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Norwegian Embassy
Islamabad

AUTOMOBILE ELECTRICIAN

CBT Curriculum

National Vocational Certificate Level 2-3

Version 1 - August 2019

NAVTTC

Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Published by
National Vocational and Technical Training Commission
Government of Pakistan

Headquarter
Plot 38, Kirthar Road, Sector H-9/4, Islamabad, Pakistan
www.navttc.org

Responsible
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Layout & design
SAP Communications

Photo Credits
TVET Sector Support Programme

This document has been produced with the technical assistance of the TVET Sector Support Programme, which is funded by the European Union, the Federal Republic of Germany and the Royal Norwegian Embassy and has been commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in close collaboration with the National Vocational and Technical Training Commission (NAVTTC) as well as provincial Technical Education and Vocational Training Authorities (TEVTAs), Punjab Vocational Training Council (PVTC), Qualification Awarding Bodies (QABs)s and private sector organizations.

Document Version
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Contents

INTRODUCTION

This certificate course is designed for the Automotive Electrician work for the level 2 and 3 as well. The training contains live practical oriented tasks and demonstrative knowledge of the electrical and electronic functions on the vehicle or simulator, health and safety at workplace under specified standards, instructions and communication skills are also delivered to the trainee for the better performance in their upcoming job.

After completion of this Automotive Electrician training program the graduates will be able to understand the electrical and electronics system, diagnose and troubleshoot electrical related problems in the vehicle with good balance of knowledge, skills, and attitude which are the essential elements of employability.

This course is designed by the National Vocational & Technical Training Commission (NAVTTC) with the collaboration of Industry (Dealerships/Workshops) and vocational trainers of different institute in Pakistan to insures current skills requirement and competencies demand for the actual workplace.

Purpose of the training program

The purpose of the training program is to inline the industry (dealerships / local workshops) with the training institutes to fill the gap of learning and performing the actual job, building the strong relationship with the employer for exchanging technology between institutes and organization.

- The learner will achieve hands own learning experience prior to the industry.
- The learner can enhance the skills, knowledge, and attitude after attainment of institute based training while doing the actual job.
- The learner can achieve his desire goals to get employed or earning from the industry.

Competencies to be gained after completion of course

After completion of the course the learner will be able to perform and execute the following tasks.

- Safety at workplace and communication skills as per job requirement.
- Able to troubleshoot electrical and electronic system of the vehicle.
- Able t troubleshoots engine Fuel and emission control system.
- Able to understand and repair vehicle instrument panel, and HVAC system.

- Able to understand and repair vehicle special features like Central locking, power window, power seats, Immobilizer, and SRS system.

The candidate will be opportunist of the following industrial sectors.

1. Automobile repair workshops and dealerships.
2. Automobile assembly plant and automobile vender industry.
3. Power generation sector.
4. Ships and marines engines.

Trainee entry level

The entry level for the automobile electrician certificate course Level-2 is Matric pass / middle with 01 year experience.

Minimum qualification of trainer

The trainer for the course Auto Electrician Level-2 and 3 should be DAE with the relevant experience of 02 years/ B.Tech (HONS) or B.E with the vocational education training background.

Recommended trainer: trainee ratio

The workshop facility is dependent upon the trainee and trainer ratio that might be changed as per actual context, recommended trainees trainer ratio is 20:1.

Medium of instruction i.e. language of instruction

The medium of the instruction is Urdu or local language, the contents for the training is available in English/Urdu.

Duration of the course (Total time, Theory & Practical time)

The course duration for the level-2 is 420 learning hours including training and assessment.

The course duration for the level-3 is 650 learning hours including training and assessment.

Structure of the Training Programmes

For the level-2 qualification, the learning hours are 300 or 30 credits. The qualification has the following competency standards:

- 071600496 Repair HVAC System of Vehicle
- 071600495 Repair Instrument Panels
- 061100560 Maintain Safe Work Environment
- 071300559 Demonstrate Communication Skills

For the Level-3 qualification, the learning hours are 650 or 65 credits. The qualification has the following competency standards:

- 071600497 Repair Chassis Electrical
- 071600494 Repair Electrical Systems of Vehicle
- 071600498 Replace Comfort and Safety Features of Vehicle
- 071600499 Repair Fuel and Emission Control System

OVERVIEW OF THE CURRICULUM

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours
071300559 Module 1: Demonstrate Communication Skills	LU1: Work in Team LU2: Deal with Clients LU3: Demonstrate Basic IT Skills	30 learning hours	Training institute
061100560 Module 2: Maintain Safe Work Environment	LU1: Identify Hazards at Workplace LU2: Observe Occupational Safety and Health (OSH	30 learning hours	Training institute
071600494 Module 3: Repair Electrical System of the vehicle.	LU1: Basic Electricity. LU2: Perform Battery Maintenance. LU3: Repair Charging System. LU4: Repair starting System. LU5: Repair Ignition system. LU6: Engine cooling fan and electrical circuit. LU7: Repair Lightning system.	300 learning hours	Training institute

071600499 Module 4: Repair Fuel and Emission Control System	LU1: Repair petrol system (carburetor and EFI Engine) LU2: Repair Exhaust gas recirculation (EGR) system LU3: Repair CNG System (carburetor and EFI Engine)	150 learning hours	Training institute	
071600496 Module 5: Repair HVAC System of the Vehicle	LU1: Repair heating in HVAC system. LU2: Repair Air conditioning system.	140 learning hours	Training institute	
071600497 Module 6: Repair Chassis Electrical	LU1: Repair Antilock Brake System (ABS) LU2: Repair Electronic power steering. LU3: Repair Auto transmission.	100 learning hours	Training institute	
071600495 Module 7: Repair Instrument panel.	LU1: Basic Electricity and measurement. LU2: replace gauges and bulbs.	100 learning hours	Training institute	
071600498 Module 8: Replace Comfort and Safety Features of Vehicle	LU1: Repair vehicle special features.	100 learning hours	Training institute	

071300559 Module 1: Demonstrate Communication Skill

Objective of the Module: After completing this module student will be able to use appropriate communication skills at workplace.

Duration:	Total hours	30	Theory:	05	Practical	25

L U	Learning Outcomes	Learning Elements	Duration	Material Required	Learning Place
LU1: Working in Team	• Treat team members with respect and maintain positive relationships to achieve common organizational goals • Listen to instructions carefully & comply with those instructions • Provide work related information to team members and identify interrelated work activities to avoid confusion • Adopt communication skills appropriate to work activities and company procedures • Identify problems and resolve them through discussion and mutual agreement	• Definition of Team • Importance and Benefits of working in Team • Role of team members and functionality of the teams • Team dynamics and stages of team development • Negotiation techniques • Conflict resolution strategies **Practical Activity:** 1. Make a team of 5 students; check the wiring of class room and lab. Discuss the problems in team. Make a report for the in-charge Maintenance.	06 Hrs.	Labs , Job Task (Theoretical or Practical Activity), Work Instructions, Equipment	Workshop / elec.lab
LU2: Dealing with Clients	• Collect and confirm work requirements from clients using appropriate communication procedures • Provide clear information to clients about work requirements including costs and time needed to accomplish the task	• Client, Value of Client. • Principles of effective and interactive communication • 7 C's of communication and their importance • Cultural and organizational practices for effective communication • Effective negotiation skills • Conflict resolution strategies • Negotiation techniques	10 Hrs.	Labs , (Group Discussion / Practical Activity by making some students client and others service provider / Electrician), Work Instructions, Equipment if required	class room/workshop/elec lab

	• Negotiate with clients regarding wages, time, labour requirements etc.	• Basic computer skills using MS Word, MS Excel, use of internet, sending and receiving emails etc. • Preparing relevant documents and reports **Practical Activity** 1. Make a team of five members, two of them are service provider and rest three are client. Client requires some wiring in his office. Service provider should discuss about the types of cable, cost and quality. Service provider and client should negotiate on the cost.		Multimedia for display of relevant videos	
LU3: Demonstrating Basic IT Skills	• Create folders and files and learn major commands of operating system/windows • Type text and use major commands such as printing, editing, creating tables, header footer, footnotes, table of contents and page number etc. • Make the document as per work specifications and client's requirement • Generate reports for clients using appropriate computer applications • Use internet for sending/receiving emails and connecting through social or other media	• Basic architecture of computer system • Input / output devices of computer and their functions • Basic computer skills using MS Word, MS Excel, use of internet, sending and receiving emails etc. • Preparing relevant documents and reports **Practical Activities** 1. Client has demanded some electrical work through email from you. Make a Detail invoice for client and send it to him along with your company profile made in Power point, by email as per following instructions. 2. Invoice should be saved in separate folder in your PC for further work. 3. Prepare invoice in excel and word both formats. 4. Send a small presentation (Power Point) of your company along with this invoice.	14Hrs.	Computers, Multimedia , Internet Connection	Computer Lab

061100560 Module 2: Maintain Safe Work Environment

Objective of the Module: After completing this module student will be able to diagnose hazards in electrical works & apply occupational health & safety procedure according to their work plan.

Duration:	**Total hours**	**30**	**Theory:**	**10**	**Practical**	**20**

Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration**	**Material Required**	**Learning Place**
LU1: Identifying Hazards at Workplace	• Read and interpret work processes and procedures correctly to identify risk of hazards at workplace • Recognize engineering processes, tools, equipment and consumable materials that have the potential to cause harm • Identify any potential hazards and take appropriate action to minimize the risk	• Types of hazards that are most likely to cause harm to health and safety • Health and safety precautions • Health and safety signs and symbols • Techniques and methods to identify the risks of hazards at workplace **Practical Activity** 1. Visit Power lab of your institute, identify potential hazards. List PPE available and required to work there.	15Hrs.	PPE , other safety equipment, firefighting equipment, Safety Charts	Class room, Labs / Workshop
LU2: Observing Occupational Safety and Health (OSH)	• Work safely at all times, complying with health and safety precautions, regulations and other relevant guidelines • Identify health and safety hazards in the workplace, so that the potential for personal injury, damage to equipment or the workplace is prevented, and corrective action is taken • Deal with problems which are within your control, and report to	• Dealing with hazards to avoid any accident or injury • Safety reporting procedures and documentation • Use of Personal Protective Equipment • First aid treatment methods including methods of resuscitation • Fire-fighting methods • Safe methods of handling heavy loads **Practical Activities** 1. Demonstrate Fire fighting	15 Hrs	PPE , other safety equipment, firefighting equipment, Safety Charts	Class room, Labs / Workshop

	the safety officer those problems that cannot be resolved • Wear, adjust, and maintain personal protective equipment to ensure correct fit and optimum protection in compliance with company procedures • Keep work area clean and clear of obstructions, and storing tools or equipment, so that the risk for accident or injury is prevented	2. Demonstrate working on 400V live circuit using appropriate PPE. 3. Demonstrate first aid procedure for any victim of electric current			

071600494 Module 3: Repair Electrical Systems of Vehicle

Objective of the Module:

This competency standard is designed to provide skills and knowledge to repair Electrical Systems of Vehicle, in accordance with the manufacturer's Manual. You will be able to diagnose faults related to Electrical System of Vehicle and repair faulty part/s according to set standards.

Duration:	Total hours	300	Theory:	75	Practical	225

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1: Basic Electricity and measurement	• Understand the basic concepts, principals and laws of electricity. • Measure DC and AC current and use different electrical components.	1. Definition/measuring Units of Current, Voltage, Resistance. 2. Basic types and example of DC and AC Current 3. Understand, Resistance and color coding, capacitor and color coding, diode and types, transistors, IC's. 4. Basic Materials and examples of Conductor, Insulator, and semiconductor. 5. Permanent and electromagnetism 6. Ohms Law and related calculations 7. Power Law and related calculations.	50 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables,	Training Institute and workshop

		8. Understand Vehicle Service Manual specification and readings. 9. Types of Circuits Open, Close, and Short with their examples in a vehicle. **Practical Activities** 1. Use of Multimeter (Voltage, Amperes, Ohm, capacitance, Continuity) ranges. 2. Making Solenoid (Electromagnet) 3. Identify the Solenoids in the vehicle such as Fuel Injector, Starter motor, AC Clutch, Relay, CNG solenoid, door solenoid. 4. Identify Electromagnets in the vehicle such as Alternator, Ignition Coil, and Motors. 5. Perform voltage measurement of battery and know the state of charge. 6. Perform Current Measurement of electric appliance on the vehicle. 7. Perform resistant measurement of electric appliance and relate with service manual. 8. Joint two wires and insulate properly. 9. Select appropriate wire gauge in different loads.			

LU2: Perform Battery Maintenance	• Inspect the Battery to find any leakage or damages. • Perform Volt Meter Test with appropriate tool and diagnose faults in voltages, if any. • Perform Hydrometer Test to check gravity of battery and diagnose faults, if any. • Perform Load Test to check the load performance of battery and diagnose faults, if any. • Check the battery indicator (magic eye) for the condition of battery electrolyte and diagnose faults, if any. • Refill the battery with electrolyte according to standard level. • Clean the corroded terminals and poles according to set standard. • Charge the battery with charger according to set standards. • Replace the battery in case of damage or irreparable leakage.	1. Lead Acid battery and internal components, proportion of water to acid. 2. Types of batteries. 3. Ampere hour rating, battery cells. 4. Battery Terminals, corroded/lose connections. 5. Reason of short circuits and catch fire due to wrong battery installation. 6. Un- insulated wires hazards. **Practical Activities** 1. Safe removal and installation of Battery from the vehicle. 2. Identify, Inspect and service the Battery terminals. Secure the battery with bracket on the vehicle. Hydrometer test, Inspect and top-up battery water. 3. Inspect and change the Ground (Earth) cable from the vehicle body. 4. Test battery performance using load tester/battery tester. 5. Use external charger to charge the battery.	40 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables,	Training Institute and workshop
LU3: Repair Charging System	• Inspect the charging system light, abnormal noise, and conditions of drive belt to diagnose faults, if any.	1. Understand Purpose and function of Alternator parts (Rotor, stator windings,	50 learning hours	Vehicle or simulator, Tools trolley, Test lamp,	Training Institute and workshop

	• Check amperes with Digital Multi Meter (DMM) and compare it with set standards and diagnose faults, if any. • Inspect physically and repair/ replace wiring harness of charging system in case of any fault. • Adjust or replace Drive Belt according to manufacturer specifications. • Replace faulty Alternator according to set standards.	Voltage regulator, Rectifier Bridge Internal cooling fan, Bearings, mounting/adjustment bolts). 2. Drive Belt and pulleys ratio. 3. Alternator input, and output identification. **Practical Activities** 1. Inspect battery warning light (battery charging indicator) in instrument panel. 2. Test output voltage of alternator using MULTIMETER under the correct specification. 3. Identify hazards of short circuit during removal and installation of alternator. 4. Adjustment/replacement of Alternator belt (Fan belt) under the specification. 5. Use Test lamp/Multimeter to identify input voltage, fuse relating to charging system. 6. Replace/service wire harness and connectors and identify alternator connections. 7. Safe procedure to replace the alternator.		Multimeter, battery, wires, load, and consumables,	
LU4: Repair Starting System	• Check battery condition with appropriate tools and diagnose faults, if any.	1. Main purpose of starting system. 2. Components of starting system, ignition switch, battery, fuse, relay, starting	40 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter,	Training Institute and workshop

	• Check starter motor for loose, corroded or broken connections or grinding noise during start, if any. • Check solenoid relay and fuses with appropriate tools and replace faulty parts, if any. • Check slipping/damage teeth of pinion and fly wheel and replace faulty part/s, if any. • Replace/repair faulty Starter Motor, if required.	solenoid, starting motor, pinion, ring gear. 3. Ratio pinion to ring gear, Starting Motor RPM, engine RPM during cranking. 4. Consuming battery Ampere/Cold Cranking Ampere of battery. 5. Pull in winding, hold in winding, over running clutch. **Practical Activities** 1. Carry out voltage drop test. 2. Carryout safe procedure of Service / replace the starter motor main wire. 3. Use Test lamp/Multimeter to test voltage from ignition switch. 4. Carryout safe procedure to replace the starter motor from the vehicle. 5. Disassembly/Assembly of starter motor and perform bench testing.		battery, wires, load, and consumables,	
LU5: Repair Ignition System	• Check the headlights at high/ low beam, tail lights and replace faulty parts, if any. • Check reverse lights and reverse gear switch and replace in case of any fault. • Check fog lights and replace in case of any fault.	1. Function of Ignition system. 2. Component of ignition system, Ignition coil, Ignition switch, Spark plug, Distributer. 3. Primary and secondary voltages of ignition system.	50 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables,	Training Institute and workshop

	• Check roof and reading lights and replace in case of any fault. • Check break switch to verify flow of power supply and replace faulty part/s, if any. • Check turn signals (indicators) to verify flow of power supply and replace faulty part/s, if any. • Check parking/ instrument panel light bulbs and replace in case of any fault. • Check combination switch and replace damaged/faulty parts, if any.	4. Reason of weak spark. 5. Purpose of advance ignition timing. 6. Vacuum/centrifugal advance mechanism in distributer. 7. Types of ignition system, CDI, Computerized (Distributer less) advance mechanism, crank sensor, and trigger wheel. **Practical Activities** 1. Carryout safe procedure to test spark occur from high tension cables. 2. Removal and refitting of spark plug cables according to the firing order. 3. Test Spark plug cable resistance using Multimeter under specified reading. 4. Replace/Service spark plugs and maintain air gap under specification. 5. Replace the distributer under specified procedure (adjust Ignition timing) 6. Use timing gun and Inspect/ adjust spark advance mechanism manually while engine running. 7. Replace/Service C.B point gap, Test condenser 8. Inspect/Service the distributer cap,			

		rotor, and tight plug cables. 9. Carryout safe procedure to Inspect/Replace ignition coil. 10. Use test lamp/Multimeter to test ignition related fuses. 11. Use test lamp/Multimeter to Inspect ground (Earth) or broken wire on primary circuit. 12. Use scanner to diagnose ignition system and replace/service faulty sensor, wire harness/connector under specified procedure.			
LU6: Engine Cooling Fan and Electrical Circuit	• Carry out inspection of operation of cooling fan and repair the faults, if any. • Carry out inspection of Water Temperature Gauge, and Sensor/ Switch and replace faulty parts, if any. • Carry out inspection of cooling fan relay, fuse, and replace faulty parts, if any. • Carry out inspection of wiring harness and repair/ replace faulty part/s, if any.	1. Function of engine cooling system, and operating temperature. 2. Main components of engine cooling and heating system, Thermostat, Radiator, Fan, hoses, Relay, Fan switch, Temperature sender, ECT Sensor, heater core, blower, and fuse. 3. Thermostat operation, coolant/antifreeze. **Practical Activities** 1. Inspect/replace radiator fan under correct specification. 2. Inspect radiator pressure cap.	30 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables,	Training Institute and workshop

		3. Carryout safe procedure to Inspect/replace temperature sender. 4. Inspect/replace Engine coolant temperature (ECT) Sensor using Scanner. 5. Inspect/ replace wiring harness/Connector. 6. Inspect/Replace Fan relay under correct specification. 7. Inspect/Replace oil warning switch.			
LU7: Repair Lightning System	• Check the headlights at high/ low beam, tail lights and replace faulty parts, if any. • Check reverse lights and reverse gear switch and replace in case of any fault. • Check fog lights and replace in case of any fault. • Check roof and reading lights and replace in case of any fault. • Check break switch to verify flow of power supply and replace faulty part/s, if any. • Check turn signals (indicators) to verify flow of power supply and replace faulty part/s, if any. • Check parking/ instrument panel	1. Function/Types of lightning system. 2. Main components of vehicle lightning system, Combination switch, parking light, headlight, indicator light, reverse light, brake light, fog light, hazard light, trunk light, and dome (Roof) light. 3. Tungsten Halogen bulb, single and double filament bulb. **Practical Activities** 1. Illustrate fuse box Interior/Exterior, Inspect and replace fuse as per service manual. 2. Inspect/Replace head beam relay under specified method. 3. Inspect/Replace flasher under specified method. 4. Inspect connector under specified	40 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables,	Training Institute and workshop

	light bulbs and replace in case of any fault. • Check combination switch and replace damaged/faulty parts, if any.	method by using test lamp/Multimeter 5. Inspect/Replace head lamp, parking bulb, indicator bulb, back light bulb, reverse light bulb.			

071600499 Module 4: Repair Fuel and Emission Control System

Objective of the Module:

This competency standard is developed to provide skills and knowledge to repair the Fuel and Emission Control System in accordance with the manufacturer's Repair Manual. You will be able to diagnose and repair the Fuel and Emission Control System.

Duration:	**Total hours**	**150**	**Theory:**	**40**	**Practical**	**110**

Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration**	**Materials (Tools & Equipment) Required**	**Learning Place**
LU1: Repair Petrol System (Carburetor and EFI Engine)	• Check EFI system with the help of scanner to diagnose faults, if any • Check Fuel Pump pressure with the help of fuel pressure tester to verify the appropriate functioning and replace the faulty Fuel Pump as per given standards • Check Fuel Injector Resistance with the help of multi-meter to ensure standard operation and replace the faulty Fuel Injector as per given standards • Replace clogged/ contaminated Fuel Filter, if any	1. Function and main components of Fuel System, Fuel pump, Fuel Sender, Fuel lines, Fuel filter, Evaporative control system (Charcoal Canister), Carburetor, Fuel rail, Injector, and Pressure regulator. 2. Petrol octane number, volatility, and insulator property. 3. Difference/ between carburetor and EFI engines. 4. EURO standards and benefits. 5. Understand difference between switch, sender, sensor, and actuators. **Practical Activities** 1. Carryout fuel supply test on fuel lines.	70 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables, fuel pressure tester.	Training Institute and workshop

		2. Inspect/Replace fuel pump, fuel sender, fuel filter, and fuel lines under specified procedure. 3. Inspect/Adjust carburetor for correct air fuel ratio under specified procedure. 4. Identify EFI engine and sensors, Intake Air temperature (IAT), mass Air flow (MAF), manifold absolute pressure sensor (MAP), Throttle position (TPS) sensor, Engine Coolant temperature (ECT) Sensor, Knock, Crank Position (CKP), Cam Position (CYP), Oxygen (Air fuel ratio) sensor. 5. Identify EFI Engine and actuators, Injectors, Idle Air control (IAC) valve, Malfunctioning indicating light, Ignition Coil, Radiator Fan, EGR, Evaporative control system, electronic throttle motor V.Tech, VVTI actuators. 6. Identify ECU, diagnostic connector, and EFI Fuses in fuse box and Mal functioning (Check Engine) light. 7. Visually Inspect for broken wire, damaged connector, and change wire harness/connector under specified method. 8. Test resistance of fuel injectors under specified method. 9. Test fuel pressure using pressure tester. 10. Use Scanner and diagnose sensors,			

		and actuators under specified method. 11. Service/Replace Crank sensor, ECT, MAF, MAP, Idle control valve, TPS, oxygen sensor, under specified procedure. 12. Service/replace Oxygen sensor under specified method. 13. Inspect/Repair wiring harness/connector under specified method.			
LU2: Repair Exhaust Gas Recirculation (EGR) System	• Identify the type of EGR value of your vehicle and remove fault, if any. • Check Oxygen sensor with the help of scanner and replace in case of any fault. • Check Wiring Harness and repair/ replace faulty wire as per set standards. • Check and service EGR System in case of any contamination or clog as per set standards.	1. Purpose and operation of EGR. 2. Main components of EGR, EGR Valve, Gasket, Actuator, vacuum **Practical Activities** 1. Remove/refit the EGR Valve under specified procedure. 2. Inspect/service EGR under specified method. 3. Repair/replace wire harness/connector under specified method.	20 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables, pressure tester.	Training Institute and workshop
LU3: Repair CNG System (carburetor and EFI Engine)	• Diagnose fault in CNG system of the vehicle as per manufacturer's instructions. • Repair CNG System under manufacturer standards.	1. CNG exploration, High Pressure conversion, safety regulations when using CNG Cylinder. 2. Main components of CNG systems, Cylinder, Main safety valve, Filler nozzle, CNG Kit, Pressure Gauge, Pressure sensor, electronic Change over switch, CNG solenoid valve,	60 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables,.	Training Institute and workshop

		Mixture adjustment screw, CNG setting screw, and Cooling lines on CNG Kit. 3. EFI CNG components, CNG Advancer, Mixture Actuator. **Practical Activities** 1. Carryout visual inspection, wires/connectors of CNG Coils under specified procedure. 2. Use test lamp/Multimeter to Inspect current and Ground (Earth) on wires. 3. Inspect/replace CNG Coil under specified procedure. 4. Inspect/replace the CNG Changeover switch and wiring harness/connector. 5. Adjust CNG setting on low and high speed			

071600496 Module 5: Repair HVAC System of the Vehicle

Objective of the Module:

This competency standard is designed to provide skills and knowledge to repair electrical systems at chases of vehicle by Auto Electrician, in accordance with the manufacturer's Manual. You will be able to perform inspection and diagnose faults of Electrical Circuits used in chassis of vehicle and perform road test to verify a performance of the vehicle.

Duration:	**Total hours**	**180**	**Theory:**	**60**	**Practical**	**120**

Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration**	**Materials (Tools & Equipment) Required**	**Learning Place**
LU1: Repair Heating in HVAC System	• Check hoses connection and water circulation in HVAC heating system and repair any loose connection or replace damaged parts. • Check for any leakage or blockage and replace faulty parts, if any. • Check dumper and repair faulty parts to ensure stable operation of heating core. • Carry out inspection of blower motor and replace in case of any fault/s or irregularity.	1. Function and main components of heating passenger room, Heater core, hoses, heater control valve, blower, duct, Air grill, thermostat **Practical Activities** 1. Service/replace heater control valve under specified procedure. 2. Replace thermostat and check for any leakage under specified procedure. 3. Service/replace heater core and check for any leakage under specified procedure. 4. Replace heater hoses and check for any leakage. 5. Identify/test fuse of blower in fuse box by test lamp/Multimeter.	50 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables	Training Institute and workshop

		6. Service/replace blower motor under specified procedure.			
LU2: Repair Air Conditioning System	• Inspect switches, relays, fuses and wiring circuit and repair/ replace faulty part/s, if any. • Inspect Air Conditioning System visually and replace manually damaged or leaking part/s, if any. • Use the AC Recycling Machine to check the refrigerant pressure in system and refill it with new refrigerant as per set standards. • Detect any abnormal noise from compressor and replace faulty part/s, if any. • Monitor Air Flow in the system and repair/ replace clogged or damaged part/s, if any.	Function and main components of AC system, Compressor, Compressor clutch, high pressure line, low pressure line, dryer (Filter), condenser, evaporator, thermostat switch, AC pressure switch, thermal protection switch. **Practical Activities** 1. Troubleshoot AC compressor clutch under specified method. 2. Inspect/adjust compressor belt tension under specified procedure. 3. Test gas pressure under specified procedure. 4. Recycle/Charge the gas as per specified pressure. 5. Replace/service AC compressor under specified procedure. 6. Replace/service AC condenser, Evaporator, and expansion valve under specified procedure.	90 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables, gas charger, pressure tester.	Training Institute and workshop

071600497 Module 6: Repair Chasses Electrical

Objective of the Module:

This competency standard is designed to provide skills and knowledge to repair electrical systems at chases of vehicle by Auto Electrician, in accordance with the manufacturer's Manual. You will be able to perform inspection and diagnose faults of Electrical Circuits used in chassis of vehicle and perform road test to verify a performance of the vehicle.

Duration:	**Total hours**	**100**	**Theory:**	**25**	**Practical**	**75**

Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration**	**Materials (Tools & Equipment) Required**	**Learning Place**
LU1: Repair Antilock Brake System (ABS)	• Identify faults of Electronic Brake System using Scanner. • Inspect continuity of electricity in wire harness and diagnose faults, if any. • Identify faulty components of Brake System (sensors, modulator etc.) to identify faults, if any. • Check Brake Indicator Switches to identify faults. Repair/ replace damaged wire harness according to set standards. • Replace faulty components of Brake System (sensors, modulator etc.) according to SOPs. • Perform road test to ensure the	1. Function and main component of ABS system, Sensors, trigger wheel, modular (ABS Actuator), brake lines. 2. Terminologies, Skidding, traction, stability, balance braking. **Practical Activities** 1. Check ABS Malfunctioning light and connect the scanner to diagnose the fault. 2. Inspect/Service wheel sensor under specified procedure. 3. Repair/replace wiring. harness/connector under specified method. 4. Inspect/Replace ABS Actuator under specified method.	40 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables	Training Institute and workshop

	proper working of Electronic Brake System.				
LU2: Repair Electric Power Steering	• Diagnose faults in EPS with the help of scanner and remove code, if any. • Check and replace faulty fuse, relay and control module, if required. • Check the motor of power steering (EPS) and replace faulty parts, if any. • Check wiring harness to find cuts or damages and repair/ replace, if required.	1. Function and main components of EPS, Power Motor, torque Sensor, fail safe. 2. Function of power steering. **Practical Activities** 3. Check EPS Malfunctioning light and connect the scanner to diagnose the fault. 4. Replace EPS motor and torque sensor under specified method.	20 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables	Training Institute and workshop
LU3: Repair Automatic Transmission	• Carry out road test at different speeds for smooth operations of torque converter and gear shifting according to manufacturer standard • Check electrical controls and Hydraulic Pressure of automatic transmission for faults if any • Check automatic transmission mounts for faults if any • Check automatic transmission solenoid by using electronic scanner and identify faults if any • Carryout vehicle road test of automatic transmission for engagement and	1. Main components of Auto transmission, Gear mod selector lever, Gear selector switch, Torque converter, ATF (Automatic Transmission Fluid), Oil Cooler, sensors. 2. Types of Automatic gears, CVT, Planetary gear system, **Practical Activities** 1. Check Automatic transmission Malfunctioning light and connect the scanner to diagnose the fault. 2. Adjust/service gear selector switch under the specified method. 3. Inspect /service shift solenoid under specified procedure 4. Inspect/replace neutral safety switch. 5. Inspect/replace Vehicle speed sensor (VSS)	40 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables	Training Institute and workshop
	disengagement, abnormal noise and vibrations if any				

071600495 Module 7: Repair Instrument Panel

Objective of the Module:

This competency standard is designed to provide skills and knowledge related to repairing of Instrument Panel of Vehicle by Auto Electrician, in accordance with the Manufacturer's Manual. You will be able to repair faulty part/s of Instrument Panel according to set standards.

Duration:	**Total hours**	**180**	**Theory:**	**60**	**Practical**	**120**

Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration**	**Materials (Tools & Equipment) Required**	**Learning Place**
LU1 Basic Electricity and measurement	• Understand the basic concepts, principals and laws of electricity. • Measure DC and AC current and use different electrical components.	10. Definition/measuring Units of Current, Voltage, Resistance. 11. Basic types and example of DC and AC Current 12. Understand, Resistance and color coding, capacitor and color coding, diode and types, transistors, IC's. 13. Basic Materials and examples of Conductor, Insulator, and semiconductor. 14. Permanent and electromagnetism 15. Ohms Law and related calculations 16. Power Law and related calculations.	50 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables,	Training Institute and workshop

		17. Understand Vehicle Service Manual specification and readings. 18. Types of Circuits Open, Close, and Short with their examples in a vehicle. **Practical Activities** 1. Use of Multimeter (Voltage, Amperes, Ohm, capacitance, Continuity) ranges. 2. Making Solenoid (Electromagnet) 3. Identify the Solenoids in the vehicle such as Fuel Injector, Starter motor, AC Clutch, Relay, CNG solenoid, door solenoid. 4. Identify Electromagnets in the vehicle such as Alternator, Ignition Coil, and Motors. 5. Perform voltage measurement of battery and know the state of charge. 6. Perform Current Measurement of electric appliance on the vehicle. 7. Perform resistant measurement of electric appliance and relate with service manual. 8. Joint two wires and insulate properly. Select appropriate wire gauge in different loads.			

LU2: Replace Gauges and Bulbs	• Check instrument panel visually to find any abnormality in gauges. • Verify the abnormal current flow or bad connection of gauges with the help of Scanners and Multimeter. • Repair/ replace wiring harness or faulty parts, if any. • Check Instrument Panel visually to find any abnormality in sensors • Verify the abnormal current flow or bad connection of sensors with the help of scanners and Multimeter • Repair/ replace wiring harness or faulty parts, if any	1. Function and main components of vehicle information system. Warning lights, malfunctioning indicating lights, meter, gauges, panel fuse, and wiring harness. **Practical Activities** 1. Inspect instrument panel using scanner/multimeter. 2. Inspect/replace warning light bulb under specified procedure. 3. Replace speedometer cable under specified procedure.	50 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables.	Training Institute and workshop

071600498 Module 8: Replace Comfort and Safety Features of Vehicle

Objective of the Module:

This competency standard is designed to provide skills and knowledge to repair system for Comfort and Safety Features of Vehicle by Auto Electrician, in accordance with the manufacturer's Manual. You will be able to diagnose faults and perform repairing according to SOPs.

Duration:	**Total hours:**	**100**	**Theory:**	**25**	**Practical:**	**75**

Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration**	**Materials (Tools & Equipment) Required**	**Learning Place**
LU1: Repair Vehicle Special Features	• Check the functionality of fuses, relays, switches and replace faulty parts, if any. • Check power window motor and observe any abnormal sound from doors and repair faulty parts if any • Check visually cable/ gear driven regulators for any damage/s and replace faulty part/s, if any. • Observe any abnormal sound during opening/ closing operation of Sun Roof and fix it according to manufacturer specifications • Check channel / track condition and service dirty parts, if any. • Find the failure with the help of Scanner and fix the problem according to set standards.	1. Function and main parts of power window system, Switch, Relay, power motor, glass machine, electronic module. 2. Function and main parts of Central locking, door solenoid, device, fuses, jerk sensor, remote. 3. Function and main parts of immobilizer system, programmed key, 4. Function and main parts of wiper and washer system. 5. Function and main parts of sun roof system. 6. Function and main parts of SRS system. 7. Function and main parts of Cruise control system.	100 learning hours	Vehicle or simulator, Tools trolley, Test lamp, Multimeter, battery, wires, load, and consumables.	Training Institute and workshop

	• Check the condition of receiver key and replace, if required. • Check the battery of remote with the help of Multimeter and replace faulty parts, if required. • Check fuse module and wiring circuit current flow and repair faulty parts, if required. • Check Supplemental Restraint System (SRS) using Scanner • Identify faulty components of Supplemental Restraint System (SRS) (Spiral Cable, Seat belt, SRS unit, Control Module, Sensor etc.) and replace faulty parts, if any. • Inspect continuity of electricity in wire harness and repair/ replace faulty harness, if required • Check the Cruise Control System and diagnose fault with the help of Scanner, if any • Check continuity of Spiral Cable, Cruise Switch, Brake Light Switch, Fuse and Module with the help of Digital Multimeter (DMM) and replace faults if any. • Check wiring harness circuit, and repair/replace faulty harness, if required. • Checks lose wiper system, electrical/wiper motor connection and secure relevant connections. • Check and tighten disengaged or loose wiper motor linkage or replace	8. Function and main parts of Power seats. 9. Function and main parts of Power Mirrors **Practical Activities** 1. Inspect/replace Power window motor and master switch, Door solenoid and remote control, power mirrors and control system, wiper motor, washer motor, and power seats master switch. 2. Connect Scanner and diagnose, Supplemental restraint system (SRS), Immobilizer, Cruise control system.			

	with new linkage fixings, if required. • Check relay/ wiper motor and multi switch; renew relay motor; replace to confirm fault; and renew relay, wiper motor, multi switch. • Check the washer fluid reservoir for dirt / leakage and clean it well inside, if required. • Look for cracks, leaks in the plastic or rubber hoses connected to the washer reservoir. Replace any faulty hoses, if any. • Unclog dirt from nozzles, hoses or screens and service these using a long pin or fine wire to pick out or poke through clogged dirt, if required. • Check operation of the seat in each direction of movement to verify the functionality of seats. • Inspect the fuse, wiring and remove/ replace faulty part/s, if any. • Inspect the power seat switches and remove/ replace the switch if faulty. • Check motor condition to ensure that the motor is not clogged with debris and replace faulty part/s, if any. • Check the fuse, relay and wiring circuit in case of no or low sound and replace faulty part/s, if any. • Check movements of mirrors in different directions to inspect the functionality of power mirrors.				

LIST OF TOOLS, MACHINERY & EQUIPMENT

S.No.	Description
1.	A/C Gas Manifold Gauge Set
2.	A/C Gas Recycling Machine
3.	A/C Gas Leakage Detector
4.	Allen Key Set
5.	Battery Tester
6.	Bench Vice
7.	Brake Efficiency Tester
8.	Brushes different types
9.	Cleaning Equipment with Detergent
10.	Coil Spring Compressor
11.	Computer Lead Box/ Diagnosis System/ Interface Box
12.	Condenser Tester
13.	DB Meter (Sound Tester)
14.	Dial Gauge with Magnetic Stand
15.	Drill Bits Set (Mason, Metal)
16.	Drill Machine
17.	Dual Techo Meter
18.	Dust Blower
19.	Electric Connector Remover
20.	Feeler Gauge
21.	Files Set for Contact Points Facing
22.	Fuel Pressure Gauge
23.	General Mechanic’s Hand Tools
24.	Hammer: different size and types
25.	Hand Drilling Machine
26.	Heat Gun
27.	Hydrometer (Gravity Meter)
28.	Injector Cleaner
29.	Injector Tester
30.	Insulation Tape
31.	Insulation Tester
32.	Jack Hoist/ Stands
33.	Jack Telescopic with Weight Lifting Capacity 1.5 Tons
34.	Jack Trolley Type with Weight Lifting Capacity 5 Tons
35.	Lifting Equipment (Service Pit)
36.	Lock Pliers
37.	Magnifying Glass
38.	Magnetic Stick
39.	Marking Tools
40.	Masking Tape
41.	Measuring Precision Tools/ Instruments
42.	Measuring Tape
43.	Multi Scanner Tools for Vehicle
44.	Multimeter (AVO Meter)
45.	Oscilloscope
46.	Pedestal Drilling Machine
47.	Pliers Set
48.	Pullers: different types
49.	Safety Clothing, Equipment and Kit
50.	Scraper
51.	Screw Driver Kit
52.	Set of Spanner

53.	Soldering Gun
54.	Soldering Iron
55.	Soldering Wire and Paste
56.	Spark Plug Deep Sockets
57.	Spark Plug Tester
58.	Special Service Tools Recommended by the Manufacturer
59.	Star Key Set (Torx Key set)
60.	Stroboscope
61.	Sucker
62.	Temperature Gauge
63.	Testing Board
64.	Torque Wrench
65.	Tweezers Kit
66.	Wire Brush
67.	Wires of different Gauges
68.	Work Bench
69.	Wrenches Set

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