



Model Curriculum

QP Name: Automobile Lead Technician (Diagnostics)

QP Version: 1.0

NSQF Level: 4.5

Model Curriculum Version: 1.0

Automotive Skills Development Council |
E-113, Gr Floor, Okhla Industrial Area, Phase – III , New Delhi – 110020

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Training Parameters

Sector	Automotive
Sub-Sector	Vehicle Service and Repair
Occupation	Automobile Service
Country	India
NSQF Level	4.5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/7213.0201
Minimum Educational Qualification and Experience	NSQF-Certificate in Automobile Technician (Diagnostic), Level-4
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 years
Last Reviewed On	15/03/2024
Next Review Date	15/03/2027
NSQC Approval Date	15/03/2024
QP Version	1.0
Model Curriculum Creation Date	15/03/2024
Model Curriculum Valid Up to Date	15/03/2027
Model Curriculum Version	1.0
Minimum Duration of the Course	1200 Hours
Maximum Duration of the Course	1200 Hours

Program Overview

This section summarizes the end objectives of the program along with its duration.

Training Outcomes

A Diploma in Automobile Lead Technician (Diagnostics) is a specialized educational program that focuses on providing students with practical skills and theoretical knowledge related to various aspects of Vehicle Service & Repair.

At the end of the program, the learner should have acquired the listed knowledge and skills.

Advanced Diagnostic Techniques:

- Demonstrate proficiency in advanced diagnostic techniques for identifying and troubleshooting complex automotive issues.

Diagnostic Software Mastery:

- Master the use of diagnostic software and tools specific to various vehicle makes and models.

Electronic Control Systems Expertise:

- Understand and diagnose issues related to electronic control systems, including engine control modules (ECM), transmission control modules (TCM), and body control modules (BCM).

Network Communication Diagnostics:

- Analyze and diagnose issues related to in-vehicle networks, communication protocols, and data bus systems.
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Hybrid and Electric Vehicle Diagnostics:

- Acquire advanced skills in diagnosing and servicing hybrid and electric vehicles, including high-voltage systems, batteries, and electric drivetrains.

Advanced Engine Diagnostics:

- Diagnose and address intricate engine-related problems, including issues with fuel injection, ignition systems, and emissions control.

Transmission and Drivetrain Expertise:

- Diagnose and repair complex transmission and drivetrain issues, including automatic and manual transmissions.

Dynamic Systems Diagnostics:

- Understand and troubleshoot issues related to dynamic vehicle systems, such as suspension, steering, and braking dynamics.

Expert Use of Diagnostic Equipment:

- Utilize advanced diagnostic equipment, including oscilloscopes, scan tools, and specialized diagnostic instruments effectively.

Mandatory & Elective Modules

The table lists the modules and their duration corresponding to the Mandatory & Elective Subjects of the Curriculum.

Subject Details	NOS Code	Subject Type	Theory	Practical	On-the-Job Training Duration	Total Duration
			Duration	Duration		
Automobile Symptom Based Diagnosis	ASC/N1304	Core Mandatory	15	30	0	45
Automobile Electrical fault finding	ASC/N1305	Core Mandatory	15	30	0	45
Various Features of Vehicle Scanner	ASC/N1306	Core Mandatory	15	30	0	45
Electric Four-Wheeler Technology (BEV and Hybrid)	ASC/N1311	Core Elective-1	30	60	0	90
Heavy Electric Vehicle Technology (BUS and Trucks)	ASC/N1312	Core Elective-2				
Best Industrial Practices	ASC/N9841	Non-Core	60	90	0	150
Noise Vibration Harshness Diagnosis	ASC/N1307	Core Mandatory	15	30	0	45
DTC based diagnosis	ASC/N1308	Core Mandatory	15	30	0	45
Fundamental of Automotive Open System Architecture	ASC/N1309	Core Mandatory	15	30	0	45
Value Added Services	ASC/N1313	Core Elective-1	30	60	0	90
Specialized Vehicles	ASC/N1314	Core Elective-2				0
Artificial Intelligence in Automotive Service	ASC/N1315	Core Elective-3				0
Environmental Studies	ASC/N9843	Non-Core	60	90	0	150
Employability Skills (120 Hours)	DGT/VSQ/0104	Non-Core	48	72	0	120
Workshop Technology (HCV)	ASC/N1310	Core Mandatory	0	0	330	330
Total Duration			318	552	330	1200

Subject Details

Semester-5

Subject: 1 Automobile Symptom Based Diagnosis

Mapped to ASC/N1304

Terminal Outcomes:

Symptom Identification:

- Participants can accurately identify and document symptoms reported by vehicle owners or observed during initial inspections.

Diagnostic Interview Skills:

- Participants develop effective diagnostic interview skills to gather relevant information from vehicle owners regarding symptoms and recent events.

Systematic Diagnostic Approach:

- Participants acquire a systematic approach to automotive diagnosis, starting with a thorough examination of symptoms before moving on to specific components and systems.

Interpreting Diagnostic Codes:

- Participants are proficient in interpreting diagnostic trouble codes (DTCs) obtained from onboard diagnostic (OBD) systems.

Data Analysis and Interpretation:

- Participants can analyze data from various diagnostic tools, sensors, and instruments to interpret patterns and identify potential root causes.

Diagnostic Software Proficiency:

- Participants demonstrate proficiency in using diagnostic software specific to different vehicle makes and models to aid in symptom-based diagnosis.

Electrical System Diagnosis:

- Participants acquire skills in diagnosing electrical system issues contributing to symptoms, including problems with wiring, sensors, and actuators.

Mechanical System Diagnosis:

- Participants develop expertise in diagnosing mechanical system problems that may manifest as symptoms, covering areas such as the engine, transmission, suspension, and steering.

Duration: <15:00>	Duration: <30:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
Understanding Automotive Systems: <ul style="list-style-type: none"> ● Develop a comprehensive understanding of various automotive systems, including engine, transmission, suspension, braking, electrical, and electronic systems. Symptom Recognition: <ul style="list-style-type: none"> ● Learn to recognize and categorize 	Understanding of Automotive Systems: <ul style="list-style-type: none"> ● Gain comprehensive knowledge of various automotive systems, including the engine, transmission, suspension, braking, electrical, and electronic systems. Identification of Common Symptoms:

<p>symptoms reported by vehicle owners accurately.</p> <p>Diagnostic Process Overview:</p> <ul style="list-style-type: none"> • Understand the systematic process of diagnosing automotive issues, from symptom identification to resolution. <p>Diagnostic Terminology:</p> <ul style="list-style-type: none"> • Familiarize with diagnostic terminology used in the automotive industry, enabling effective communication with colleagues and clients. <p>Vehicle Inspection Techniques:</p> <ul style="list-style-type: none"> • Acquire skills in conducting thorough visual inspections and initial assessments of vehicles to identify potential issues. 	<ul style="list-style-type: none"> • Develop the ability to recognize common symptoms of automotive issues, such as unusual noises, vibrations, warning lights, and performance irregularities. <p>Diagnostic Tools and Equipment:</p> <ul style="list-style-type: none"> • Familiarize oneself with the proper use of diagnostic tools and equipment, including scanners, multimeters, oscilloscopes, and other specialized tools for troubleshooting automotive problems. <p>Data Interpretation:</p> <ul style="list-style-type: none"> • Learn to interpret data from diagnostic tools and understand the significance of readings to pinpoint potential problem areas within a vehicle. <p>Diagnostic Procedures:</p> <ul style="list-style-type: none"> • Acquire a systematic approach to diagnosing automotive issues, including following step-by-step procedures to identify and isolate problems.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
<p>Diagnostic Scan Tools:</p> <ul style="list-style-type: none"> • OBD-II (On-Board Diagnostics) scanner: Essential for reading and interpreting fault codes from the vehicle's electronic control unit (ECU). • Manufacturer-specific scan tools: Some vehicles may require specialized diagnostic tools for in-depth analysis. <p>Multimeter:</p> <ul style="list-style-type: none"> • Used for measuring voltage, current, and resistance in electrical circuits. <p>Oscilloscope:</p> <ul style="list-style-type: none"> • Provides a graphical representation of electrical signals, helpful for diagnosing complex electronic issues. <p>Fuel Pressure Gauge:</p> <ul style="list-style-type: none"> • Measures the pressure in the fuel system, aiding in diagnosing fuel delivery problems. <p>Compression Tester:</p> <ul style="list-style-type: none"> • Checks the compression levels in the engine cylinders, helping to identify engine issues. <p>Vacuum Gauge:</p> <ul style="list-style-type: none"> • Useful for diagnosing engine problems related to vacuum leaks or issues with the intake 	

system.

Exhaust Gas Analyzer:

- Measures the composition of exhaust gases, assisting in diagnosing engine performance and emission issues.

Subject: 2 Automobile Electrical fault finding

Mapped to ASC/N1305

Terminal Outcomes:

Understanding of Automotive Electrical Systems:

- Describe the basic components of automotive electrical systems.
Explain the functions of key electrical components (battery, alternator, starter motor, ignition system, etc.).
- Identify and understand different types of wiring diagrams.

Safety Procedures:

- Demonstrate knowledge and adherence to safety procedures when working with automotive electrical systems.
- Use personal protective equipment (PPE) appropriately.

Diagnostic Techniques:

- Apply systematic diagnostic techniques to identify electrical faults in vehicles.
- Use multimeters and other diagnostic tools effectively.

Fault Identification and Analysis:

- Identify common electrical faults in automotive systems.
- Analyze symptoms and determine possible causes of electrical issues.

Troubleshooting and Problem Solving:

- Develop problem-solving skills to troubleshoot electrical faults in an efficient manner.
- Demonstrate the ability to isolate and rectify electrical problems.

Use of Technical Documentation:

- Interpret and use technical manuals, wiring diagrams, and repair guides effectively.

Duration: <15:00>	Duration: <30:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
Understanding Automotive Electrical Systems:	Understanding Automotive Electrical Systems:

<ul style="list-style-type: none"> ● Knowledge of basic automotive electrical systems, including the battery, alternator, starter motor, ignition system, lighting, and various sensors. ● Understanding the flow of electrical current in a vehicle. <p>Electrical Symbols and Diagrams:</p> <ul style="list-style-type: none"> ● Interpretation of electrical symbols and diagrams used in automotive wiring diagrams. ● Ability to read and understand electrical schematics and diagrams. <p>Safety Precautions:</p> <ul style="list-style-type: none"> ● Awareness of safety protocols and precautions when working with automotive electrical systems. ● Proper handling of tools and equipment to minimize the risk of electrical accidents. <p>Use of Multimeters and Testing Equipment:</p> <ul style="list-style-type: none"> ● Proficiency in using multimeters and other testing equipment to measure voltage, current, resistance, and continuity. ● Hands-on experience with various diagnostic tools used in automotive electrical fault finding. <p>Battery Diagnosis and Maintenance:</p> <ul style="list-style-type: none"> ● Knowledge of battery types, maintenance procedures, and common issues. ● Techniques for testing and diagnosing battery-related problems. <p>Charging System Diagnosis:</p> <ul style="list-style-type: none"> ● Understanding the alternator and charging system. ● Diagnosis of alternator-related issues and their rectification. 	<ul style="list-style-type: none"> ● Gain a comprehensive understanding of the various electrical systems in automobiles, including the charging system, starting system, lighting system, ignition system, and accessory systems. <p>Reading Wiring Diagrams:</p> <ul style="list-style-type: none"> ● Develop proficiency in reading and interpreting wiring diagrams to understand the electrical layout of a vehicle. This skill is crucial for tracing circuits and locating potential faults. <p>Use of Multimeters and Diagnostic Tools:</p> <ul style="list-style-type: none"> ● Learn to use multimeters and other diagnostic tools effectively to measure voltage, current, resistance, and diagnose electrical faults. This includes understanding the proper selection of tools for specific tasks. <p>Identification of Common Electrical Components:</p> <ul style="list-style-type: none"> ● Recognize and understand the function of common electrical components such as relays, fuses, switches, sensors, and actuators in automotive systems. <p>Testing and Troubleshooting Techniques:</p> <ul style="list-style-type: none"> ● Acquire practical skills in systematic testing and troubleshooting techniques to identify faults in electrical circuits. This may involve step-by-step procedures for diagnosing issues in starting systems, charging systems, and lighting systems. <p>Battery Testing and Maintenance:</p> <ul style="list-style-type: none"> ● Learn how to test and evaluate the condition of automotive batteries, including checking voltage, load testing, and assessing battery health. Understand maintenance practices to extend battery life.
<p>Classroom Aids: Whiteboard, marker pen, projector</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>Multimeter:</p>	

- Digital and analog multimeters for measuring voltage, current, and resistance.
- Clamp meter for measuring current without disconnecting wires.

Voltage Tester:

- Non-contact voltage testers for quickly checking the presence of voltage.

Circuit Testers:

- Continuity testers to check for broken circuits.
- Test lights to check for the presence of voltage.

Oscilloscope:

- Helps analyze waveform patterns in electrical circuits.

Scan Tool:

- For diagnosing and reading trouble codes in the vehicle's electronic control modules.

Diagnostic Software:

- Software tools for interpreting diagnostic trouble codes (DTCs) and troubleshooting.

Wiring Diagrams:

- Access to vehicle-specific wiring diagrams for better understanding of the electrical system.

Battery Tester:

- For checking the condition of the vehicle's battery.

Jumper Cables:

- Useful for jump-starting a vehicle and testing starter circuits.

Subject: 3 Various Features of Vehicle Scanner

Mapped to ASC/N1306

Terminal Outcomes:

OBD-II (On-Board Diagnostics) Code Reading:

- Trainees should be able to use the scanner to retrieve and interpret OBD-II trouble codes. This helps in identifying malfunctions within the vehicle's systems.

Live Data Streaming:

- Trainees should be proficient in accessing and analyzing live data streams from various sensors and modules. This aids in real-time monitoring of the vehicle's performance and identifying abnormal patterns.

Freeze Frame Data:

- Trainees should learn how to capture and analyze freeze frame data, providing a snapshot of vehicle parameters at the time a fault occurs. This helps in understanding the context of a particular issue.

Vehicle Identification and VIN Decoding:

- Trainees should be able to use the scanner to identify the vehicle and decode its Vehicle Identification Number (VIN). This is crucial for accessing specific vehicle information and ensuring compatibility with diagnostic procedures.

Component Testing:

- Trainees should understand how to use the scanner to perform component testing, such as activating relays, solenoids, and other components. This is useful for verifying the functionality of different vehicle systems.

Duration: <15:00>	Duration: <30:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Understanding of Vehicle Scanner Basics:</p> <ul style="list-style-type: none"> ● Define what a vehicle scanner is and its role in automotive diagnostics. ● Explain the basic components and features of a typical vehicle scanner. <p>Diagnostic Trouble Codes (DTCs):</p> <ul style="list-style-type: none"> ● Interpret and analyze Diagnostic Trouble Codes generated by the vehicle scanner. ● Understand the significance of DTCs in identifying vehicle issues. <p>OBD-II Protocols:</p> <ul style="list-style-type: none"> ● Explain different On-Board Diagnostics (OBD) protocols and their importance. ● Demonstrate the ability to navigate and interpret OBD-II data using the scanner. <p>Live Data Streaming:</p> <ul style="list-style-type: none"> ● Describe the concept of live data streaming and its relevance in diagnosing vehicle problems. ● Interpret real-time sensor data to identify potential issues. <p>Vehicle System Scanning:</p> <ul style="list-style-type: none"> ● Demonstrate the process of performing a 	<p>Scanner Operation:</p> <ul style="list-style-type: none"> ● Understand the basic functionality and operation of a Vehicle Scanner. ● Demonstrate the correct setup and connection procedures for the scanner. ● Perform a system check to ensure the scanner is functioning properly. <p>Diagnostic Code Interpretation:</p> <ul style="list-style-type: none"> ● Interpret and analyze diagnostic trouble codes (DTCs) generated by the scanner. ● Identify common error codes and their meanings. ● Understand the importance of DTCs in troubleshooting vehicle issues. <p>Live Data Monitoring:</p> <ul style="list-style-type: none"> ● Use the scanner to monitor live data from various vehicle sensors.

<p>comprehensive vehicle system scan using the scanner.</p> <ul style="list-style-type: none"> ● Identify various vehicle systems that can be scanned, such as engine, transmission, ABS, airbags, etc. <p>Bi-Directional Control:</p> <ul style="list-style-type: none"> ● Explain the concept of bi-directional control and its applications in vehicle diagnostics. ● Demonstrate the use of the scanner to actuate components and perform tests. 	<ul style="list-style-type: none"> ● Analyze live data to diagnose performance issues and identify potential problems. ● Demonstrate the ability to interpret real-time sensor readings. <p>System-Specific Scanning:</p> <ul style="list-style-type: none"> ● Gain expertise in scanning and diagnosing specific vehicle systems (e.g., engine, transmission, ABS, airbag). ● Identify and troubleshoot issues related to specific systems using the scanner.
<p>Classroom Aids:</p>	
<p>Whiteboard, marker pen, projector</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>OBD-II Scanner:</p>	
<ul style="list-style-type: none"> ● A basic On-Board Diagnostics (OBD-II) scanner is essential for reading standard fault codes and accessing basic vehicle information. 	
<p>Enhanced OBD-II Scanner:</p>	
<ul style="list-style-type: none"> ● For advanced diagnostics and accessing manufacturer-specific codes, an enhanced OBD-II scanner is necessary. Make sure it supports the specific vehicle make and model you are working on. 	
<p>Diagnostic Software:</p>	
<ul style="list-style-type: none"> ● Install and configure diagnostic software on a computer or tablet compatible with the Vehicle Scanner. This software should be regularly updated to support the latest vehicle models and features. 	
<p>Laptop or Tablet:</p>	
<ul style="list-style-type: none"> ● A portable computer device with sufficient processing power and memory to run the diagnostic software. 	
<p>Vehicle Data Cable:</p>	
<ul style="list-style-type: none"> ● Depending on the vehicle's make and model, you may need specific data cables to connect the scanner to the vehicle's onboard diagnostics port. 	

Subject: 4 Electric Four-Wheeler Technology (BEV and Hybrid)

Mapped to ASC/N1311

Core-Elective-1

Terminal Outcomes:

Understanding Electric Vehicle (EV) Basics:

- Explain the fundamental principles of electric propulsion.
- Define key terms related to electric vehicle technology.

Components and Architecture:

- Identify and describe the main components of electric vehicles, including batteries, electric motors, inverters, and charging systems.
- Understand the architecture of Battery Electric Vehicles (BEV) and Hybrid vehicles.

Battery Technology:

- Explain the different types of batteries used in electric vehicles.
- Understand the principles of battery charging and discharging.

Motor and Inverter Technology:

- Describe the types of electric motors used in electric vehicles.
- Understand the role of inverters in converting DC power to AC power for electric motors.

Charging Infrastructure:

- Explain the various charging methods and standards.
- Understand the importance of charging infrastructure for electric vehicles.

Energy Management and Efficiency:

- Discuss energy management systems in electric vehicles.
- Understand strategies to optimize energy efficiency in electric vehicles.

Hybrid Technology:

- Compare and contrast different types of hybrid vehicle architectures.
- Understand the benefits and challenges of hybrid technology.

Duration: <30:00>	Duration: <60:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Understanding Electric Vehicle Basics:</p> <ul style="list-style-type: none"> ● Define and explain the key components of an electric vehicle, including the electric motor, battery pack, power electronics, and charging system. ● Differentiate between conventional vehicles and electric vehicles in terms of architecture and functioning. <p>Battery Technology:</p> <ul style="list-style-type: none"> ● Describe the various types of batteries used in electric vehicles, such as lithium-ion, nickel-metal hydride, and solid-state 	<p>Understanding Electric Vehicle (EV) Basics:</p> <ul style="list-style-type: none"> ● Interpret the basic electric vehicle components and architecture. ● Understanding the differences between traditional internal combustion engine vehicles and electric vehicles. <p>Battery Technology:</p> <ul style="list-style-type: none"> ● Understanding various battery chemistries used in electric vehicles. ● Apply the Knowledge of battery management systems and their role in optimizing performance and lifespan.

<p>batteries.</p> <ul style="list-style-type: none"> ● Understand the principles of battery charging and discharging, including charging infrastructure and charging protocols. <p>Electric Drive Systems:</p> <ul style="list-style-type: none"> ● Explore the working principles of electric motors and their role in driving electric vehicles. ● Discuss different types of electric drive systems, such as single-motor systems, dual-motor systems, and their impact on vehicle performance. <p>Vehicle Control and Management Systems:</p> <ul style="list-style-type: none"> ● Explain the role of vehicle control systems in managing power flow, energy regeneration, and overall vehicle performance. ● Understand the integration of sensors, controllers, and software for efficient vehicle operation. <p>Energy Management and Efficiency:</p> <ul style="list-style-type: none"> ● Analyze the factors influencing the energy efficiency of electric vehicles, including regenerative braking, thermal management, and aerodynamics. ● Evaluate strategies for optimizing energy consumption and extending the driving range. <p>Charging Infrastructure:</p> <ul style="list-style-type: none"> ● Comprehend the different charging standards, such as AC and DC charging, and their impact on charging times. ● Explore the development of charging infrastructure, including public charging stations and home-based charging solutions. 	<p>Electric Motors and Drivetrain:</p> <ul style="list-style-type: none"> ● Familiarity with electric motor types used in EVs and hybrids. ● Understanding the drivetrain and power delivery mechanisms in electric vehicles. <p>Charging Infrastructure:</p> <ul style="list-style-type: none"> ● Knowledge of different charging standards and types (e.g., Level 1, Level 2, DC fast charging). ● Practical skills related to connecting and charging an electric vehicle. <p>Range and Efficiency Optimization:</p> <ul style="list-style-type: none"> ● Perform the Techniques for optimizing driving range. ● Understanding factors affecting energy efficiency in electric vehicles. <p>Hybrid Technology:</p> <ul style="list-style-type: none"> ● Perform the operation of hybrid systems (parallel, series, plug-in). ● Practical knowledge of regenerative braking and energy recapture. <p>Vehicle Control Systems:</p> <ul style="list-style-type: none"> ● Interpret the role of software and control systems in electric and hybrid vehicles. ● Practical experience in diagnosing and troubleshooting control system issues.
<p>Classroom Aids:</p>	
<p>Whiteboard, marker pen, projector</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>Classroom Setup:</p>	
<ul style="list-style-type: none"> ● Whiteboard and markers for theoretical explanations. ● Projector or display for presentations and multimedia content. ● Audio-visual equipment for video demonstrations. 	
<p>Theoretical Material:</p>	

- Course textbooks and reference materials on electric vehicle technology.
- Computer terminals for accessing online resources and simulations.

Safety Equipment:

- Personal protective equipment (PPE) including safety glasses, gloves, and lab coats.
- First aid kit.

Basic Tools:

- Screwdrivers, pliers, wrenches, and other basic hand tools for assembly and disassembly.
- Multimeter for electrical measurements.

Diagnostic Tools:

- OBD-II scanners for reading on-board diagnostics data.
- Battery testers for evaluating the health of electric vehicle batteries.

Simulation Software:

- Computer-based simulation tools for understanding electric vehicle systems.
- Software for simulating battery performance and management.

Subject: 5 Heavy Electric Vehicle Technology (BUS and Trucks)

Mapped to ASC/N1312

Core-Elective-2

Terminal Outcomes:

Understanding of Electric Vehicle (EV) Basics:

- Participants should have a solid understanding of the basic principles behind electric vehicle technology, including how electric motors work, battery technology, and charging infrastructure.

Knowledge of Heavy EV Components:

- Participants should be familiar with the specific components of heavy electric vehicles, such as the electric drivetrain, regenerative braking systems, battery management systems, and thermal management systems.

Safety Protocols:

- Emphasis on safety protocols and procedures related to high-voltage systems in heavy electric vehicles, including emergency response and handling procedures.

Maintenance and Troubleshooting Skills:

- Participants should be equipped with skills related to maintenance, diagnostics, and troubleshooting of electric components in heavy vehicles. This includes understanding common issues and solutions.

Charging Infrastructure:

- Knowledge of different charging standards, charging station types, and the charging infrastructure required for heavy electric vehicles. This may also include practical experience with charging equipment.

Energy Management Strategies:

- Understanding strategies for efficient energy management, such as optimizing routes to maximize range, and using regenerative braking effectively.

Duration: <30:00>	Duration: <60:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Overview of Electric Vehicles (EVs):</p> <ul style="list-style-type: none"> ● Define the concept of electric vehicles and their significance in the transportation industry. ● Understand the different types of electric vehicles, with a focus on heavy-duty electric buses and trucks. <p>HEV Components and Architecture:</p> <ul style="list-style-type: none"> ● Identify and describe the key components of a heavy electric vehicle, including the electric motor, battery pack, power electronics, and charging infrastructure. ● Explain the overall architecture and integration of these components in a heavy electric vehicle system. <p>Battery Technology:</p> <ul style="list-style-type: none"> ● Explore various battery technologies used in heavy electric vehicles. ● Understand the principles of battery management systems and their role in optimizing battery performance and lifespan. <p>Charging Infrastructure:</p> <ul style="list-style-type: none"> ● Describe different charging methods for heavy electric vehicles, including fast charging and opportunity charging. ● Understand the design and deployment of charging infrastructure for heavy electric fleets. 	<p>Understanding Electric Vehicle Fundamentals:</p> <ul style="list-style-type: none"> ● Define the basic principles of electric vehicles. ● Explain the key components of an electric powertrain, including batteries, motors, and power electronics. <p>Heavy Electric Vehicle Architecture:</p> <ul style="list-style-type: none"> ● Interpret the specific design and architecture of heavy electric vehicles, taking into account the unique requirements of buses and trucks. ● Explore the differences between traditional internal combustion engine vehicles and electric counterparts. <p>Battery Technology and Management:</p> <ul style="list-style-type: none"> ● Provide insights into various types of batteries used in heavy EVs and their specific characteristics. ● Explain battery management systems, charging infrastructure, and safety considerations. <p>Electric Motors and Power Electronics:</p> <ul style="list-style-type: none"> ● Understand the types of electric motors used in heavy vehicles and their performance characteristics. ● Explain power electronics systems responsible for controlling the flow of electrical energy within the vehicle. <p>Charging Infrastructure:</p>

<p>Energy Management and Efficiency:</p> <ul style="list-style-type: none"> Analyze strategies for optimizing energy management in heavy electric vehicles. Discuss factors affecting energy efficiency, including regenerative braking and thermal management. 	<ul style="list-style-type: none"> Familiarize participants with different charging standards and infrastructure for heavy electric vehicles. Discuss practical considerations for setting up charging stations for buses and trucks.
<p>Classroom Aids:</p>	
<p>Whiteboard, marker pen, projector</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>Basic Tools:</p> <ul style="list-style-type: none"> Screwdrivers (various sizes) Pliers (needle-nose, regular, etc.) Wrenches (adjustable, combination, torque wrenches) Sockets and ratchets Multimeters <p>Diagnostic Tools:</p> <ul style="list-style-type: none"> OBD-II scanners for electric vehicles Battery testers Motor and controller diagnostic tools Charging system testers <p>Hands-On Components:</p> <ul style="list-style-type: none"> Electric motors (various types and sizes) Battery packs (Li-ion, Li-Po, etc.) Inverters and converters Charging systems Electric drivetrain components <p>Vehicle Simulator:</p> <ul style="list-style-type: none"> HEV simulation software for virtual training Virtual reality (VR) or augmented reality (AR) tools for immersive learning 	

Subject: 6 Best Industrial Practices

Mapped to ASC/N9841

Terminal Outcomes:

- Workplace Safety:** Demonstrate an understanding of basic workplace safety protocols, including hazard identification, proper tool usage, and personal protective equipment (PPE) requirements.
- Work Ethics and Professionalism:** Exhibit professionalism, punctuality, teamwork, and effective communication skills in an industrial setting.
- Basic Tool Proficiency:** Develop proficiency in using common hand tools, power tools, and measuring instruments relevant to industrial tasks.

- **Material Handling:** Learn safe and efficient methods for handling materials, including lifting, transporting, and storing items in an industrial environment.
- **Basic Manufacturing Processes:** Gain familiarity with fundamental manufacturing processes such as machining, welding, assembly, and quality control.
- **Precision Measurement:** Develop skills in using precision measuring tools such as calipers, micrometers, and gauges to ensure accurate work.
- **Workshop Organization:** Learn how to maintain an organized and clean workshop, ensuring tools and materials are properly stored and workspaces are safe and efficient.

Duration: <60:00>	Duration: <90:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Workplace Safety Principles: Understand the fundamental principles of workplace safety, including hazard recognition, risk assessment, and the importance of adhering to safety protocols. • Industrial Regulations and Standards: Familiarize yourself with industry-specific regulations, safety standards, and guidelines that govern practices within industrial environments. • Work Ethics and Professionalism: Grasp the concepts of professionalism, work ethics, and the importance of punctuality, accountability, and effective communication in an industrial setting. • Basic Manufacturing Processes: Learn about common manufacturing processes, such as machining, welding, casting, and assembly, and understand their applications and limitations. • Technical Drawings Interpretation: Develop skills in reading and interpreting technical drawings, blueprints, schematics, and symbols used in industrial contexts. • Material Properties and Handling: Understand the properties of common industrial materials, their appropriate handling techniques, and considerations for material selection. 	<ul style="list-style-type: none"> • Workplace Safety Implementation: Apply workplace safety protocols by identifying and mitigating hazards, wearing appropriate PPE, and following safety guidelines. • Tool Proficiency: Develop hands-on proficiency in using common hand tools, power tools, and measuring instruments used in industrial tasks. • Material Handling Techniques: Practice safe and efficient methods for lifting, transporting, and storing materials within an industrial environment. • Manufacturing Process Application: Gain practical experience by participating in or observing basic manufacturing processes like machining, welding, or assembly. • Measurement and Metrology Skills: Develop skills in accurately measuring dimensions using precision measuring tools, ensuring precision in work. • Technical Drawing Interpretation: Apply knowledge of technical drawings to accurately interpret and follow assembly instructions and specifications.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
<ul style="list-style-type: none"> • Safety Equipment: Personal protective equipment (PPE) including safety glasses, gloves, helmets, ear protection, and appropriate clothing to ensure worker safety. • Hand Tools: Common hand tools such as screwdrivers, pliers, wrenches, hammers, and utility knives for various tasks. • Power Tools: Electric or pneumatic tools such as drills, grinders, saws, and impact wrenches for efficient and precise work. 	

- **Measuring Instruments:** Precision measuring tools like calipers, micrometers, gauges, rulers, and tape measures for accurate measurements.
- **Workbenches:** Sturdy work surfaces equipped with clamps, vises, and holders for securing materials during tasks.
- **Lifting and Handling Equipment:** Hoists, cranes, forklifts, and pallet jacks for safe and efficient material handling.
- **Welding Equipment:** Welding machines, torches, protective gear, and welding accessories for joining metals.
- **Machining Tools:** Lathe machines, milling machines, and CNC machines for precision shaping and cutting of materials.
- **Safety Signs and Labels:** Signage indicating hazardous areas, emergency exits, safety guidelines, and equipment instructions.

Semester-6

Subject: 1 Noise Vibration Harshness Diagnosis

Mapped to ASC/N1307

Terminal Outcomes:

Understanding NVH Fundamentals:

- Participants should have a solid understanding of the basic principles of noise, vibration, and harshness in the context of automotive systems.
- Knowledge of key terminology, concepts, and measurement units related to NVH.

NVH Measurement Techniques:

- Proficiency in using various instruments and tools for measuring and analyzing noise and vibration.
- Ability to interpret data from accelerometers, microphones, and other sensors commonly used in NVH analysis.

Identification of NVH Sources:

- Capability to identify and categorize different sources of noise, vibration, and harshness in a vehicle.
- Understanding the interaction between various vehicle components and their contribution to NVH.

NVH Diagnosis Skills:

- Ability to diagnose and troubleshoot NVH issues through systematic analysis.
Effective use of diagnostic tools and methodologies to pinpoint the root causes of NVH problems.

Computer-Aided NVH Analysis:

- Proficiency in using computer-aided tools and simulations for NVH analysis.
- Understanding the role of simulation software in predicting and optimizing NVH performance.

Duration: <15:00>	Duration: <30:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Introduction to NVH:</p> <ul style="list-style-type: none"> • Definition and significance of Noise, Vibration, and Harshness. • Understanding the impact of NVH on vehicle and machinery performance. <p>NVH Sources:</p> <ul style="list-style-type: none"> • Identification of various sources of noise and vibration in vehicles and machinery. • Understanding the types and characteristics of noise (e.g., airborne noise, structure-borne noise) and vibration. <p>NVH Measurement and Analysis:</p> <ul style="list-style-type: none"> • Techniques for measuring and analyzing noise and vibration. • Instruments and tools used in NVH testing. <p>Frequency Analysis:</p> <ul style="list-style-type: none"> • Frequency domain analysis of noise and vibration data. • Identifying dominant frequencies and their relationship to specific components or issues. <p>Modal Analysis:</p> <ul style="list-style-type: none"> • Understanding the concept of modal analysis and its application in NVH. • Identifying natural frequencies and mode shapes. <p>NVH Control Strategies:</p> <ul style="list-style-type: none"> • Strategies for controlling and minimizing noise and vibration. • Implementation of design modifications to address NVH issues. <p>Diagnostic Techniques:</p> <ul style="list-style-type: none"> • Diagnosis of specific NVH problems. • Troubleshooting and root cause analysis. 	<p>Understanding NVH Fundamentals:</p> <ul style="list-style-type: none"> • Knowledge of basic principles and concepts related to noise, vibration, and harshness. • Interpret the factors influencing NVH, including sources, transmission paths, and receivers. <p>Measurement Techniques:</p> <ul style="list-style-type: none"> • Proficiency in using various measurement tools and techniques to quantify noise and vibration levels. • Familiarity with sensors, data acquisition systems, and analysis software. <p>Signal Analysis:</p> <ul style="list-style-type: none"> • Ability to analyze signals obtained from sensors to identify frequency components, amplitudes, and temporal patterns. • Apply signal processing techniques for extracting relevant information from raw data. <p>Modal Analysis:</p> <ul style="list-style-type: none"> • Knowledge of modal analysis methods to determine natural frequencies, mode shapes, and damping ratios of structures. • Application of modal analysis for understanding system dynamics and resonance behavior. <p>NVH Troubleshooting:</p> <ul style="list-style-type: none"> • Skills in diagnosing and troubleshooting NVH issues in real-world scenarios. • Ability to differentiate between various types of vibrations and their potential causes. <p>Noise Control and Reduction Techniques:</p> <ul style="list-style-type: none"> • Apply the principles of noise control and reduction. • Measures to minimize noise and vibration, such as damping treatments, isolators, and other design modifications.
Classroom Aids:	

Whiteboard, marker pen, projector

Tools, Equipment and Other Requirements

Vibration Analyzer:

- Essential for measuring and analyzing vibrations in different components of a vehicle.

Sound Level Meter:

- Used to measure the intensity of sound, which is crucial for understanding the noise levels associated with different components.

Accelerometer:

- Devices used to measure accelerations, essential for capturing and analyzing vibrations.

Modal Analysis Software:

- Helps in understanding the natural frequencies and modes of vibration in structures or components.

Microphones:

- High-quality microphones are used to capture and analyze various noise sources in vehicles.

Data Acquisition System:

- A system that records and processes data from various sensors (accelerometers, microphones, etc.) for analysis.

Chassis Ears:

- Wireless microphones placed strategically on the vehicle to help identify and locate noise sources.

Stethoscope:

- Used for listening to vibrations and noises in specific components.

Subject: 2 DTC based diagnosis

Mapped to ASC/N1308

Terminal Outcomes:

Understanding of OBD-II System:

- Participants should have a comprehensive understanding of the On-Board Diagnostics (OBD-II) system, including its purpose, components, and how it interfaces with the vehicle's electronic control systems.

Interpretation of Diagnostic Trouble Codes:

- Proficiency in interpreting DTCs is crucial. Trainees should be able to read and understand the meaning of various Diagnostic Trouble Codes, which are alphanumeric codes that represent specific issues within the vehicle.

Use of Scan Tools and Equipment:

- Trainees should be familiar with the operation of diagnostic scan tools and equipment used to retrieve and interpret DTCs. This includes knowledge of connection methods, reading live data, and performing system tests.

Identification of Troubleshooting Procedures:

- Participants should learn how to follow systematic troubleshooting procedures based on DTCs. This involves understanding diagnostic flowcharts, service manuals, and technical documents provided by the vehicle manufacturer.

Component and System Diagnosis:

- Proficiency in diagnosing and resolving issues related to specific components or systems identified by DTCs. This includes understanding the interdependence of various vehicle systems.

Duration: <15:00>	Duration: <30:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Understanding Diagnostic Trouble Codes (DTCs):</p> <ul style="list-style-type: none"> ● Define what DTCs are and their role in vehicle diagnostics. ● Explain the structure of a DTC, including the standardized format. <p>DTC Sources and Generation:</p> <ul style="list-style-type: none"> ● Identify the various sensors and systems in a vehicle that can generate DTCs. ● Explore the conditions under which DTCs are generated. <p>Diagnostic Process:</p> <ul style="list-style-type: none"> ● Outline the systematic process of diagnosing issues using DTCs. ● Emphasize the importance of a step-by-step approach to problem-solving. <p>Scan Tool Operation:</p> <ul style="list-style-type: none"> ● Familiarize with the functionality of OBD- 	<p>Understanding of DTCs:</p> <ul style="list-style-type: none"> • Define what Diagnostic Trouble Codes (DTCs) are. • Explain the purpose of DTCs in modern vehicle systems. <p>DTC Code Structure:</p> <ul style="list-style-type: none"> • Interpret the structure of a DTC and understand the information encoded within it. • Identify the key components of a DTC, such as the P-code, B-code, and U-code. <p>DTC Retrieval Methods:</p> <ul style="list-style-type: none"> • Demonstrate proficiency in using OBD-II (On-Board Diagnostics) scanners and other diagnostic tools to retrieve DTCs from a vehicle's computer system. <p>Interpretation of DTCs:</p> <ul style="list-style-type: none"> • Analyze and interpret DTCs to identify specific issues within different vehicle systems (e.g., engine, transmission, ABS, airbags). • Understand the severity and urgency

<p>II (On-Board Diagnostics) scan tools.</p> <ul style="list-style-type: none"> ● Learn how to retrieve, interpret, and clear DTCs using scan tools. <p>Interpreting DTCs:</p> <ul style="list-style-type: none"> ● Understand the significance of each digit and character in a DTC. ● Learn to associate specific DTCs with potential issues in vehicle systems. <p>Diagnostic PIDs (Parameter IDs):</p> <ul style="list-style-type: none"> ● Introduce the concept of PIDs and their role in live data analysis. ● Explore how PIDs can be used to pinpoint issues in real-time. <p>Common DTCs and Troubleshooting:</p> <ul style="list-style-type: none"> ● Examine a range of common DTCs and associated troubleshooting procedures. ● Provide hands-on exercises to reinforce the application of diagnostic techniques. 	<p>associated with different DTCs.</p> <p>Common DTCs and Troubleshooting:</p> <ul style="list-style-type: none"> ● Identify common DTCs associated with specific vehicle issues. ● Develop troubleshooting strategies based on DTCs to diagnose and resolve problems effectively. <p>Diagnostic Procedures:</p> <ul style="list-style-type: none"> ● Learn systematic diagnostic procedures for addressing DTCs, including the use of flowcharts and diagnostic trees. ● Practice applying diagnostic procedures to real-world scenarios.
<p>Classroom Aids:</p>	
<p>Whiteboard, marker pen, projector</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>OBD-II Scan Tool:</p> <ul style="list-style-type: none"> ● Essential for reading and interpreting DTCs from a vehicle's onboard diagnostic system. <p>Vehicle Diagnostic Software:</p> <ul style="list-style-type: none"> ● Software that complements the OBD-II scan tool, providing detailed information about specific DTCs, live data, and vehicle parameters. <p>Service Manuals:</p> <ul style="list-style-type: none"> ● Manuals specific to various vehicle makes and models, containing diagnostic procedures, code definitions, and troubleshooting guides. <p>Multimeter:</p> <ul style="list-style-type: none"> ● Used for electrical testing and troubleshooting within a vehicle's electrical system. <p>Oscilloscope:</p> <ul style="list-style-type: none"> ● Useful for diagnosing complex electrical issues and analyzing sensor signals. 	

Subject: 3 Fundamental of Automotive Open System Architecture

Mapped to ASC/N1309

Terminal Outcomes:

Understanding Automotive Open System Architecture (AUTOSAR):

- Participants should gain a solid understanding of the principles and concepts behind AUTOSAR, which is an open and standardized automotive software architecture.

Knowledge of AUTOSAR Architecture Layers:

- Participants may be expected to comprehend the different layers of the AUTOSAR architecture, such as the application layer, runtime environment, basic software layer, and the microcontroller abstraction layer.

Hands-on Experience:

- Depending on the module, there might be practical exercises or projects to allow participants to apply their knowledge. This could involve working with AUTOSAR tools, configuring software components, or developing sample applications.

Integration Skills:

- Participants may be expected to learn how to integrate AUTOSAR-compliant software components from different suppliers, ensuring compatibility and functionality.

Debugging and Troubleshooting:

- The training module might cover essential skills for debugging and troubleshooting AUTOSAR-based systems, identifying and resolving common issues that may arise during development or integration.

Duration: <15:00>	Duration: <30:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Understanding Automotive System Architecture:</p> <ul style="list-style-type: none"> ● Define and comprehend the concept of open system architecture in the context of automotive systems. ● Identify the key components and modules involved in automotive open system architecture. <p>Communication Protocols:</p> <ul style="list-style-type: none"> ● Explore various communication protocols used in automotive systems (e.g., CAN, LIN, FlexRay) and understand their applications. ● Analyze the advantages and disadvantages of different communication protocols in automotive architectures. <p>System Integration and Interoperability:</p> <ul style="list-style-type: none"> ● Learn how different automotive systems and components can be integrated to ensure seamless communication and interoperability. ● Understand the challenges and solutions 	<p>Understanding Automotive Open System Architecture (AUTOSAR):</p> <ul style="list-style-type: none"> ● Gain a comprehensive understanding of AUTOSAR principles, concepts, and components. ● Familiarity with the history, development, and evolution of AUTOSAR. <p>System Architecture Design:</p> <ul style="list-style-type: none"> ● Learn how to design automotive systems using open system architecture principles. ● Understand the modular and scalable nature of open architectures in automotive systems. <p>Communication Protocols and Standards:</p>

<p>related to system integration in the context of open architectures.</p> <p>Standardization and Compliance:</p> <ul style="list-style-type: none"> ● Explore industry standards and regulations relevant to automotive open system architecture. ● Understand the importance of complying with standards for interoperability and safety. <p>Security in Automotive Systems:</p> <ul style="list-style-type: none"> ● Investigate security considerations in open automotive systems, including authentication, encryption, and protection against cyber threats. ● Learn strategies for ensuring the integrity and confidentiality of data in automotive architectures. 	<ul style="list-style-type: none"> ● Explore communication protocols and standards commonly used in automotive open systems. ● Understand how these protocols facilitate communication between various components within a vehicle. <p>Software Development and Integration:</p> <ul style="list-style-type: none"> ● Acquire practical skills in developing software components adhering to AUTOSAR standards. ● Learn how to integrate and configure software modules within the automotive open system. <p>Configuration and Parameterization:</p> <ul style="list-style-type: none"> ● Understand the process of configuring and parameterizing AUTOSAR software components. ● Learn how to adapt and optimize system configurations based on specific requirements. <p>Diagnostic and Debugging Techniques:</p> <ul style="list-style-type: none"> ● Gain proficiency in diagnosing and debugging issues in an open system architecture. ● Learn tools and techniques for effective troubleshooting.
<p>Classroom Aids:</p>	
<p>Whiteboard, marker pen, projector</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>AUTOSAR Software Stack:</p> <ul style="list-style-type: none"> ● AUTOSAR-compliant software stack, which may include the AUTOSAR runtime environment and basic software modules. 	
<p>Development Environment:</p>	

- Integrated Development Environment (IDE) with AUTOSAR support, such as Vector DaVinci, Elektrobit, or any other AUTOSAR-compliant tool.

Hardware Platforms:

- Microcontroller Development Boards: Hardware platforms compatible with AUTOSAR, such as those from Infineon, NXP, or other vendors.
- Electronic Control Unit (ECU) hardware for practical implementation and testing.

Communication Protocols:

- CAN (Controller Area Network) hardware and tools for communication testing.
- FlexRay or Ethernet hardware if your training involves these communication protocols.

Simulation Tools:

- Simulation tools that support AUTOSAR, such as MATLAB/Simulink with Embedded Coder, or specialized AUTOSAR simulation tools.

Subject: 4 Value Added Services

Mapped to ASC/N1313

Core-Elective-1

Terminal Outcomes:

Enhanced Customer Satisfaction:

- VAS can lead to improved customer satisfaction by providing additional services beyond basic maintenance and repairs.
- Addressing customer needs comprehensively can result in a positive overall service experience.

Increased Customer Loyalty:

- Value-added services can create a sense of loyalty among customers, encouraging them to return for future services.
- Satisfied customers are more likely to become repeat customers, leading to a stable customer base.

Differentiation in the Market:

- Offering unique and valuable services sets an automotive service provider apart from competitors.
- The differentiation can attract customers seeking comprehensive and high-quality service options.

Upselling Opportunities:

- VAS provides opportunities for upselling additional services, increasing revenue for the automotive service provider.
- Proper training enables service staff to effectively communicate and promote these added services to customers.

Duration: <30:00>	Duration: <60:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Understanding Value Added Services (VAS):</p> <ul style="list-style-type: none"> ● Define and explain the concept of Value Added Services in the context of automotive services. ● Recognize the importance of VAS in enhancing customer experience and satisfaction. <p>Customer Relationship Management (CRM):</p> <ul style="list-style-type: none"> ● Explore CRM strategies to build and maintain strong customer relationships. ● Understand the role of VAS in fostering customer loyalty and repeat business. <p>Identifying Customer Needs:</p> <ul style="list-style-type: none"> ● Develop skills to identify and analyze customer needs and expectations. ● Learn techniques for effective communication and active listening to understand customer requirements. <p>Product Knowledge:</p> <ul style="list-style-type: none"> ● Acquire in-depth knowledge about the various VAS offerings in the automotive service industry. ● Understand how product knowledge contributes to effective sales and customer satisfaction. 	<p>Increased Technical Proficiency:</p> <ul style="list-style-type: none"> ● Mastery of advanced automotive technologies and systems. ● Proficient diagnosis and troubleshooting skills. <p>Enhanced Customer Service Skills:</p> <ul style="list-style-type: none"> ● Improved communication and interpersonal skills to interact effectively with customers. ● Ability to educate and inform customers about complex automotive issues. <p>Efficient Time Management:</p> <ul style="list-style-type: none"> ● Streamlined workflow processes to reduce repair and service times. ● Effective time management for increased productivity. <p>Advanced Diagnostic and Repair Techniques:</p> <ul style="list-style-type: none"> ● Mastery of cutting-edge diagnostic tools and techniques. ● Ability to address complex and sophisticated vehicle issues. <p>Specialized Training in New Technologies:</p> <ul style="list-style-type: none"> ● Knowledge of emerging automotive technologies, such as electric vehicles (EVs), hybrid systems, and autonomous

<p>Sales Techniques:</p> <ul style="list-style-type: none"> ● Learn effective sales techniques tailored to VAS in the automotive sector. ● Develop skills for upselling and cross-selling VAS to customers. <p>Service Quality and Standards:</p> <ul style="list-style-type: none"> ● Emphasize the importance of maintaining high-quality standards in delivering VAS. ● Understand how service quality impacts customer perception and loyalty. 	<p>features.</p> <ul style="list-style-type: none"> ● Ability to service and repair vehicles with advanced safety and entertainment systems. <p>Increased Sales and Up selling Skills:</p> <ul style="list-style-type: none"> ● Training in effective up selling strategies for additional services or products. ● Enhanced sales skills to promote maintenance packages and other value-added offerings.
<p>Classroom Aids:</p> <p>Whiteboard, marker pen, projector</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>Diagnostic Tools:</p> <ul style="list-style-type: none"> ● OBD-II Scanners: For reading and interpreting on-board diagnostics data. ● Vehicle-specific diagnostic tools: Manufacturer-specific tools for in-depth diagnostics. <p>Technical Service Bulletins (TSBs):</p> <ul style="list-style-type: none"> ● Access to online databases or subscription services providing TSBs. <p>Software and Computer Systems:</p> <ul style="list-style-type: none"> ● Repair information systems: Such as AllData, Mitchell, or similar systems. ● Workshop management software: For scheduling, billing, and customer management. <p>Shop Management Software:</p> <ul style="list-style-type: none"> ● Customer Relationship Management (CRM) software: To manage customer interactions and enhance customer experience. <p>Point of Sale (POS) system: For smooth billing and invoicing processes.</p> <p>Appointment scheduling software: To efficiently manage service appointments.</p>	

Subject: 5 Specialized Vehicles

Mapped to ASC/N1314

Core-Elective-2

Terminal Outcomes:

Improved safety: Specialized vehicles, such as autonomous cars, can significantly reduce accidents caused by human error. They can also be equipped with advanced safety features, such as collision avoidance systems, to further enhance safety.

Increased efficiency: Specialized vehicles, such as electric delivery trucks or autonomous agricultural equipment, can significantly improve efficiency by reducing labor costs, increasing productivity, and minimizing environmental impact.

Enhanced accessibility: Specialized vehicles, such as mobility scooters or electric wheelchairs, can significantly improve accessibility for individuals with disabilities by providing greater mobility and independence.

Reduced environmental impact: Specialized vehicles, such as electric cars or hydrogen fuel cell trucks, can significantly reduce greenhouse gas emissions and air pollution, contributing to a more sustainable and environmentally-friendly transportation system.

Advancements in technology: The development and implementation of specialized vehicles can lead to significant advancements in technology, such as improved sensors, software, and communication systems, which can have far-reaching impacts beyond the transportation industry.

Duration: <30:00>	Duration: <60:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> ● Understanding of specialized vehicles: Different types of specialized vehicles such as fire trucks, ambulances, construction vehicles, and military vehicles. They will learn about their unique features, functions, and applications. ● Safety procedures: Safety procedures related to specialized vehicles, such as crossing the road safely near fire trucks or ambulances, avoiding construction sites, and following traffic rules near military vehicles during parades or exercises. ● Technical aspects: Technical aspects of specialized vehicles such as engines, transmissions, brakes, steering systems, suspension systems, and hydraulic systems. They will learn how these systems work together to make the vehicle functional and efficient. ● Environmental concerns: Environmental concerns related to specialized vehicles, such as emissions, fuel consumption, and waste management. They will learn about the efforts being made to make specialized 	<ul style="list-style-type: none"> ○ Understanding of the different types of specialized vehicles used in various industries such as construction equipment (e.g., cranes, bulldozers), emergency vehicles (e.g., ambulances, fire trucks), agricultural machinery (e.g., tractors, harvesters), and transportation vehicles (e.g., trains, subways). ○ Knowledge of the design, construction, and operation of specialized vehicles, including their engines, transmissions, steering systems, and safety features. ○ Analyze the advantages and disadvantages of different specialized vehicles for specific applications and environments. ○ Interpret regulatory and legal frameworks governing the use and operation of specialized vehicles, including licensing requirements, safety standards, and environmental considerations. ○ Familiarity with the latest trends and innovations in specialized vehicle technology, such as electric and autonomous vehicles, and their potential impact on

<p>vehicles more eco-friendly.</p> <ul style="list-style-type: none"> ● Cultural and historical significance: Students will learn about the cultural and historical significance of specialized vehicles, such as the evolution of fire trucks, the role of ambulances in medical emergencies, and the military history of specialized vehicles. ● Critical thinking and problem-solving skills: Students will learn to apply critical thinking and problem-solving skills to analyze and evaluate specialized vehicles. They will learn to identify potential problems and develop solutions to address them. 	<p>industry and society.</p> <ul style="list-style-type: none"> ○ Follow the importance of following proper safety procedures and protocols when operating specialized vehicles, such as wearing appropriate personal protective equipment (PPE) and avoiding hazardous areas. ○ Integrate different types of training and certification required for operating specialized vehicles, such as firefighter training for fire truck operators and crane operator certification for crane operators. ○ Understand the importance of ongoing training and education to stay up-to-date with the latest safety procedures and equipment for specialized vehicles. ○ Learn about the potential hazards and risks associated with operating specialized vehicles, such as falls, collapses, and equipment failure, and how to mitigate these risks through proper safety procedures and equipment.
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Classroom Aids:

Whiteboard, marker pen, projector

Tools, Equipment and Other Requirements

Specialized Vehicles:

a. Ambulance: Defibrillator, oxygen tanks, suction units, stretchers, patient monitors, IV pumps, medical supplies (bandages, gauze, antiseptics), communication devices (radios, mobile phones), GPS navigation systems, and emergency lighting systems.

b. Fire Truck: Water pump, fire hoses, ladders, fire extinguishers, thermal imaging cameras, hydraulic tools (jaws of life), communication devices (radios), GPS navigation systems, emergency lighting systems, water tankers, foam generators, aerial platforms (platform ladders), and water monitors.

c. Police Car: Two-way radios, emergency lights, sirens, handcuffs, first aid kits (bandages, antiseptics), firearms (if authorized), tasers (if authorized), pepper spray (if authorized), and GPS navigation systems.

d. Mobile Command Center: Satellite communication systems, computers, printers, scanners, fax machines, telephones, radios, GPS navigation systems, and emergency lighting systems.

e. Search and Rescue Vehicle: Winches, ropes, pulleys, shovels, axes, saws, first aid kits, communication devices (radios), GPS navigation systems, and emergency lighting systems.

Tools and Equipment:

a. Welding equipment (welding machines, welding rods, welding helmets, welding gloves)

b. Power tools (drills, saws, grinders, sanders)

c. Hand tools (screwdrivers, pliers, wrenches, hammers)

d. Ladders (step ladders, extension ladders)

e. Scaffolding (tube and clamp scaffolding, system scaffolding)

f. Cranes (mobile cranes, tower cranes)

g. Hoists (electric hoists, manual hoists)

- h. Generators (diesel generators, petrol generators)
 - i. Lighting equipment (floodlights, work lamps, headlamps)
 - j. Safety equipment (hard hats, safety glasses, safety shoes, safety vests)
 - k. Communication equipment (radios, walkie-talkies, intercom systems)
 - l. Material handling equipment (forklifts, pallet trucks, conveyors)
- Other Requirements:
- a. Maintenance and repair equipment (spare parts, lubricants, grease, oil)
 - b. Training and certification programs for operators and technicians
 - c. Regular inspections and maintenance schedules
 - d. Safety protocols and procedures
 - e. Emergency response plans
 - f. Liability insurance and risk management strategies
 - g. Regulatory compliance and permits
 - h. Transport and logistics planning
 - i. Budgeting and financial planning
 - j. Project management and coordination.

Subject: 6 Artificial Intelligence in Automotive Service

Mapped to ASC/N1315

Core-Elective-3

Terminal Outcomes:

Enhanced Learning Experience:

- **Personalized Learning Paths:** AI can analyze the performance of individual learners and tailor training modules to address specific needs and weaknesses. This personalized approach can optimize the learning experience, ensuring that each participant receives the necessary information at their own pace.

Simulation and Virtual Reality Training:

- **Realistic Simulations:** AI can be used to create realistic simulations and virtual reality environments for hands-on training. This allows trainees to practice various automotive service

procedures in a risk-free and controlled setting, enhancing their skills before working on actual vehicles.

Predictive Maintenance Training:

- Predictive Analytics: AI algorithms can analyze historical data to predict when a vehicle might require maintenance. Training modules can incorporate this predictive maintenance aspect, teaching technicians to proactively address potential issues before they lead to major failures.

Diagnostic Assistance:

- AI-Powered Diagnostics: Training modules can include AI systems that assist technicians in diagnosing complex vehicle issues. These systems can analyze sensor data, interpret error codes, and provide recommendations for troubleshooting and repair.

Duration: <30:00>	Duration: <60:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Introduction to AI in Automotive Industry:</p> <ul style="list-style-type: none"> ● Define artificial intelligence and its relevance in the automotive sector. ● Explain the historical context and evolution of AI in automotive applications. <p>Basic AI Concepts:</p> <ul style="list-style-type: none"> ● Understand foundational AI concepts such as machine learning, deep learning, neural networks, and natural language processing. ● Explain how these concepts relate to automotive applications. <p>Sensor Technologies:</p> <ul style="list-style-type: none"> ● Explore various sensors used in automotive systems. ● Understand how AI integrates with sensor technologies for data collection and analysis. <p>Data Processing and Analysis:</p> <ul style="list-style-type: none"> ● Learn about data preprocessing techniques for automotive datasets. ● Understand the role of AI in analyzing large volumes of data generated by vehicles. <p>Machine Learning in Automotive Systems:</p> <ul style="list-style-type: none"> ● Explore applications of machine learning in predictive maintenance, fault detection, and diagnostics. ● Understand how machine learning 	<p>Diagnostic and Predictive Maintenance Skills:</p> <ul style="list-style-type: none"> ● Learn to use AI-powered diagnostic tools for faster and more accurate identification of vehicle issues. ● Gain expertise in predictive maintenance techniques that leverage AI algorithms to anticipate potential failures before they occur. <p>Data Analysis and Interpretation:</p> <ul style="list-style-type: none"> ● Acquire skills in handling and interpreting large sets of automotive data. ● Understand how AI algorithms analyze data to identify patterns, trends, and anomalies relevant to vehicle performance. <p>AI-Integrated Repair Procedures:</p> <ul style="list-style-type: none"> ● Learn to use AI-guided repair procedures for efficient and effective troubleshooting. ● Understand how AI can assist in recommending the most suitable repair methods based on the specific issue. <p>Human-Machine Collaboration:</p> <ul style="list-style-type: none"> ● Develop the ability to work seamlessly with AI systems in a collaborative environment. ● Understand how to leverage AI assistance to enhance decision-making and problem-solving capabilities. <p>Sensor and IoT Integration:</p> <ul style="list-style-type: none"> ● Gain knowledge of sensors and IoT devices

<p>algorithms contribute to improving vehicle performance and reliability.</p>	<p>used in vehicles and how AI processes data from these sources.</p> <ul style="list-style-type: none"> ● Learn to interpret sensor data for diagnostics, predictive maintenance, and performance optimization.
<p>Classroom Aids:</p>	
<p>Whiteboard, marker pen, projector</p>	
<p>Tools, Equipment and Other Requirements</p>	
<p>Computers and Servers:</p> <ul style="list-style-type: none"> • High-performance computers or servers are essential for running complex AI algorithms and simulations. • Graphics Processing Units (GPUs) or Tensor Processing Units (TPUs) can accelerate machine learning computations. <p>Software Development Tools:</p> <ul style="list-style-type: none"> • Integrated Development Environments (IDEs) such as PyCharm, Jupyter Notebooks, or Visual Studio for coding and testing AI algorithms. • Version control systems like Git for collaborative software development. <p>Programming Languages:</p> <ul style="list-style-type: none"> • Python is widely used in the AI community. Libraries such as TensorFlow and PyTorch are popular for deep learning applications. • C++ and Java may be required for certain applications and integrations. <p>AI Frameworks:</p> <ul style="list-style-type: none"> • TensorFlow, PyTorch, Keras, and scikit-learn for building and training AI models. • OpenCV for computer vision applications. <p>Simulators:</p> <ul style="list-style-type: none"> • Simulators like CARLA, AirSim, or similar tools for simulating automotive environments and scenarios for training AI models. 	

Subject: 7 Environmental Studies

Mapped to ASC/N9843

Terminal Outcomes:

- Terminal outcomes of environmental studies represent the culmination of knowledge and skills gained through the study of environmental science, ecology, conservation, sustainability, and related disciplines. These outcomes reflect an individual's understanding of environmental issues, their ability to contribute to sustainable practices, and their capacity to address complex environmental challenges.
- Environmental Awareness: Develop a comprehensive awareness of the interconnectedness of natural systems, human activities, and the impact of environmental changes.
- Ecosystem Understanding: Gain an in-depth understanding of various ecosystems, their components, interactions, and the role of biodiversity in maintaining ecological balance.
- Sustainability Principles: Master the principles of sustainability, including resource conservation, renewable energy adoption, and waste reduction to ensure a balanced and resilient environment.

- **Environmental Policy Knowledge:** Understand local, national, and international environmental policies, regulations, and agreements that govern environmental protection and conservation.

Duration: <60:00>	Duration: <90:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Interconnectedness of Systems: Understand how ecosystems, climate, geology, hydrology, and human activities are interconnected and influence one another. • Ecosystem Dynamics: Gain knowledge of ecosystem components, energy flows, nutrient cycles, and ecological succession, and how disturbances impact ecosystems. • Biodiversity and Species Interactions: Learn about biodiversity, species interactions, ecological niches, and the importance of preserving biological diversity. • Environmental Ethics and Philosophy: Explore different ethical perspectives related to the environment, addressing issues of intrinsic value, anthropocentrism, and eco-centric values. • Ecological Footprints and Carrying Capacity: Grasp the concepts of ecological footprints and carrying capacity, understanding how human activities impact natural resources and ecosystems. 	<ul style="list-style-type: none"> • Field Research Techniques: Develop skills in conducting field studies, including data collection, observation, sampling, and recording relevant environmental data. • Ecosystem Monitoring: Gain hands-on experience in monitoring and assessing the health and biodiversity of ecosystems, identifying indicators of environmental changes. • Biodiversity Identification: Acquire proficiency in identifying various plant and animal species, understanding their ecological roles and contributions to ecosystems. • Sustainability Practices: Implement sustainable practices in daily life, such as reducing energy consumption, practicing responsible waste management, and promoting eco-friendly behaviors. • Environmental Impact Assessments: Participate in or conduct environmental impact assessments for development projects to evaluate potential effects on natural resources and ecosystems. • Data Analysis and Interpretation: Learn to analyze environmental data using statistical tools, interpret findings, and draw conclusions for informed decision-making.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
Field Research and Data Collection:	
<ul style="list-style-type: none"> • Field Notebooks: For recording observations, data, and notes during field studies. • GPS Device: To accurately record geographical coordinates of study sites. • Binoculars: For bird watching and observing wildlife from a distance. • Camera: To document field observations, landscapes, and species. • Measuring Tools: Such as measuring tape, ruler, and callipers for taking measurements in the field. • Soil Sampling Kits: For collecting soil samples for analysis. • Water Sampling Equipment: Including water bottles, water quality meters, and sampling kits for collecting water samples. 	

Subject 8: Employability Skills (120 Hours)

Mapped to DGT/VSQ/N0104

Terminal Outcomes:

- Discuss about Employability Skills in meeting the job requirements

Duration: <48:00>	Duration: <72:00>
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Adaptability and Flexibility: Understand the importance of adapting to changing circumstances, learning new skills, and embracing challenges. • Leadership and Decision-Making: Develop leadership qualities, decision-making skills, and the ability to take initiative in various situations. • Ethical and Professional Conduct: Understand professional ethics, integrity, and the importance of maintaining a positive reputation in the workplace. • Cultural Awareness and Diversity: Gain cultural competence, respect for diversity, and the ability to work harmoniously in multicultural environments. • Financial Literacy: Understand basic financial concepts, budgeting, and financial planning for personal and career development. • Continuous Learning: Develop a growth mindset and recognize the importance of continuous learning and professional development. • Negotiation Skills: Learn negotiation techniques for salary discussions, contract agreements, and other workplace situations. 	<ul style="list-style-type: none"> • Adaptation to Change: Navigate unexpected changes or challenges and demonstrate adaptability in adjusting to new circumstances. • Leadership Opportunities: Take leadership roles in group projects, demonstrating initiative, decision-making, and the ability to guide a team. • Ethical Dilemmas: Analyze ethical dilemmas and make informed decisions that align with professional ethical standards. • Cultural Sensitivity: Engage in cross-cultural interactions or projects to demonstrate cultural awareness and sensitivity. • Budgeting and Financial Planning: Create personal budgets and financial plans, demonstrating basic financial literacy and planning skills. • Continuous Learning Initiatives: Engage in online courses, workshops, or self-directed learning to acquire new skills and stay updated in the field. • Negotiation Scenarios: Participate in negotiation exercises to practice salary negotiations or contract discussions.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
Networking Events: Attend career fairs, conferences, and industry meetups to connect with professionals, recruiters, and potential employers.	
Online Learning Platforms: Websites like Coursera, Udemy, and LinkedIn Learning offer courses to enhance specific skills relevant to your career goals.	
Personal Branding Resources: Learn how to create an effective LinkedIn profile and develop an online presence that showcases your skills and accomplishments.	

Communication Skill Tools: Practice communication skills using platforms like Toastmasters or practice public speaking through video recordings.

Problem-Solving Scenarios: Participate in case competitions, hackathons, or workshops that challenge your problem-solving abilities.

Time Management Apps: Use apps like Trello, Asana, or Todoist to organize tasks, set priorities, and manage deadlines effectively.

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	2	Mechanical/Automobile/ Electrical/ Electronics	1	Mechanical/Automobile/ Electrical/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/Automobile/ Electrical/ Electronics	0	Mechanical/Automobile/ Electrical/ Electronics	NA

Trainer Certification	
Domain Certification	Platform Certification
“Automobile Lead Technician (Diagnostics) score is 80%.	Recommended that the Assessor is certified for the job role “Assessor (VET and Skills)”, Mapped to Qualification Pack: MEP/Q2701, V2.0” Minimum accepted score is 80%.

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	6	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/Automobile/ Electrical/ Electronics	1	Mechanical/Automobile/ Electrical/ Electronics	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/Automobile/ Electrical/ Electronics	0	Mechanical/Automobile/ Electrical/ Electronics	NA

Assessor Certification	
Domain Certification	Platform Certification
“Automobile Lead Technician (Diagnostics) , version 1.0”. Minimum accepted score is 80%.	“Recommended that the Assessor is certified for the job role “Assessor (VET and Skills)”, Mapped to Qualification Pack: MEP/Q2701, V2.0” Minimum accepted score is 80%.

Assessment Strategy

1. Assessment System Overview:
 - Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
 - Assessment agencies send the assessment confirmation to VTP/TC looping SSC
 - Assessment agency deploys the ToA certified Assessor for executing the assessment
 - SSC monitors the assessment process & records
2. Testing Environment:
 - Confirm that the centre is available at the same address as mentioned on SDMS or SIP
 - Check the duration of the training.
 - Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
 - If the batch size is more than 30, then there should be 2 Assessors.
 - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
 - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
 - Confirm the number of TABs on the ground is correct to execute the Assessment smoothly.
 - Check the availability of the Lab Equipment for the particular Job Role.
3. Assessment Quality Assurance levels / Framework:
 - Question papers created by the Subject Matter Experts (SME)
 - Question papers created by the SME verified by the other subject Matter Experts
 - Questions are mapped with Semester-wise Curriculum.
 - Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
 - Assessor must be ToA certified & trainer must be ToT Certified
 - Assessment agency must follow the assessment guidelines to conduct the assessment
4. Types of evidence or evidence-gathering protocol:
 - Time-stamped & geotagged reporting of the assessor from assessment location
 - Centre photographs with signboards and scheme specific branding
 - Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
 - Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos
5. Method of verification or validation:
 - Surprise visit to the assessment location
 - Random audit of the batch
 - Random audit of any candidate
6. Method for assessment documentation, archiving, and access
 - Hard copies of the documents are stored
 - Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage
 - Soft copies of the documents & photographs of the assessment are stored in the Hard Drives

References

Glossary

Term	Description
Declarative Knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning Outcome	Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
OJT	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective or psychomotor skills.
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.
Terminal Outcome	Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
SOP	Standard Operating Procedure
WI	Work Instructions
PPE	Personal Protective equipment