper circuit connection B3.02 Constructing reverse lamp circuit <i>Knowledge</i> • Operation of reverse lamp circuit • Purpose of reverse lamp • Construction and operation of reverse lamp switch <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper circuit connection B3.03 Constructing fog light circuit <i>Knowledge</i> • Purpose of fog light • Types of fog light • Types of fog light switches • Construction and operation of fog light switch <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations
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	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper circuit connection B3.04 Constructing side lamp circuit <i>Knowledge</i> • Operation of side lamp circuit • Purpose of side lamp • Construction and operation of side lamp switch <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B3.05 Constructing head lamp circuit <i>Knowledge</i> • Components of head lamp and its function • Types of head lamp • Types of head light bulb • Function of head lamp • Function of head lamp switch and dimmer switch • Function of Daytime Running Light (DRL) • Operation of DRL • Operation of head lamp circuit • Construction and operation of head lamp switch <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant
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	• Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper circuit connection B3.06 Constructing turn signal circuit <i>Knowledge</i> • Purpose of turn signal • Purpose of flasher relay • Types of flasher relay • Terminal number of flasher relay • Operation of flasher relay • Operation of turn signal circuit • Construction and operation of turn signal switch <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper circuit connection B3.07 Constructing emergency/hazard lamp circuit <i>Knowledge</i> • Purpose of emergency lamp • Types of emergency lamp • Operation of emergency lamp circuit • Construction and operation of emergency lamp switch <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment
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	• Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B3.09 Replacing combination switch Knowledge • Function of combination switch • Operation of combination switch • Terminals and colour code of wires Skills • Interpreting circuit diagram • Interpreting wire colour codes • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B3.10 Replacing headlight motor and lamp Knowledge • Purpose and operation of headlamp motor • Operation of headlamp level adjusting switch • Introduction to adaptive front lighting system Skills • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	B3.11 Adjusting headlight <i>Knowledge</i> • Symmetry of headlight • Methods of headlight adjustment • Purpose of adjusting headlight beam • Purpose of Head Up Display (HUD) <i>Skills</i> • Using headlight aligner • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Effective time management • Being a team player • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to adjust the headlamp as per the standard requirement B3.12 Servicing wire harness <i>Knowledge</i> • Definition of wire harness • Purpose of wire harness • Types of connectors and its functions <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring selection of appropriate wire size
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	B3.13 Diagnosing lighting system fault Knowledge • Symptoms, causes and remedies of lighting system failure Skills • Interpreting circuit diagram • Using OBD scan tool • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT Lab • Workshop Materials • Pen, pencil, notebook, wire, insulation tape, emergency switch, brake/stop lamp switch, tail lamp assembly, reverse lamp switch, combination switch, head lamp assembly, single filament & double filament bulbs, bulbs, battery, connector, relay, plug-in bulbs, fuse, instrument panel, wire harness, flasher relay, marker, spiral cable, headlamp motor, headlamp relay, headlight, connectors, Markin cloth, Fog light, fog light switch, zip lock, terminals, DRL bulb, DRL frame/cover, lead, flux, glue, wire shield and heat shrink tube Tools • Socket set, screwdriver set, measuring tape, spanner set, wire puller, allen key set, trox wrench, pliers and glue gun

	Instruments • Multimeter Equipment • Trainer board, OBD scan tool, headlight aligner, soldering iron and heat blower PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Industrial visits/training • Demonstration • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
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
MAINTAINING IGNITION AND STARTING SYSTEM

MODULE INFORMATION

Occupation	Auto Electrician
Competency Area	Maintain ignition and starting system
Module Title	Maintaining ignition and starting system
Module Code	7412-L2-M3
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to service ignition system, starting system and pre-heating system
Nominal Duration	220 Hours
Certificate Level	National Certificate Level 2
Pre-requisite	Completed Module 7412-L2-M2
Learning Outcome	1. Service ignition system 2. Service starting system 3. Service pre-heating system

Module Title	Maintaining ignition and starting system		
Module Code	7412-L2-M3		
Learning Outcome 1	Service ignition system		
Duration	Theory: 24 hours	Practical: 96 hours	Total: 120 hours
Assessment Criteria	- Ignition circuit is constructed as per the circuit diagram following standard procedure - Spark plug is serviced as per the standard procedure - Ignition coil is replaced as per the standard procedure - Distributor is replaced as per the standard procedure - Ignition Control Module is replaced as per the standard procedure - Ignition switch is replaced as per the standard procedure - Cam shaft position sensor is checked and replaced as per the standard procedure - Crank shaft position sensor is tested and replaced as per the standard procedure - Ignition timing is set as per the standard procedure - Ignition system fault is diagnosed as per the standard procedure		
Content	C1.01 Constructing ignition circuit Knowledge - Introduction to ignition system - Types of ignition system - Purpose of ignition system - Components of ignition system and their functions - Operation of ignition system - Difference between low and high-tension circuit Skills - Interpreting circuit diagram - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste C1.02 Servicing spark plug Knowledge - Function of spark plug - Types of spark plug		

	• Construction of spark plug • Working of spark plug • Purpose of spark plug gap • Spark plug defects Skills • Interpreting circuit diagram • Using spark plug gap adjuster • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.03 Replacing ignition coil Knowledge • Function of ignition coil • Types of ignition coil • Construction of ignition coil and ignition coil pack • Operation of ignition coil and ignition coil pack • Purpose of ballast resistor • Purpose of igniter Skills • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.04 Replacing distributor Knowledge • Function of distributor • Types of distributor • Construction and operation of distributor
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	• Function of HT cable • Vacuum advanced unit mechanism • Purpose of Contact Breaker (CB), hall effect sensor and pickup coil sensor • Operation of contact breaker point, hall effect sensor and pickup coil sensor • Effects of different CB point gap and air gap • Purpose of capacitor/condenser Skills • Interpreting circuit diagram • Using multimeter • Using High Voltage tester • Using feeler gauge • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.05 Replacing Ignition Control Module (ICM) Knowledge • Purpose of ICM • Terminals of ICM Skills • Interpreting circuit diagram • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring connection of DLS connectors as per firing order C1.06 Replacing ignition switch Knowledge • Function of ignition switch • Construction and operation of ignition switch
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	• Introduction to smart key unit/keyless entry • Four positions of ignition switch and its purposes • Purpose of immobilizer Skills • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.07 Replacing cam-shaft position sensor Knowledge • Purpose of cam-shaft position sensor • Types of cam-shaft position sensor • Principle of signal generator Skills • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.08 Replacing crank-shaft position sensor Knowledge • Purpose of crank-shaft position sensor • Types of crank-shaft position sensor Skills • Using multimeter • Using OBD scan tool • Observation skills
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	- Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste C1.09 Setting ignition timing <i>Knowledge</i> - Definition of engine - Types of engines - Working process of SI two stroke engine - Working process of SI four stroke engine - Definition of ignition timing - Firing order - Differences between SI and CI engine <i>Skills</i> - Using timing light - Using multimeter - Observation skills - Analytical skills <i>Attitude, safety and environment concern</i> - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to connect HT cable as per firing order C1.10 Diagnosing ignition system fault <i>Knowledge</i> - Symptoms, causes and remedies of ignition system failure <i>Skills</i> - Using timing light - Using multimeter - Using OBD scan tool - Observation skills - Analytical skills <i>Attitude, safety and environment concern</i> - Having work ethics and integrity
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	• Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • 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) • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Ignition switch, fuse, HT cables, low tension lead, ignition coil, ballast resistor, wires, connectors, insulation tape, spark plug, distributor, CB point, ignitor, condenser, rotor knob, water paper, petrol, engine oil, Markin cloth, cam shaft position sensor, crank shaft position sensor, Ignition Control Module and coil pack Tools • Feeler gauge, spark plug socket, combination plier, screwdriver set, socket set, spanner set, test lamp, spark plug gauge, spark plug adjuster, spark plug remover, long nose plier, allen key set, trox wrench and torque wrench Instruments • Multimeter and high voltage tester Equipment • OBD scan tool and timing light PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture

	• Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Maintaining ignition and starting system		
Module Code	7412-L2-M3		
Learning Outcome 2	Service starting system		
Duration	Theory: 12.5 hours	Practical: 69.5 hours	Total: 82 hours
Assessment Criteria	• Starter system circuit diagram is constructed as per circuit diagram following standard procedure • Starter motor is replaced as per the standard procedure • Starter motor is securely dismantled as per the standard procedure • Starter motor components are serviced as per the standard procedure • Starter motor is assembled as per the standard procedure • Starter motor test is performed as per standard procedure • Starting safety switch is replaced as per the standard procedure • Start stop button switch is replaced as per the standard procedure • Starting system fault is diagnosed as per the standard procedure		
Content	C2.01 Constructing starter system circuit diagram Knowledge • Function of starting system • Components of starting system and its functions • Operation of starting system • Starter motor terminals • Difference between wire and cable Skills • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals C2.02 Replacing starter motor Knowledge • Function of starter motor • Types of starter motor • Construction of starter motor • Working principle of starter motor • Fleming's right-hand and left-hand rules		

	Skills • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.03 Dismantling starter motor Knowledge • Components of starter motor and its functions • Starter motor terminals and its purpose Skills • Observation skills • Analytical skills • Planning skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.04 Servicing starter motor components Knowledge • Types of drive unit • Working of overrunning clutch • Construction and operation of armature and commutator • Operation of solenoid switch Skills • Interpreting circuit diagram • Using Vernier calliper • Using multimeter • Using soldering iron • Using armature growler • Observation skills • Analytical skills
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	<i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals C2.05 Assembling starter motor <i>Knowledge</i> • Purpose of applying grease • Importance of insulation <i>Skills</i> • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.06 Test starter motor <i>Knowledge</i> • Definition to starter motor test • Types of test circuit and its functions <i>Skills</i> • Interpreting circuit diagram • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection as per the test circuit diagram
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	C2.07 Replacing starting safety switch (Clutch Safety Switch) Knowledge • Purpose of Clutch safety switch • Operation of clutch safety circuit Skills • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.08 Replace start stop button switch Knowledge • Purpose of push button start system • Relationship between push button switch and immobilizer • Importance of testing push button switch Skills • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.09 Diagnosing starting system fault Knowledge • Symptoms, causes and remedies of starting system failure Skills • Interpreting circuit diagram • Using multimeter • Using Vernier calliper • Numeracy skills
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	• Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Markin cloth, wires, jumper cables, terminals, connectors, crocodile clip, insulation tape, battery, ignition switch, clutch safety switch, starter motor, fuse, starter relay, solenoid switch, push button switch, contact plate, carbon brush & spring, armature, commutator, soldering lead, flux, yoke, fork, overrunning clutch, plunger, bush and bearing Tools • Screwdriver set, combination pliers, long nose pliers, spanner set, test lamp and socket set Instruments • Multimeter, Vernier calliper and feeler gauge Equipment • Bench vice, armature growler, starter motor test bench and soldering iron PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills

	• Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Maintaining ignition and starting system		
Module Code	7412-L2-M3		
Learning Outcome 3	Service preheating system		
Duration	Theory: 4.5 hours	Practical: 13.5 hours	Total: 18 hours
Assessment Criteria	• Glow plug is replaced as per the standard procedure • Glow plug timer is replaced as per the standard procedure • Preheating system is diagnosed as per the standard procedure		
Content	C3.01 Replacing glow plug Knowledge • Purpose of preheating system • Application of preheating system • Purpose of glow plug • Types of glow plug • Construction and operation of glow plug • Method of testing glow plug Skills • Using multimeter • Using glow plug tester • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal of glow plug C3.02 Replacing glow plug timer/control unit Knowledge • Purpose of glow plug timer/control unit • Purpose of preheating warning lamp • Terminal of glow plug timer/control unit Skills • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity		

	• Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C3.03 Diagnosing pre-heating system fault Knowledge • Symptoms, causes and remedies of preheating system failure Skills • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper diagnosis of pre-heating system
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Glow plug timer, glow plug, insulation tape, relays, fuse, wire, jumper wires and battery Tools • Socket set, spanner set, DE/ring spanner set, combination plier, long nose pliers, wire stripper, glow plug socket set, test lamp, allen key set, trox wrench and screwdriver set

	Instruments • Multimeter and glow plug tester Equipment • OBD scan tool PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

MODULE 4
ON
MAINTAINING ELECTRICAL ASSESSORIES

MODULE INFORMATION

Occupation	Auto Electrician
Competency Area	Maintain electrical accessories
Module Title	Maintaining electrical accessories
Module Code	7412-L2-M4
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to service meter & gauges, audio visual system, wiper & washer system, horn, power mirror system, power window system, sun roof system, power seat system and power steering system
Nominal Duration	280.5 Hours
Certificate Level	National Certificate Level 2
Pre-requisite	Completed Module 7412-L2-M3
Learning Outcome	1. Service meter & gauges 2. Service audio visual system 3. Service wiper & washer system 4. Service horn 5. Service power mirror system 6. Service power window system 7. Service sun roof system 8. Service power seat system 9. Service power steering system

Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 1	Service meter and gauges		
Duration	Theory: 10 hours	Practical: 37.5 hours	Total: 47.5 hours
Assessment Criteria	- Instrument panel is serviced as per the standard procedure - Tire Pressure Monitoring Sensor (TPMS) is replaced as per the standard procedure - Temperature switch is serviced as per the standard procedure - Pressure switch is serviced as per standard procedure - Fuel sender unit is serviced as per the standard procedure		
Content	D1.01 Servicing instrument cluster assembly Knowledge - Introduction to instrument cluster assembly - Function of instrument cluster assembly - Types of gauges and its Purpose - Symbol and indicator of the warning light - Types of bulbs used in instrument panel - Function of photo diode sensor - Purpose of remote start climate function Skills - Interpreting circuit diagram - Using OBD scan tool - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste D1.02 Replacing Tire Pressure Monitoring System (TPMS) Knowledge - Function of TPMS - Types of TPMS - Operation of TPMS - Function of TPMS sensor - Advantages and disadvantages of TPMS - Importance of calibrating TPMS Skills - Interpreting circuit diagram		

	• Using OBD scan tools • Using SST • Using tire pressure gauge • Observation skills • Analytical skills <i>Attitude, safety and environment concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal and installation of TPMS D1.03 Servicing coolant temperature switch/sensor <i>Knowledge</i> • Purpose of coolant temperature switch/sensor • Types of temperature gauge • Working principle of temperature switch/sensor • Symptoms, causes and remedies of defective temperature gauge and switch/sensor <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environment concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D1.04 Servicing oil pressure switch <i>Knowledge</i> • Function of oil pressure switch • Working principle of oil pressure switch • Symptoms, causes and remedies of oil pressure gauge and switch failure <i>Skills</i> • Interpreting circuit diagram
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	• Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D1.05 Servicing fuel sender unit <i>Knowledge</i> • Purpose of fuel sender unit • Construction of fuel sender unit • Working principle of fuel sender unit • Symptoms, causes and remedies of fuel sender unit failure <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop

	Materials • Pen, pencil, notebook, instrument panel, instrument panel bulb, insulation tape, coolant temperature switch/sensor, water, fuel sender unit, photo diode sensor and oil pressure switch Tools • Socket set, spanner set, pliers, wire stripper, screwdriver set, allen key set, trox wrench and test lamp Instruments • Multimeter and thermometer Equipment • Water heater and OBD scan tool PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 2	Service audio visual system		
Duration	Theory: 5.5 hours	Practical: 25 hours	Total: 30.5 hours
Assessment Criteria	• Audio unit is installed as per circuit diagram following standard procedure • Video unit is installed as per the circuit diagram following standard procedure • Rear view camera is installed as per the standard procedure		
Content	D2.01 Installing audio unit Knowledge • Introduction to audio unit • Components of audio unit and their function • Features of audio unit • Terminals and connections of audio unit • Function of handsfree microphone • Types of speaker • Construction of speaker and woofer • Operation of speaker and woofer • Purpose of antenna • Types of antenna Skills • Interpreting circuit diagram • Using multimeter • Using soldering iron • ICT skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals • Ensuring proper removal and installation of audio unit D2.02 Installing video unit Knowledge • Features of video unit • Terminals and connections of video unit • Smart phone integration system		

	• Importance of system update Skills • Interpreting circuit diagram • Using multimeter • Using soldering iron • ICT skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of the terminals D2.03 Installing camera Knowledge • Types of camera and its purposes • Purpose of sensors • Terminals and connections of camera unit Skills • Interpreting circuit diagram • Using multimeter • Using portable hand drilling machine • Using circuit tester • Using OBD scan tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of the terminals
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals

	• Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, pencil, notebook, insulation tape, audio unit, video unit, antenna, camera, switches, audio speaker, woofer, drill bits, soldering lead, flux, wires, connectors, screws and washers Tools • Socket set, spanner set, combination pliers, long nose pliers, plastic pry tool, metal scale, wire stripper, screwdriver set and test lamp Instruments • Multimeter Equipment • Portable hand drilling machine and soldering iron PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 3	Service wiper and washer system		
Duration	Theory: 8.5 hours	Practical: 37.5 hours	Total: 46 hours
Assessment Criteria	- Wiper motor circuit is constructed as per the circuit diagram following standard procedure - Wiper motor is serviced as per the standard procedure - Wiper arm linkages are replaced as per the standard procedure - Washer motor is replaced as per the standard procedure - Wiper switch is replaced as per the standard procedure - Rain sensor is replaced as per the standard procedure - Wiper and washer system fault is diagnosed as per the standard procedure		
Content	D3.01 Constructing wiper motor circuit Knowledge - Purpose of wiper system - Components of wiper system and its functions - Types of defrost system - Operation of defrost system - Operation of wiper motor circuit Skills - Interpreting circuit diagram - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring secure connection of the terminals D3.02 Servicing wiper motor Knowledge - Function of wiper motor and pump - Construction and operation of wiper motor Skills - Using multimeter - Observation skills - Analytical skills		

	<i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals D3.03 Replacing wiper arm linkages <i>Knowledge</i> • Function of wiper arm • Function of wiper blade • Function of wiper arm linkages • Mechanism and operation of wiper arm linkages <i>Skills</i> • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.04 Replacing washer motor <i>Knowledge</i> • Function of washer motor • Construction and circuit of washer motor • Operation of washer motor <i>Skills</i> • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	D3.05 Replacing wiper switch Knowledge • Function of wiper switch • Construction and block diagram of wiper switch Skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.06 Replacing rain sensor Knowledge • Purpose of rain sensor • Types of rain sensor and its operation • Pin configuration of rain sensor Skills • Interpreting circuit diagram • Using OBD scan tool • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.06 Diagnosing wiper and washer system fault Knowledge • Symptoms, causes and remedies of wiper and washer system failure Skills • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • ICT skills
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	• Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, pencil, notebook, insulation tape, wiper motor, wiper blade, wiper arm, wiper linkages, washer motor, safety pin, wiper switch, wiper relay, ignition switch, marker, fuse, battery, wires, crocodile clip, rain sensor, Markin cloth, connectors, nuts & bolts, screws and washers Tools • Socket set, spanner set, pliers, plastic hammer, wire stripper, screwdriver set, wiper arm puller and test lamp Instruments • Multimeter Equipment • OBD scan tool PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills

	• Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 4	Service horn		
Duration	Theory: 6.5 hours	Practical: 18 hours	Total: 24.5 hours
Assessment Criteria	- Horn circuit is constructed as per the circuit diagram following standard procedure - Horn is replaced as per the standard procedure - Horn switch is replaced as per the standard procedure - Spiral cable is replaced as per the standard procedure - Siren is installed as per the standard procedure - Horn system fault is diagnosed out as per the standard procedure		
Content	D4.01 Constructing horn circuit Knowledge - Introduction to horn system - Components of horn system - Types of horn circuit Skills - Interpreting circuit diagram - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring secure connection of the terminals D4.02 Replacing horn Knowledge - Purpose of horn - Types of horn - Construction of horn - Working principle of horn - Purpose of using high and low pitch horn - Purpose of horn relay - Relationship between horn and vehicle security system Skills - Interpreting circuit diagram - Using multimeter - Communication skills		

	- Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring secure connection of the terminals D4.03 Replacing horn switch <i>Knowledge</i> - Function of horn switch - Construction of horn switch - Types of horn switch <i>Skills</i> - Interpreting circuit diagram - Using multimeter - Observation skills - Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring secure connection of the terminals D4.04 Replacing spiral cable/clock spring /contact coil <i>Knowledge</i> - Purpose of spiral cable/contact coil/clock spring - Construction and operation of spiral cable/contact coil/clock spring - Safety precautions for replacing spiral cable/ contact coil/clock spring <i>Skills</i> - Interpreting circuit diagram - Spiral cable setting skills - Observation skills - Analytical skills <i>Attitude, safety and environmental concern</i> - Having work ethics and integrity - Being efficient in using materials
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	• Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D4.05 Installing siren <i>Knowledge</i> • Types of siren • Purpose of siren • Circuit diagram of siren <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using portable hand drilling machine • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of the terminals D4.06 Diagnosing horn system fault <i>Knowledge</i> • Symptoms, causes and remedies of horn system failure <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	Ensuring secure connection of the terminals
Learning Conditions	Learning Materials - CBLM - Hand-outs - Audio Visuals - Reference books - Manuals Learning Facilities and infrastructure - Classroom with adequate facilities - Information Technology (IT) lab - Library - Workshop Materials - Pen, pencil, notebook, horn, horn relay, switch, fuse, spiral cable, insulation tape, heat shrink tube, relay, wires, connectors, alligator clip, battery, siren, cable tie, Markin cloth, screws and washers Tools - Socket set, spanner set, pliers, steering puller, wire stripper, Allen key set, trox wrench and screwdriver set Instruments - Multimeter Equipment - Heat shrink gun and OBD scan tools PPE - Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	- Teamwork - Negotiation - Communication skills - Problem solving skills - Analytical skills - Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial training/attachment - Guided practice - Group activity with project-based learning - Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics
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Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 5	Service power mirror system		
Duration	Theory: 3.5 hours	Practical: 13.5 hours	Total: 17 hours
Assessment Criteria	- Power mirror motor is replaced as per the standard procedure - Power mirror switch is replaced as per the standard procedure - Troubleshooting of power mirror system is performed as per the standard procedure		
Content	D5.01 Replacing power mirror motor Knowledge - Purpose of power mirror - Components of power mirror system - Construction and operation of power mirror circuit - Purpose of blind spot monitoring system Skills - Interpreting circuit diagram - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring secure connection of the terminals D5.02 Replacing power mirror switch Knowledge - Purpose of power mirror control switch - Construction and operation of power mirror switch - Purpose of auto folding mirror - Location of power mirror switch and its purpose Skills - Interpreting circuit diagram - Using multimeter - Using OBD scan tool - ICT skills - Communication skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity		

	• Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals D5.03 Diagnosing power mirror system fault Knowledge • Symptoms, causes and remedies of power mirror system failure Skills • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • ICT skills • Observation skills • Communication skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Power mirror, Markin cloth, power mirror motor, power mirror switch, wire harness, insulation tape, fuse, push lock, power mirror relay, connectors, heat shrink tube and battery

	Tools • Screwdriver set, combination pliers, long nose pliers, spanner set, socket set and test lamp Instrument • Multimeter Equipment • OBD scan tool and heat gun PPE • Safety gloves, safety boots, mouth mask and working dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 6	Service power window system		
Duration	Theory: 4 hours	Practical: 18 hours	Total: 22 hours
Assessment Criteria	- Power window motor is serviced as per the standard procedure - Power window switch is serviced as per the standard procedure - Power window regulator is serviced as per the standard procedure - Power window system fault diagnosed is performed as per the standard procedure		
Content	D6.01 Servicing power window motor Knowledge - Components of power window system - Purpose of power window motor - Operation of power window motor - Construction and operation of power window circuit - Difference between one directional and uni-directional motor Skills - Interpreting circuit diagram - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring secure connection of the terminals D6.02 Servicing power window switch Knowledge - Types of power window switch - Purpose of power window switch - Construction and operation of power window switch - Importance of calibrating power window Skills - Interpreting circuit diagram - Using multimeter - Using OBD scan tool - Observation skills - Analytical skills		

	<i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals D6.03 Servicing power window regulator <i>Knowledge</i> • Purpose of power window regulator • Types of power window regulator • Operating mechanism of power window regulator <i>Skills</i> • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals D6.04 Diagnosing power window system fault <i>Knowledge</i> • Symptoms, causes and remedies of power window system failure <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	Ensuring secure connection of the terminals
Learning Conditions	Learning Materials - CBLM - Hand-outs - Audio Visuals - Reference books - Manuals Learning Facilities and infrastructure - Classroom with adequate facilities - Information Technology (IT) lab - Library - Workshop Materials - Power window motor, power window switch, power window relay, power window regulator, water paper, grease, push lock, fuse, battery, connectors, insulation tape, wire harness and door trim Tools - Screwdriver set, combination pliers, long nose pliers, spanner set, socket set and test lamp Instruments - Multimeter Equipment - OBD scan tool PPE - Safety gloves, safety boots, safety goggles, mouth mask and working dress
Underpinning skills	- Teamwork - Negotiation - Communication skills - Problem solving skills - Analytical skills - Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial training/attachment - Guided practice - Group activity with project-based learning - Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics
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Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 7	Service sun roof system		
Duration	Theory:5 hours	Practical: 17 hours	Total: 22 hours
Assessment Criteria	- Sun roof motor is serviced as per the standard procedure - Sun roof switch is serviced as per the standard procedure - Sunroof system fault is diagnosed as per the standard procedures		
Content	D7.01 Servicing sun roof motor Knowledge - Purpose of sunroof system - Components of sun roof system - Operating mechanism of sunroof system - Purpose of sunroof motor - Sunroof switch's terminals and position - Terminals and position of motor connector Skills - Interpreting circuit diagram - Sunroof motor setting skills - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring secure connection of the terminals D7.02 Servicing sunroof switch Knowledge - Function of sunroof switch - Sunroof switch's terminals and position Skills - Interpreting circuit diagram - Using multimeter - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment		

	• Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals D7.03 Diagnosing sun roof system fault Knowledge • Symptoms, causes and remedies of sun roof system failure Skills • Interpreting circuit diagram • Using multimeter • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Sunroof motor, sunroof switch, shutter rack, relay, sunroof glass, sunroof rail, wire harness, fuse, battery, connectors and insulation tape Tools • Screwdriver set, plier, spanner set, socket set, allen key set, trox wrench and test lamp Instruments • Multimeter

	PPE • Safety gloves, safety goggles, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 8	Service power seat system		
Duration	Theory: 5 hours	Practical: 23 hours	Total: 28 hours
Assessment Criteria	- Power seat motor is serviced as per the standard procedure - Power seat switch is serviced as per the standard procedure - Power seat system fault is diagnosed as per the standard procedure		
Content	D8.01 Servicing power seat motor Knowledge - Purpose of power seat - Construction of power seat circuit - Power seat mechanism - Features of power seat system - Purpose of power seat motor Skills - Interpreting circuit diagram - Using multimeter - Using OBD scan tool - Observation skills - Analytical skills Attitude, safety and environmental concern - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and equipment - Being vigilant - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring secure connection of the terminals D8.02 Servicing power seat switches Knowledge - Function of slide motor limit switch - Function of motor limit switch - Function of slide switch - Function of front vertical switch - Function of rear vertical switch - Maintenance of seat rack Skills - Interpreting circuit diagram - Using multimeter - Using OBD scan tool - Observation skills - Analytical skills		

	<i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals D8.03 Diagnosing power seat system fault <i>Knowledge</i> • Symptoms, causes and remedies of power seat system failure <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Using OBD scan tool • Observation skills • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring secure connection of the terminals
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop

	Materials • Pen, pencil, notebook, carbon brush, water paper, power seat motors, power seat switches, power seat rack, relay, wire harness, fuse, battery, connectors, grease, insulation tape, pinion gear, screws and washers Tools • Screwdriver set, plier, spanner set, test lamp, allen key set, trox wrench and socket set Instruments • Multimeter Equipment • OBD scan tool PPE • Safety gloves, safety goggles, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Maintaining electrical accessories		
Module Code	7412-L2-M4		
Learning Outcome 9	Service power steering system		
Duration	Theory: 6.5 hours	Practical: 36.5 hours	Total: 43 hours
Assessment Criteria	• Electric Power Steering (EPS) motor is serviced as per the standard procedure • EPS Control Unit (ECU) is replaced as per the standard procedure • EPS sensors are replaced as per the standard procedure • Power steering system fault is diagnosed as per the standard procedure		
Content	D9.01 Servicing Electric Power Steering (EPS) motor Knowledge • Purpose of EPS system • Types of EPS • Components of EPS and their functions • Operation of EPS • Difference between Electric Power Steering and Hydraulic Power Steering Skills • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D9.02 Replacing EPS Control Unit Knowledge • Purpose of EPS control unit • Terminals of EPS control unit Skills • Interpreting EPS control circuit diagram • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials		

	• Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper polarity connection of ECU terminals D9.03 Replacing EPS sensors Knowledge • EPS sensors and its Purpose • Construction and operation of EPS sensors Skills • Using multimeter • Using OBD scan tool • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to disconnect the terminals properly • Ensuring to tighten screws to its specific torque while installing sensor D9.04 Diagnosing Electric Power Steering (EPS) system fault Knowledge • Symptoms, causes and remedies of EPS failure Skills • Using multimeter • Using OBD scan tool • Observation skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and equipment • Being vigilant • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, pencil, notebook, EPS motor, EPS Control Unit, insulation tape, torque sensor, steering angle sensor, wheel speed sensor, vehicle speed sensor, relay, marker, wire harness, spiral cable, ABS control unit, jumper wires, wire shield, Markin cloth, battery and fuse Tools • Socket set, mini socket set, screwdriver set, spanner set, long nose pliers, allen key set, trox wrench and combination plier Instrument • Multimeter Equipment • Hydraulic jack, wheel wedge, safety stand and OBD scan tool PPE • Safety gloves, safety boots, mouth mask and working dress
Underpinning skills	• Teamwork • Negotiation • Communication skills • Problem solving skills • Analytical skills • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics
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ANNEXES

Annex I: Assessment Sample

Unit of competency	Drive Light Vehicle
Unit Code	8322-U4-L2
Module Title	Driving Light Vehicle
Module Code	8322-U4-L2-M1
Time Duration	45 min *
Problem or Project: Drive Light Vehicle	
Introduction: Perform pre-operating procedures before starting the vehicle. Drive light vehicle under different environment conditions following standard traffic rules and defensive driving techniques. Perform post operating procedures after parking the vehicle.	
Observation: (How will you be assessed as Competent?) Your performance will be assessed based on the following criteria: • Performance of pre and post operating procedures as per standard practices; • Application of standard procedures while starting the LMV; • Demonstrating the driving skills in different road condition using the system of vehicle control (SOVC); • Demonstrating your adherence to RSTA Rules, Defensive Driving; • The final outcome of your driving skills	
Note: For Assessor/Institute for preparation for assessment. Materials and Equipment for 1 candidate • LMV in good running condition with all necessary vehicle documents 2. Roles and responsibilities of assessors (before/during and after assessment) • Identify in advance the different road environment (rough road, town, simulated night and poor light condition, highway) • During assessment let the candidate demonstrate moving off, reversing, overtaking, and parking.	

Assessor/ Observation Check List

Unit of competency	Drive Light Vehicle		
Unit Code	8322-U4-L2		
Module Title	Driving Light Vehicle		
Module Code	8322-U4-L2-M1		
Problem/Project: Drive Light Vehicle	Psychomotor (Practical) domain level: P2		
Candidate's Name:			
Place of Assessment:		Date of Assessment:	
A. During the demonstration of skills did the candidate do following:	Marks allocated	Marks received	Remarks
1. Check mirror settings, fluid level, tire pressure and required documents.	4		
2. Start LMV according to the procedure of standard starting procedure (Cockpit Drill)	2		
3. Move off and steer LMV wearing seat belts and without stalling the engine*	3		
4. Reverse LMV safely without stalling the engine*	3		
5. Park LMV safely in the centre of given parking area following standard parking procedure	2		
6. Drive LMV on the highway according to the road conditions following the road safety signs.	2		
7. Drive LMV in towns according to the traffic signs and signals.	2		
8. Drive LMV on 4WD safely (if necessary and available)	1		
9. Giving pass and overtake the vehicle safely according to the road and weather condition *	3		
10. Stop LMV safely in a given area according to standard stopping procedure	1		
B. Is the job outcome correct in the following areas?			
Caused no accidents and damages to the vehicle. *	5		
Total marks obtained	28		
The Candidate's performance	Satisfactory:		
	Not Satisfactory:		

Note: The questions marked with * are the critical questions which the trainees must be able to answer. Otherwise, they will be rated unsuccessful even if they perform well in the practical exam. The mark **P** is for the psychomotor domain level (P1- Simple Routine Assignment; P2- Questions related to Simple Routine Assignment and P3- Questions not related to Simple Routine Assignment)

Oral Questions checklist:

Unit of competency	Drive Light Vehicle			
Unit Code	8322-U4-L2			
Module Title	Driving Light Vehicle			
Module Code	8322-U4-L2-M1			
Problem/Project: Drive Light Vehicle				
Candidate's Name:				
Place of Assessment:		Date of Assessment:		
Questions (and its domain level) to be answered by the trainee / candidate:	Key Answer	Marks allocated	Marks obtained	Remarks
Why do you keep the vehicle in start mode for a few minutes before moving? (Verifying observations) (C1)				
In case of accidents who will you contact first? (Contingency questions) (C2)				
While entering intersection, before how many seconds do you have to give signal? (Verifying observations) (C3)				
Total Marks Obtained				
The candidate's performance was:		Satisfactory:		
		Not Satisfactory:		
Assessor's Name:		Signature:		

Note: The questions marked with C describes the cognitive level of the questions. C1- Remembering; C2- Purposeful Understanding and C3- Problem Solving.

Written questions checklist:

Unit of competency	Drive Light Vehicle		
Unit Code	8322-U4-L2		
Module Title	Driving Light Vehicle		
Module Code	8322-U4-L2-M1		
Problem/Project: Drive Light Vehicle			
Candidate's Name:			
Place of Assessment:		Date of Assessment:	
Questions (and its domain level) to be answered by the trainee/ candidate:	Key Answer	Marks Allocated	Marks Obtained
1. List down three types of parking. (Short Answer Question) (C1)	Angle, Straight and Parallel Parking	1	
2. All of the following are honking prohibited places EXCEPT: (C2) a. pedestrian crossing c. traffic jam b. public procession d. curves and bends (Multiple Choice Question)	D	2	
3. According to RSTA Regulations how much is the penalty for drunk driving? (C1)	Nu. 1750	1	
4. Match the following signs in column A with the indications in column B. (Matching Type) (C2) Column A 1.  2.  3.  Column B a. Give way b. Restriction End c. Compulsory Ahead d. Pedestrian Prohibited	1-c, 2-a, 3-d	3	
Total marks obtained			
The Candidate's performance was:		Satisfactory:	
		Not Satisfactory:	
Assessor's Name:		Signature:	
The Candidate's overall result:	Competent:		
	Not Yet Competent:		
Feedback to Candidate:			

(Provide feedback to the candidate on how they could improve – especially if they are not competent)		
I am satisfied with the way assessment was conducted: (Please include reasons if not satisfied) Candidate Name: Signature: Date:	YES	NO

Assessor Name:

Signature:

Training Provider:

Date:

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)

Date: / /(dd/mm/yyyy)

Head of the Institute:

Trained Assessor (Institute)/Exam OC:

.....

.....

Signature:

Signature:

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

Date: / /(dd/mm/yyyy)

Annex III: 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
<i>Introduction:</i> <i>Main body</i> <i>Conclusion</i>				
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			
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**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 IV: 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.												
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4													
OJT																																																			
Assessment and Certification																																																			

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 :

Annexure V: Time Distribution					
Auto Electrical BQF Certificate-2					
Module Title	Learning outcomes	Tasks	Theory	Practical	Total (hours)
			(hours)	(hours)	
A: Applying fundamentals of electricity	A1 Construct basic electrical circuits	A1.00 Introductory knowledge	2	0	2
		A1.01 Perform wire crimping	1.5	3	4.5
		A1.02 Perform wire jointing	1	3	4
		A1.03 Perform soldering	1	5	6
		A1.04 Construct series circuit	2	4	6
		A1.05 Construct parallel circuit	1.5	4.5	6
		A1.06 Construct compound circuit	1	5	6
	Sub Total Duration		10	24.5	34.5
	A2 Verify DC circuits	A2.01 Verify characteristics of AC and DC circuit	1	3	4
		A2.02 Measure IVR	2	10	12
		A2.03 Verify Ohm's law	4	4	8
		A2.04 Verify Kirchhoff's current law	3	3	6
		A2.05 Verify Kirchhoff's voltage law	2	4	6
	Sub Total Duration		12	24	36
	A3 Test basic electronic components	A3.01 Test Resistor	4	2	6
		A3.02 Test capacitor	3	3	6
		A3.03 Test diodes	4	6	10
		A3.04 Test transistor	2	2	4
		A3.05 Test thyristor	1	1	2
		A3.06 Replace fuse	1.5	1	2.5
		A3.07 Replace relays	2	2	4
		A3.08 Inspect PCB	1	1	2
	Sub Total Duration		18.5	18	36.5
	Total Duration (A)		40.5	66.5	107
B: Maintaining automobile batteries, charging and lighting system	B1: Service automobile batteries	B1.01 Replace battery	1	4	5
		B1.02 Test cell voltage	1	1	2
		B1.03 Check specific gravity of electrolyte	2	2	4
		B1.03 Service battery	1.5	2	3.5
		B1.05 Repair battery pole	1	3	4
		B1.04 Charge battery	1.5	4.5	6
		B1.05 Perform jump start	1	3	4
		B1.06 Replace battery sensor	1.5	4.5	6
		B1.07 Diagnose battery fault	0.5	3	3.5
	Sub Total Duration		11	27	38
	B2: Service charging system	B2.01 Construct charging system circuit	3	6	9
		B2.02 Replace alternator	1	5	6
		B2.03 Dismantle alternator	2.5	10	12.5
		B2.04 Service alternator components	6	24	30
		B2.05 Assemble alternator	1	11.5	12.5

C: Maintaining ignition and starting system		B2.06 Test alternator	1	6	7
		B2.07 Diagnose charging system fault	1	4	5
	sub-total		15.5	66.5	82
	B3: Service lighting system	B3.01 Construct stop/brake lamp circuit	4	6	10
		B3.02 Construct reverse lamp circuit	1	5	6
		B3.03 Construct fog light circuit	1	5	6
		B3.04 Construct side lamp circuit	0.5	5.5	6
		B3.05 Construct head lamp	3	12	15
		B3.06 Construct turn signal circuit	1	5	6
		B3.07 Construct emergency lamp circuit	0.5	5.5	6
		B3.08 Replace combination switch	1.5	6	7.5
		B3.09 Replace headlight motor and lamp	2	6	8
		B3.10 Adjust headlight	2	10	12
		B3.11 Service wire harness	1.5	28.5	30
		B3.12 Diagnose lighting system	1	6	7
	Sub Total Duration		19	100.5	119.5
	Total Duration (B)		45.5	194	239.5
	C1: Service ignition system	C1.01 Construct ignition circuit	4	8	12
		C1.02 Service spark plug	3	6	9
		C1.03 Replace ignition coil	3	3	6
		C1.04 Replace distributor	3	3	6
		C1.05 Replace ignition control module	2	4	6
		C1.06 Replace ignition switch	2	4	6
		C1.07 Replace cam-shaft position sensor	1	3	4
		C1.08 Replace crank-shaft position sensor	1	4	5
		C1.09 Set ignition timing	4	56	60
		C1.10 Diagnose ignition system fault	1	5	6
	Sub Total Duration		24	96	120
	C2: Service starting system	C2.01 Construct starter system circuit diagram	2	6	8
		C2.02 Replace starter motor	4	8	12
		C2.03 Dismantle starter motor	1.5	12	13.5
		C2.04 Service starter motor components	1	17	18
		C2.05 Assemble starter motor	0.5	5.5	6
		C2.06 Test starter motor	1	11	12

D. Maintaining electrical accessories		C2.07 Replace starting safety switch (Clutch safety switch)	0.5	3	3.5
		C2.08 Replace start stop button switch	1	2	3
		C2.08 Diagnose starting system	1	5	6
	Sub Total		12.5	69.5	82
	C3: Service preheating system	C3.01 Test glow plug	2	4	6
		C3.02 Test glow plug timer	1.5	4.5	6
		C3.03 Diagnose preheating system fault	1	5	6
	Sub Total		4.5	13.5	18
	Total Duration (C)		41	179	220
	D1: Service meter and gauges	D1.01 Service instrument cluster assembly	3	12	15
		D1.02 Replace Tire Pressure Monitoring Sensor (TPMS)	1	5	6
		D1.03 Service coolant temperature switch	2	4	6
		D1.04 Service oil pressure switch	1	4.5	5.5
		D1.05 Replace fuel sender unit	3	12	15
	Sub Total Duration		10	37.5	47.5
	D2: Service audio visual system	D2.01 Install audio unit	3	6	9
		D2.02 Install video unit	1	11	12
		D2.03 install siren	0.5	3	3.5
		D2.04 install rear view camera	1	5	6
	Sub Total Duration		5.5	25	30.5
	D3: service wiper and washer system	D3.01 construct wiper motor circuit	1	5	6
		D3.02 replace wiper motor	1	5	6
		D3.03 Replace wiper arm linkages	2	10	12
		D3.04 Service washer motor	1	3	4
		D3.05 Replace wiper switch	1	5	6
		D3.06 Replace rain sensor	1.5	4.5	6
		D3.07 Diagnose wiper and washer system fault	1	5	6
	Sub Total Duration		8.5	37.5	46
	D4: Service horn	D4.01 construct horn circuit	1	3	4
		D4.02 replace horn	1	2	3
		D4.03 replace horn switch	1.5	6	7.5
		D4.04 replace spiral cable	2	4	6
		D4.05 Diagnose horn system fault	1	3	4
	Sub Total Duration		6.5	18	24.5
	D5: Service power mirror system	D5.01 Replace power mirror motor	1.5	4.5	6
		D5.02 Replace power mirror switch	1	4	5

	D5.03 Diagnose power mirror system fault	1	5	6
Sub Total Duration		3.5	13.5	17
D6: service power window system	D6.01 Service power window motor	1	5	6
	D6.02 service power window switch	1	5	6
	D6.03 Service power window regulator	1	5	6
	D6.04 Diagnose power window system fault	1	3	4
Sub Total Duration		4	18	22
D7: service sun roof system	D7.01 service sun roof motor	3	9	12
	D7.02 Service sunroof switch	1	5	6
	D7.03 Diagnose sun roof system fault	1	3	4
Sub Total Duration		5	17	22
D8: service power seat system	D8.01 Service power seat motor	2	10	12
	D8.02 Service power seat switches	2	10	12
	D8.03 Diagnose power seat system fault	1	3	4
Sub Total Duration		5	23	28
D9: Service power steering system	D9.01 replace EPS motor	3	18	21
	D9.02 replace EPS control unit	0.5	5.5	6
	D9.03 replace EPS sensor	2	10	12
	D9.04 Diagnose power steering system fault	1	3	4
Sub Total Duration		6.5	36.5	43
Total Duration (D)		54.5	226	280.5
Grand Total Duration (hours)		181.5	665.5	847



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