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AUTOMOTIVE MECHATRONICS

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - November, 2019

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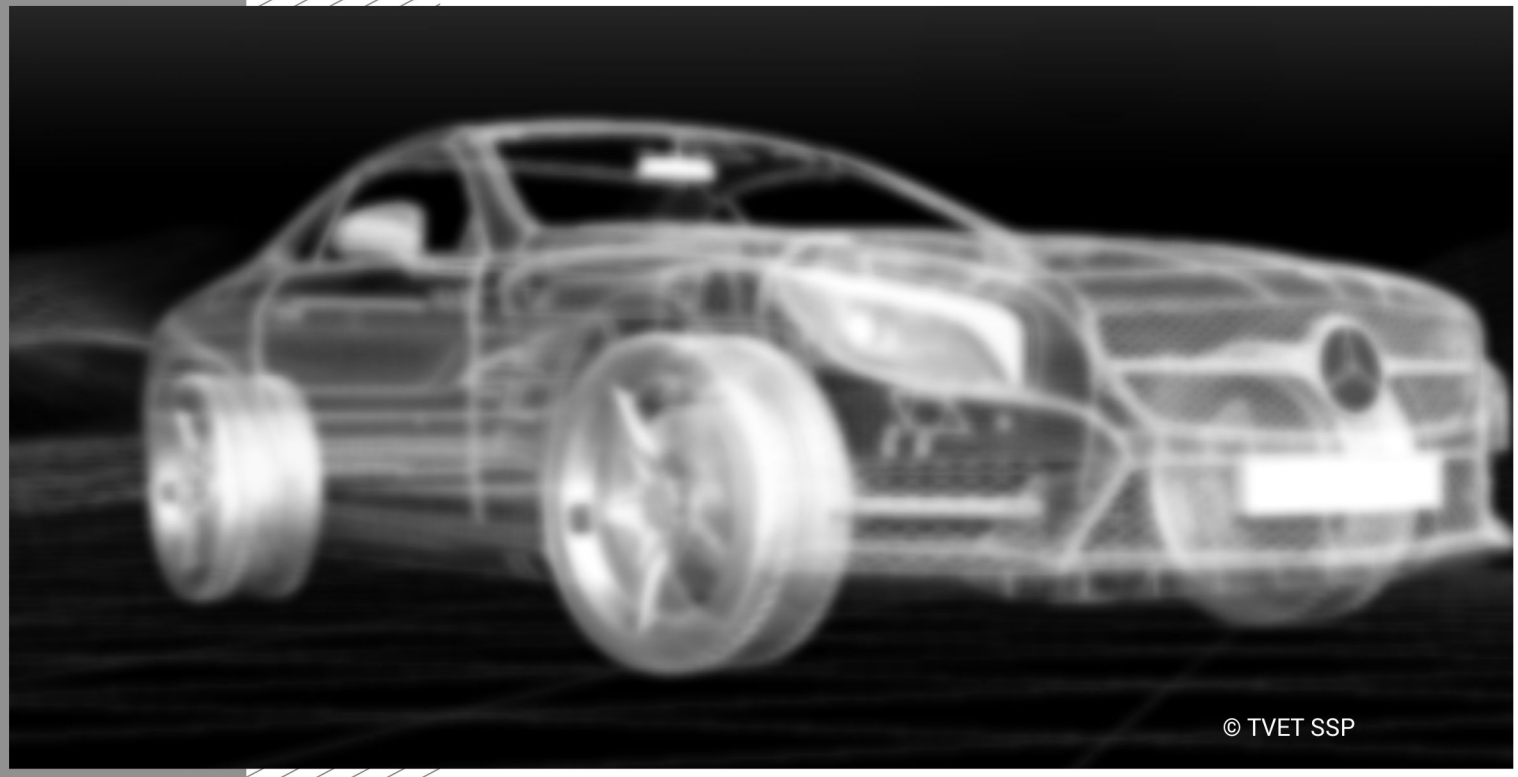

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Introduction

Definition/ Description of the training program for Automotive Mechatronics L*ev-2*

Automotive Mechatronics field is in demand across the country and abroad. Mechatronics combines principles of mechanics, electronics and computing to improve technical systems and to create new equipment with built-in 'artificial intelligence'. In this qualification, trainees will maintain engine assembly, fuel system, engine lubrication brake system and suspension system. Trainees will learn to service engine cooling system and electrical system. They will learn to check vehicle transmission system and perform on-board diagnostic (OBD-II) scanner operations. They will also learn to maintain personal health, hygiene & safety, perform basic communication skills, dispose of the waste materials and demonstrate basic numeracy skills, by which they will be able to work in a safe & professional environment.

The purpose of the Automotive Mechatronics course is to engage young people with a program of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. Upon completion of this qualification, trainees will be ready to join the workforce with a healthy number of options in automobile industry.

Overall objectives of training program

The overall objectives of the Automotive Mechatronics program are:

- Managing an Automobile Workshop (technically and economically)
- Selecting tools and equipment used to maintain ignition, fuel control, controlled brake system and to service comfort and safety system
- Selecting tools, equipment's and consumables accurately according to Job specification
- Sequencing the different stages of preparation, diagnosis and maintenance
- Working safely and professionally

Competencies to be gained after completion of course

At the end of the course, the trainee must have attained the following competencies:

1. Comply Personal Health and Safety Guidelines
2. Communicate the Workplace Policy and Procedure
3. Perform Basic Communication (Specific)
4. Perform Basic Computer Application (Specific)
5. Maintain Engine Assembly

6. Maintain Fuel System
7. Service Engine Cooling System
8. Maintain Engine Lubrication System
9. Maintain Brake System
10. Maintain Suspension System
11. Check Vehicle Transmission System
12. Service Electrical System
13. Perform On-Board Diagnostic (OBD-II) scanner Operations

Possible available job opportunities available immediately and later in the future

After completing the Automotive Mechatronics course, the certified candidates are employed in automobile industry. Experienced technicians may advance through promotions with the same employer or by moving to more advanced positions with other employers. They can become:

- Automobile Technicians
- Spare Parts Dealers

Some experienced Automotive Mechatronics technicians achieve a highly respected level of salaries. There are good prospects for travel both within Pakistan and abroad. The employment outlook in this occupation will be influenced by a wide variety of factors including:

- Trends and events affecting overall employment (especially in Automobile Industry)
- Location in Pakistan
- Employment turnover (work opportunities generated by people leaving existing positions)
- Occupational growth (work opportunities resulting from the creation of new positions that never existed before)
- Size of the industry
- Flexibility of the applicant (concerning location and schedule of work)

Trainee entry level

Middle (Grade 8).

Minimum qualification for trainer

Must hold at least level 3 qualification in Automotive Mechatronics; or

B-Tech (Hons) / B.Sc. Eng. Tech. with 3 years relevant experience; or

Diploma of Associate Engineer (DAE) with 5 years relevant work experience; or He/she should hold or be working towards a formal teaching qualification.

Other formal qualifications in the Automobile industry would be useful in addition to the above.

Recommended trainer: trainee ratio

The recommended maximum trainer: trainee ratio for this program is 1 trainer for 20 trainees

Medium of instruction i.e. language of instruction

Instructions will be in Urdu/English/Local language.

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

This curriculum comprises 13 modules. The recommended delivery time is 600 hours. Delivery of the course could therefore be full time, 5 days a week, for 6 months. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follows:

Module	Theory hours	Workplace hours	Total hours
Module 1: Comply Personal Health and Safety Guidelines			30
Module 2: Communicate the Workplace Policy and Procedure			20
Module 3: Perform Basic Communication (Specific)			30
Module 4: Perform Basic Computer Application (Specific)			40
Module 5: Maintain Engine Assembly	16	34	50
Module 6: Maintain Fuel System	12	38	50
Module 7: Service Engine Cooling System	12	38	50
Module 8: Maintain Engine Lubrication System	06	24	30
Module 9: Maintain Brake System	16	34	50
Module 10: Maintain Suspension	20	40	60

Module	Theory hours	Workplace hours	Total hours
System			
Module 11: Check Vehicle Transmission System	10	40	50
Module 12: Service Electrical System	20	50	70
Module 13: Perform On-Board Diagnostic (OBD-II) scanner Operations	11	39	50

Sequence of the modules

This qualification is made up of 13 modules. A suggested distribution of these modules is presented overleaf. This is not prescriptive and training providers may modify this if they wish.

Module 1; maintain personal health, hygiene & safety; covers various aspects related to occupational health & safety that are required for the students to understand in order to work in a safe environment. 5 modules relate to the maintenance task of different system of a vehicle, for example module 2; maintain engine assembly, module 3; maintain fuel system, module 5; maintain engine lubrication system, module 6; maintain brake system and module 7 ; maintain suspension system. 3 other modules are also comprises to the service and maintenance of a vehicle for example module 4; service engine cooling system, module 8; check vehicle transmission system and module 9; service electrical system. Module 10; perform on-board diagnostic (OBD-II) scanner operations is relating to cover the operational procedures of diagnosis the faults in a vehicle that an Automotive Mechatronics technician must learn and understand in order to become an effective professional. These modules are interdependent and need to be delivered in parallel. This is illustrated in the distribution table.

Each module covers a range of learning components. These are intended to provide detailed guidance to teachers (for example the Learning Elements component) and give them additional support for preparing their lessons (for example the Materials Required component). The detail provided by each module will contribute to a standardized approach to teaching, ensuring that training providers in different parts of the country have clear information on what should be taught. Each module also incorporates the industrial demand of Pakistan that make this qualification unique to Pakistan’s industry needs.

The distribution table is shown below:

Module 5: Maintain Engine Assembly 50 hours	**Module 8:** Maintain Engine Lubrication System 30 hours	**Module 7:** Service Engine Cooling System 50 hours	**Module 1:** Comply Personal Health and Safety Guidelines 30 hours
Module 6: Maintain Fuel System 50 hours	**Module 11:** Check Vehicle Transmission 50 hours	**Module 10**: Maintain Suspension System 60 hours	**Module 2**: Communicate the Workplace Policy and Procedure 20 hours
Module 9: Maintain Brake System 50 hours	**Module 13:** Perform On-Board Diagnostic (OBD-II) scanner Operations 50 hours		**Module 3:** 30 hours Perform Basic Communication (Specific)

Module 12:

Service Electrical System

70 hours

Module 4:

Perform Basic Computer Application (Specific)

40 hours

Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 1: Comply Personal Health and Safety Guidelines **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to comply personal health and safety guidelines	**LU 1:** Identify Personal Hazards at Workplace **LU 2:** Apply Personal Protective and Safety Equipment (PPE) **LU 3:** Comply Occupational Safety and Health (OSH) **LU 4:** Dispose of hazardous Waste/materials from the designated area			30 Hrs
Module 2: Communicate the Workplace Policy and Procedure **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to communicate the workplace policy and procedure	**LU 1:** Identify workplace communication procedures **LU 2:** Communicate at workplace **LU 3:** Draft Written Information **LU 4:** Review Documents			20 Hrs
Module 3: Perform Basic Communication (Specific) **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perform basic communication (specific)	**LU 1:** Communicate in a team to achieve intended outcomes **LU 2:** Follow Supervisor's instructions as per organizational SOPs **LU 3:** Develop Generic communication skills at workplace			30 Hrs

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 4: Perform Basic Computer Application (Specific) **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perform basic computer application (specific)	**LU 1:** Create Word Documents **LU 2:** Use internet for Browsing			40 Hrs
Module 5: 071400942 **Maintain Engine Assembly** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain engine assembly	**LU 1:** Remove & Refit Engine Head Assembly **LU 2:** Remove & Refit Engine Block Assembly **LU 3:** Set Engine Timings **LU 4:** Couple Engine & Transmission	16 Hrs	34 Hrs	50 HRS
Module 6: 071400943 **Maintain Fuel System** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain fuel system	**LU 1:** Service Fuel Injectors and Rail **LU 2:** Repair Fuel Pump **LU 3:** Perform Carburettor Service **LU 4:** Perform Throttle Body Service	12 Hrs	38 Hrs	50 HRS
Module 7: 071400944 **Service Engine Cooling System** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to service engine cooling system	**LU 1:** Perform Radiator Service **LU 2:** Perform Radiator Fan Service **LU 3:** Evaluate Thermostat Valve Performance **LU 4:** Evaluate Water Pump Performance	12 Hrs	38 Hrs	50 HRS

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 8: 071400945 **Maintain Engine Lubrication System** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain engine lubrication system	**LU 1:** Test Performance of Oil Pressure Switch **LU 2:** Service Oil Pump **LU 3:** Investigate & Repair Oil Leakages	06 Hrs	24 Hrs	30 HRS
Module 9: 071400946 **Maintain Brake System** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain brake system	**LU 1:** Perform Maintenance of Mechanical Brake System **LU 2:** Perform Maintenance of Hydraulic Brake System **LU 3:** Perform Maintenance of Pneumatic Brake System	16 Hrs	34 Hrs	50 HRS
Module 10: 071400947 **Maintain Suspension System** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain suspension system	**LU 1:** Check Performance of McPherson Strut **LU 2:** Check Tie Rod Performance **LU 3:** Check Performance of Coil Spring Sagging **LU 4:** Test Performance of Stabilizer Bar **LU 5:** Test Knuckle Assembly Operations **LU 6:** Check Performance of Upper & Lower Suspension Arms **LU 7:** Test Differential System **LU 8:** Test Axle Assembly **LU 9:** Maintain Wheel Alignment **LU 10:** Maintain Wheel Balancing	20 Hrs	40 Hrs	60 HRS

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 11: 071400948 **Check Vehicle Transmission System** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to check vehicle transmission system	**LU 1:** Check Performance of Manual Transmission **LU 2:** Check Performance of Mechanical Clutch System **LU 3:** Check Performance of Hydraulic Clutch System	10 Hrs	40 Hrs	50 HRS
Module 12: 071400949 **Service Electrical System** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to service electrical system	**LU 1:** Check Performance of Ignition System **LU 2:** Test Performance of Fuses & Relays **LU 3:** Service Lighting System **LU 4:** Test Performance of Alternator **LU 5:** Service Self-Starting System	20 Hrs	50 Hrs	70 HRS
Module 13: 071400950 **Perform On-Board Diagnostic (OBD-II) Scanner Operations** **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perform On-Board diagnostic scanner operation	**LU 1:** Perform Scanning & Diagnoses **LU 2:** Investigate OBD-II for Fault Analysis **LU 3:** Check Vehicle's Mechanical Parameters of OBD-II Operations **LU 4:** Maintain OBD-II Scanner	11 Hrs	39 Hrs	50 HRS

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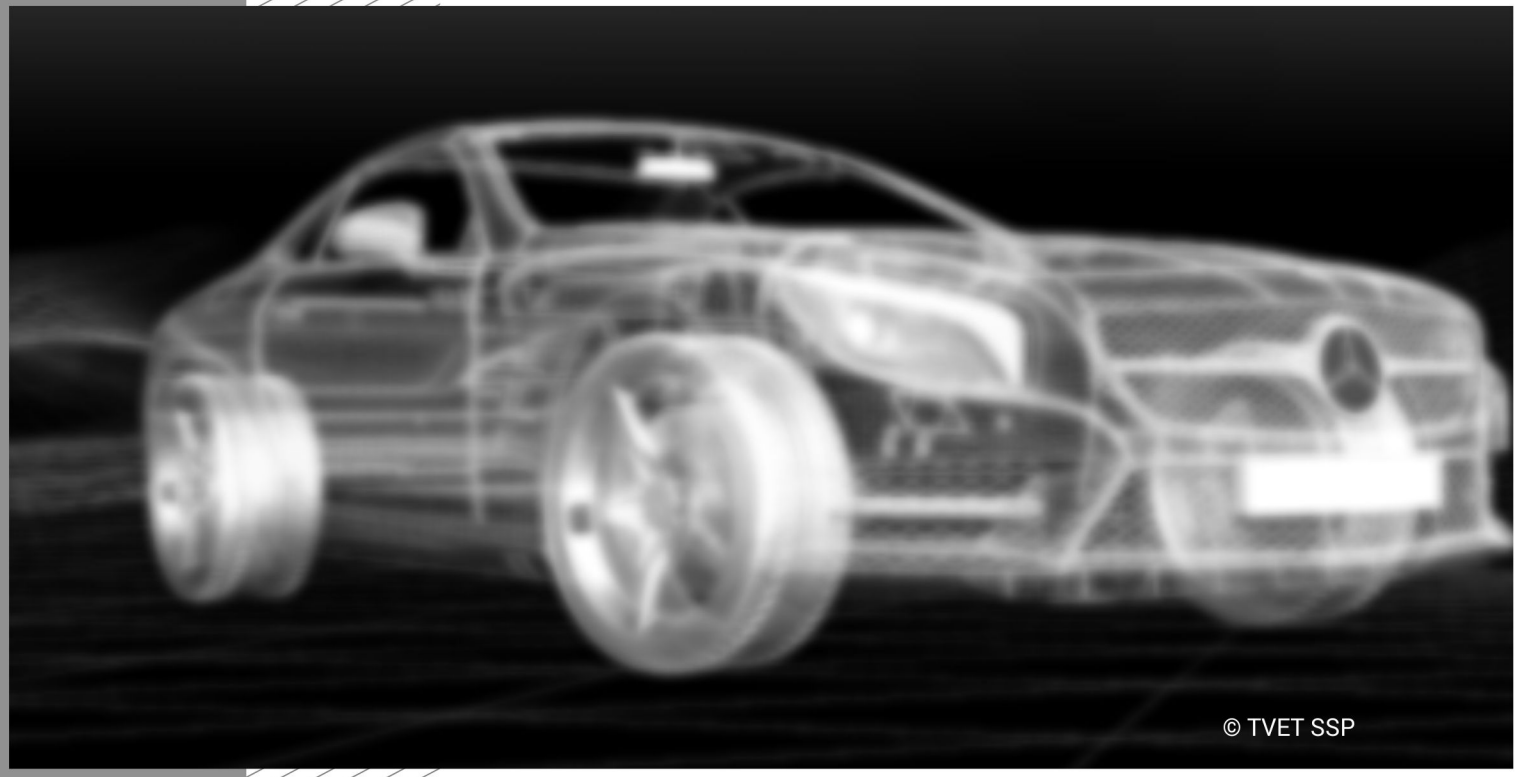

Module-1

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Modules

Module 1: Comply Personal Health and Safety Guidelines

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to comply personal health and safety guidelines.

Duration: 30 Hrs **Theory: Hrs** **Practical: Hrs**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Identify Personal Hazards at Workplace	**The trainee will be able to:** Identify risk to personal health Identify hygiene and safety at work place Identify processes Identify tools, equipment and consumable materials that have the potential to cause harm Report, identified risk to Health, hygiene and safety to concerned				
LU 2: Apply Personal Protective and Safety Equipment (PPE)	**The trainee will be able to:** List the Personal Protective equipment				

	Select personal protective equipment in terms of type and quantity according to work orders. Wear personal protective equipment according to job requirements. Clean personal protective equipment Stored Personal Protective equipment in proper place after use.				
LU 3: Comply Occupational Safety and Health (OSH)	**The trainee will be able to:** Maintain cleanliness and hygiene as per organizational policy Comply with Health, hygiene and safety precautions before starting work Comply organizational Health, hygiene and safety guidelines during work				

	Deal with resolvable problems according to prescribed procedures Report un resolvable problems to concerned Place the tools equipment etc at their prescribed place after completion of work				
LU 4: Dispose of hazardous Waste/materials from the designated area.	**The trainee will be able to:** Identify hazardous waste materials which needs to be disposed off Segregate hazardous or non-hazardous waste carefully from the designated area as per approved procedure Use proper disposal hazardous containers for dispose-off hazardous waste as per procedure Take necessary precautions like putting masks and gloves while disposing hazardous waste/ materials as per standard operating procedure				

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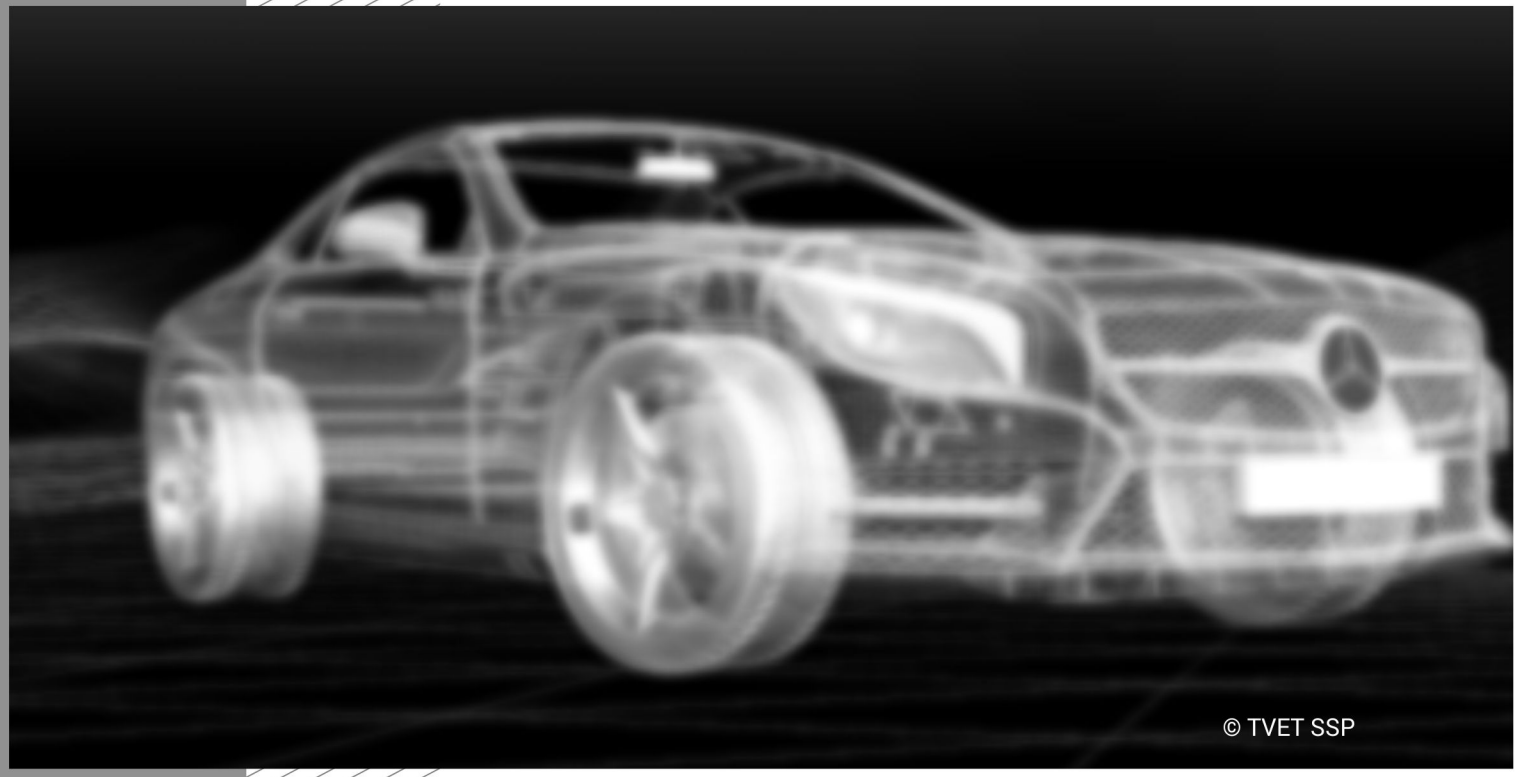

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Module 2: Communicate the Workplace Policy and Procedure

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to communicate the workplace policy and procedure.

Duration: 20 Hrs **Theory: Hrs** **Practical: Hrs**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Identify workplace communication procedures	**The trainee will be able to:** Identify organizational communication requirements and workplace procedures with assistance from relevant authority Identify appropriate lines of communication with supervisors and colleagues. Seek advice on the communication method/equipment most appropriate for the task				
LU 2: Communicate at workplace	**The trainee will be able to:** Use effective questioning, and active				

	listening and speaking skills to gather and convey information Use appropriate non-verbal behavior at all times Encourage, acknowledge and act upon constructive feedback				
LU 3: Draft Written Information	**The trainee will be able to:** Identify and comply with required range of written materials in accordance with organizational policy and procedures Draft and present assigned written information for approval, ensuring it is written clearly, concisely and within designated timeframes. Ensure written information meets				

	required standards of style, format and detail. Seek assistance and/or feedback to aid communication skills development				
LU 4: Review Documents	**The trainee will be able to:** Check draft for suitability of tone for audience, purpose, format and communication style Check draft for readability, grammar, spelling, sentence and paragraph construction and correct any inaccuracies or gaps in content. Check draft for sequencing and structure Check draft to ensure it meets organizational				

	requirements Ensure draft is proofread, where appropriate, by supervisor or colleague				

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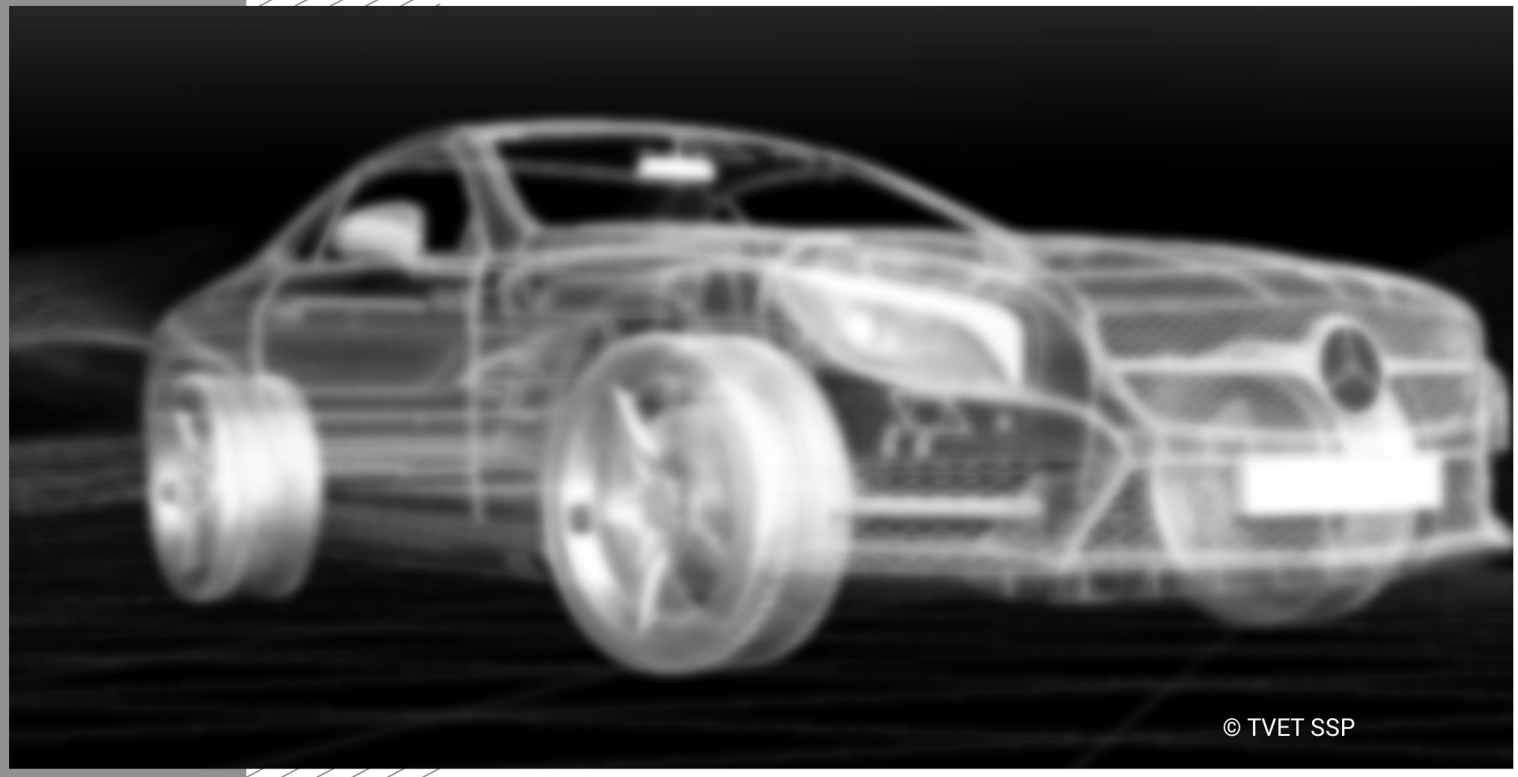

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Module 3: Perform Basic Communication (Specific)

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to perform basic communication.

Duration: 30 Hrs **Theory: Hrs** **Practical: Hrs**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Communicate in a team to achieve intended outcomes	**The trainee will be able to:** Treat team members with respect Maintain positive relationships to achieve common organizational goals Get work related information from team Identify interrelated work activities to avoid confusion Adopt communication skills, which are designed in a team. Identify problems in communication with a team Resolve				

	Communication barrier through discussion and mutual agreement				
LU2. Follow Supervisor's instructions as per organizational SOPs	**The trainee will be able to:** Receive the instructions from Supervisor Carry out the instructions of the supervisor Report to the supervisor as per organizational SOPs.				
LU 3. Develop Generic communication skills at workplace	**The trainee will be able to:** Develop basic reading skills Develop Basic writing Skills Develop basic listening skills Place the tools equipment etc. at their prescribed place after completion of work				

Module 4: Perform Basic Computer Application (Specific)

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to perform basic computer application.

Duration: 40 Hrs **Theory: Hrs** **Practical: Hrs**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Create Word Documents	**The trainee will be able to:** Open word processing application Create a word document Customize page layout with relevant name setting Set up page in a word document Edit word document as required Use simple formatting tools when creating the document Save word document to directory Insert table in a word document Insert appropriate images into document				

	as necessary Insert header/footer in a word document Insert section break in a word document Set style in word document Select basic Print settings Print the document				
LU 2: Use internet for Browsing	**The trainee will be able to:** Use search engines to open website Search data on different topics Refine search to increase relevance of information or content Navigate a website to access the information or content required.				

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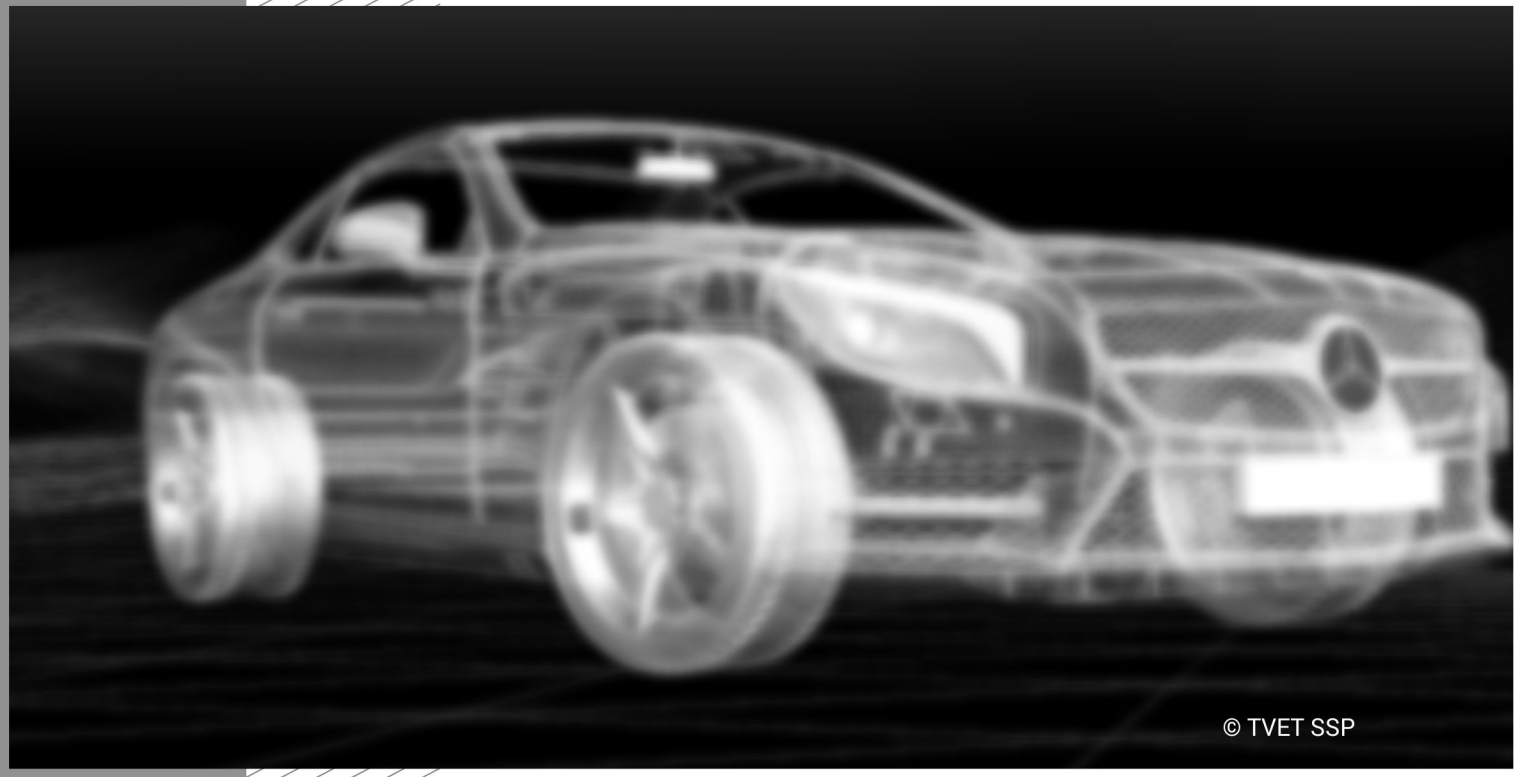

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Module 5: 071400942 Maintain Engine Assembly

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to maintain engine assembly.

Duration: 50 Hrs **Theory:** 16 Hrs **Practical:** 34 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Remove & Refit Engine Head Assembly	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Remove the inlet and exhaust manifold Remove the cylinder head cover Remove cylinder head bolts Remove cam gear by using cam puller Remove the camshaft and cam bearings Remove valve and valve springs using valve lifter Check cylinder head for flatness or warped/twisted Inspect and verify the fault Refit Engine Head	Operational knowledge and understanding of tools/equipment, required for remove & refit engine head assembly **Tools:** For example valve lifter, ring compressor, ring expander, plier set, engine hoist, hydraulic jack, combination spanner set, Allen key set Determining engine types (i.e. 2 stroke, 4 stoke, Petrol Engine, Diesel Engine etc.) and main parts of engine head assembly (i.e. Cylinder Head, Tappet Cover, Valves, Valve Guides, Cam Shaft, Intake Manifold, Exhaust Manifold) Describing function of inlet and exhaust manifold Explaining valve timing and valve mechanism of engine Explaining procedure of disassembly and assembly of cylinder head including checking of cylinder head for warpage Explaining variable valve timing with intelligence (VVTI) and variable valve timing & lift electronic control (VTEC) Knowledge of Magnetic Particle Inspection	**Total** 18 Hrs **Theory:** 6 Hrs **Practical:** 12 Hrs	Compression Tester Valve Lifter Ring Compressor Ring Expander Plier set Engine Hoist Hydraulic Jack Combination Spanner Set Allen key Set Socket Set Oil filter spanner Torque Wrench Tool Trolley Engine mounts. Hammer Mallet Clutch plate alignment tool Engine Oil Kerosene Oil Lock Tight Silicon Tube Engine Gasket Set Emery Paper Cotton Waste Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	assembly as per the workshop manual Ensure housekeeping after completion of task	The importance of PPEs when remove and refit engine head assembly Importance of health and safety Importance of housekeeping			
LU 2: Remove & Refit Engine Block Assembly	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Remove the cylinder head cover Remove the cylinder head Remove oil sump/pan Remove Crank shaft front and rear Main oil seal Remove main Journal bearing caps. Remove Big end Journal bearing caps Refit Engine Block Assembly as per the workshop manual Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required for remove & refit engine block assembly Explaining main parts of engine block assembly (i.e. Cylinder Block, Crank Shaft, Piston, Rings, Connecting Rod, Flywheel, Main seal housing) Knowledge of crank and cam shaft function and their location Explaining function of engine components (i.e. Piston, Piston Rings, Cylinder Liner, Oil Galleries, Thrust Bearings) Describing types of Engine blocks (i.e. V Engine, Inline Block, Boxer Engines) Demonstrating procedure of disassembly and assembly of engine block as per vehicle's manual The importance of PPEs when remove and refit engine block assembly Importance of health and safety Importance of housekeeping	**Total** 18 Hrs **Theory:** 5 Hrs **Practical:** 13 Hrs	Compression Tester Valve Lifter Ring Compressor Ring Expander Plier set Engine Hoist Hydraulic Jack Combination Spanner Set Allen key Set Socket Set Oil filter spanner Torque Wrench Tool Trolley Engine mounts. Hammer Mallet	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

				Clutch plate alignment tool Engine Oil Kerosene Oil Lock Tight Silicon Tube Engine Gasket Set Cotton Waste Emery Paper Relevant PPEs	
LU 3: Set Engine Timings	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Set engine timing Start engine for idle running speed as per workshop manual Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to set engine timings Defining importance of engine timings Explaining procedure to adjusting timing gears Reading and understanding the workshop manual The importance of PPEs when set engine timings Importance of health and safety Importance of housekeeping	**Total** 7 Hrs **Theory:** 2 Hrs **Practical:** 5 Hrs	Compression Tester Plier set Engine Hoist Hydraulic Jack Combination Spanner Set Allen key Set Socket Set Torque Wrench Tool Trolley Engine mounts Hammer	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

				Mallet Clutch plate alignment tool Silicon Tube Cotton Waste Relevant PPEs	
LU 4: Couple Engine & Transmission	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Hold the engine assembly and transmission at same level Ensure transmission primary / input shaft centrally aligned with clutch plate drive hub. Insert transmission primary shaft into the clutch plate drive hub. Ensure Bell housing completely fix with engine rear side Fit engine and transmission bolts Apply torque as per workshop manual and fix the engine and	Operational knowledge and understanding of tools/equipment, required to Couple Engine & Transmission Explaining function of clutch assembly Describing parts (i.e. Clutch plate, Pressure plate, Flywheel, Clutch bearing) of clutch assembly Explaining procedure of disassembly/assembly of coupling engine and transmission The importance of PPEs when Couple Engine & Transmission Importance of health and safety Importance of housekeeping	**Total** 7 Hrs **Theory:** 3 Hrs **Practical:** 4 Hrs	Plier set Engine Hoist Hydraulic Jack Combination Spanner Set Allen key Set Socket Set Torque Wrench Tool Trolley Engine mounts. Hammer Mallet Clutch plate alignment tool Silicon Tube Cotton Waste Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	transmission Ensure housekeeping after completion of task				

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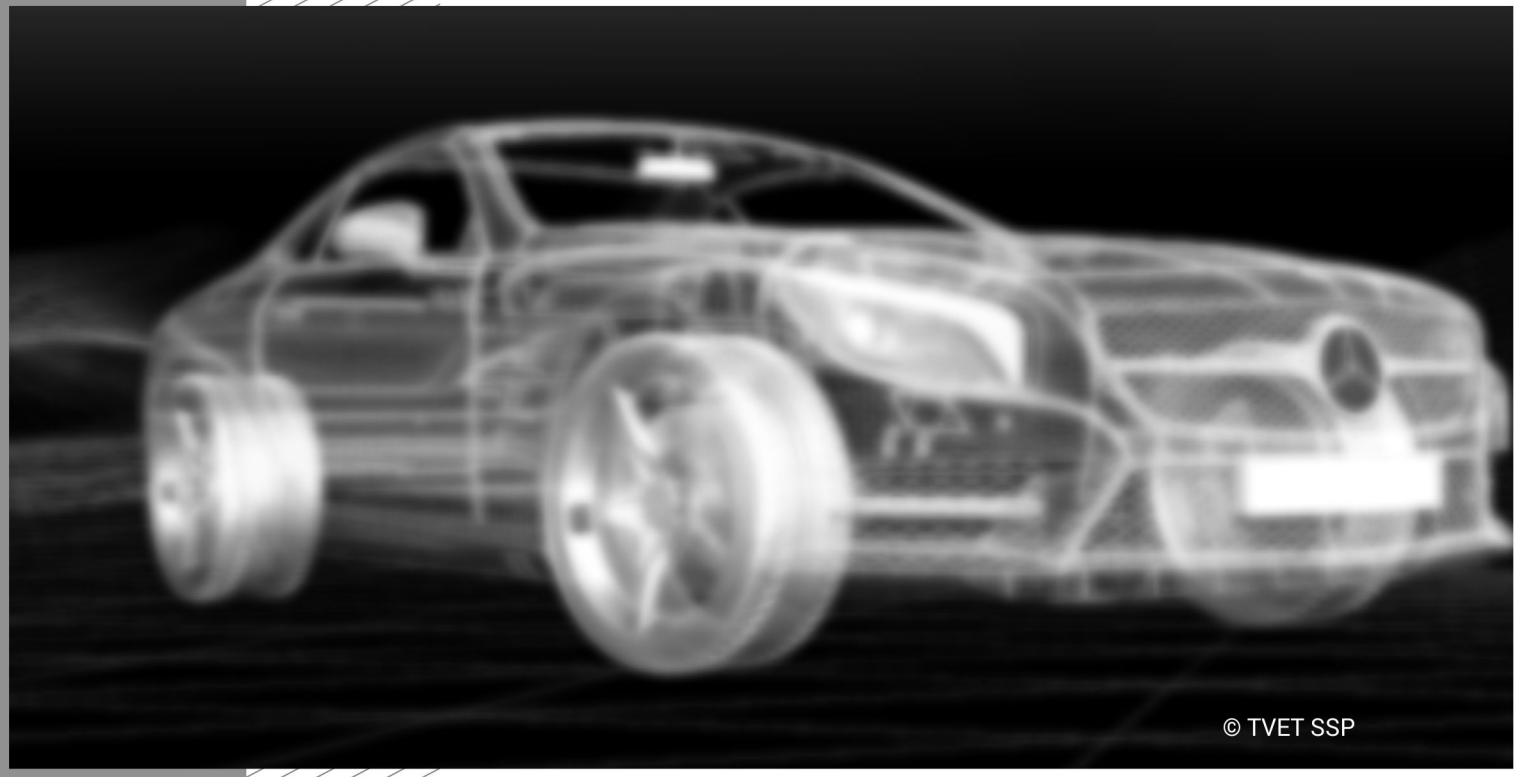

Module-6

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Module 6: 071400943 Maintain Fuel System

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to maintain fuel system.

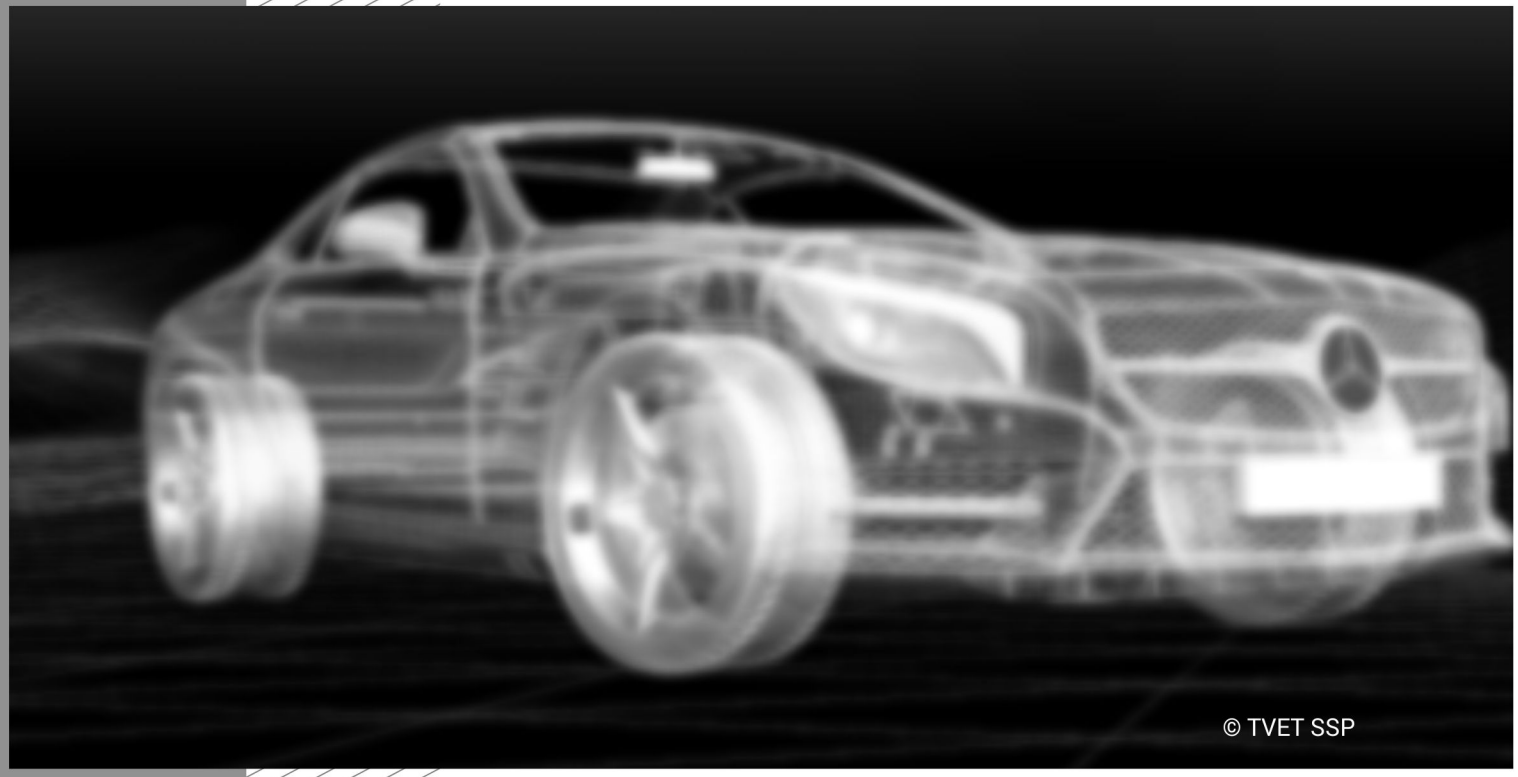
Duration: 50 Hrs **Theory:** 12 Hrs **Practical:** 38 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Service Fuel Injectors and Rail	**The trainee will be able to:** Select appropriate Tools and equipment. Ensure work safely at all times, complying with health and safety precautions, regulations and other relevant guidelines. Observe Fuel Injector condition through engine operation Check wire harness and connectors Check input supply of fuel injectors. Remove the air cleaner and accessories. Remove and Service of fuel injectors. Assemble the air cleaner and accessories Perform test drive. Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required for service fuel injectors and rail Explaining function and working of fuel system Defining types of fuel used in vehicles gasoline (Petrol), Diesel, LPG (Liquid petroleum gas) and CNG (compressed natural gas) Explaining and identifying parts of fuel system (i.e. Fuel Tanks, Fuel lines and rails, Fuel Pump, Fuel filter, Fuel injectors) Describing function of fuel injectors Understanding purpose and method to assemble air cleaner Servicing of injectors as per vehicle's manual The importance of PPEs when service fuel injectors and rail Importance of health and safety Importance of housekeeping	**Total** 15 Hrs **Theory:** 5 Hrs **Practical:** 10 Hrs	Injector cleaner Petrol Kerosene Oil Cotton waste Emery paper Silicon tube Teflon tape Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

LU 2: Repair Fuel Pump	**The trainee will be able to:** Select appropriate tools and equipment. Ensure work safely at all times, complying with health and safety precautions, regulations and other relevant guidelines. Diagnose physical damage or faulty fuel pump in vehicle (Diesel / Petrol) by applying prescribed diagnostic techniques. Check pressure of fuel pump Check vacuum of fuel pump. Repair/replace faulty fuel pump Ensure function of fuel pump after service of vehicle fuel system. Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to repair fuel pump Operational knowledge and understanding of types of fuel pumps (mechanical fuel pump, electrical fuel pump) Defining function of fuel pump Describing method of servicing fuel pumps including diagnostic techniques (i.e. pressure of fuel, vacuum of fuel) The importance of PPEs to repair fuel pump Importance of health and safety Importance of housekeeping	**Total** 15 Hrs **Theory:** 3 Hrs **Practical:** 12 Hrs	Petrol Kerosene Oil Cotton waste Emery paper Silicon tube Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Perform Carburettor Service	**The trainee will be able to:** Select appropriate tools and equipment. Ensure work safely at all times. Remove the engine air filter and accessories. Identify and adjust air fuel mixture adjustment screws. Test the engine carburettor at idle and while revving up.	Operational knowledge and understanding of tools/equipment, required to perform carburettor service Describing the types of carburettor and its various circuits. Operational knowledge and understanding of main parts of carburettor Identifying air filter Defining method to remove air filter	**Total** 12 Hrs **Theory:** 2 Hrs **Practical:** 10 Hrs	Petrol Kerosene Oil Cotton waste Emery paper Silicon tube Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	Identify the idle mixture screw; adjust it until the engine is idling smoothly, with no misfires or shakes, and at the proper speed. Assemble the air filter and accessories onto the carburettor Perform test drive. Ensure housekeeping after completion of task	Explaining procedure of disassembly and assembly of carburettor including its service method as per workshop manual Explaining purpose of mixture screws Defining procedure to adjust mixture screws to get smooth idling of engine The importance of PPEs to perform carburettor service Importance of health and safety Importance of housekeeping			
LU 4: Perform Throttle Body Service	**The trainee will be able to:** Select appropriate tools and equipment. Ensure work safely at all times. Observe idle speed of vehicle. Disconnect all connectors from throttle body Remove the mounting bolts of throttle body and its accessories Clean the throttle body with non-abrasive cleaner. Assemble the throttle body and accessories Perform test drive Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to perform throttle body service Defining throttle body assembly with accessories (pressure regulator, injector or injectors, TP sensor, idle speed control motor, throttle shaft) Explaining function of throttle body Describing servicing procedure of throttle body The importance of PPEs to perform throttle body service Importance of health and safety Importance of housekeeping	**Total** 08 Hrs **Theory:** 2 Hrs **Practical:** 6 Hrs	Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

AUTOMOTIVE MECHATRONICS



Module-7

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - November, 2019

Module 7: 071400944 Service Engine Cooling System

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to service engine cooling system.

Duration: 50 Hrs **Theory:** 12 Hrs **Practical:** 38 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Perform Radiator Service	**The trainee will be able to:** Select the tool and equipment according to the job requirement Disconnect all water, automatic transmission fluid (ATF) hoses and electric connections from radiator Remove radiator from vehicle Remove fan with shroud Service/replace the radiator Refit fan and shroud with radiator Refit the radiator in the engine Check leakages in cooling system Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to perform radiator service The importance of using the correct tools and equipment (as per job requirement), to perform the competence Operational knowledge and understanding of function and basic parts of cooling system (i.e. Radiator, Hoses, Water Jackets, Thermostat valve, Temperature Switch, Cooling Fan, Water Pump) Explaining purpose and function of coolant in cooling system Defining function of (heat exchanger) Radiator Identifying components of Radiator (i.e. Fins, Upper Tank, Lower Tank, Tubes, Pressure Cap and Drain Plug etc.) function of pressure cap valves (i.e. Pressure relief valve and Vacuum valve) The importance of PPEs when perform radiator service Importance of health and safety Importance of housekeeping	**Total** 14 Hrs **Theory:** 05 Hrs **Practical:** 09 Hrs	Relevant PPEs Wire Brush Combination Pliers Nose Plier Spanner set Coolant drain tray Fiber brush Phillips Screw Driver Set Flat Screw Driver Set Pressure Cap Tester Thermometer	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 2: Perform	**The trainee will be able**	Operational knowledge and understanding	**Total**	Wire Brush	Class room with

Radiator Fan Service	**to:** Select the tool and equipment according to the job requirement Disconnect all water, automatic transmission fluid ATF and electric connections from radiator Remove radiator from vehicle Remove fan from shroud Service/replace the fan motor and fan Replace the carbon brushes Refit the fan with shroud. Refit the radiator in the vehicle Ensure housekeeping after completion of task	of tools/equipment, required to perform radiator fan service Defining types of cooling system (i.e. Air cooling system, Water cooling system) Explaining percentage of direct air cooling (29%) and water cooling (71%) The importance of PPEs when perform radiator fan service Importance of health and safety Importance of housekeeping	11 Hrs **Theory:** 03 Hr **Practical:** 08 Hrs	Combination Pliers Nose Plier Spanner set Coolant drain tray Fiber brush Phillips Screw Driver Set Flat Screw Driver Set Pressure Cap Tester Thermometer Relevant PPEs	multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Evaluate Thermostat Valve Performance	**The trainee will be able to:** Select the tool and equipment according to the job requirement Disconnect the water connections from thermostat valve hosing. Remove the thermostat	Operational knowledge and understanding of tools/equipment, required to evaluate thermostat valve performance Operational knowledge and understanding of function of thermostat valve Defining material used in thermostat valve (i.e. Wax pellet) Knowledge of operating temperature of thermostat valves	**Total** 08 Hrs **Theory:** 02 Hr **Practical:** 06 Hrs	Combination Pliers Nose Plier Spanner set Phillips Screw Driver Set Flat Screw Driver Set	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	valve Check the thermostat valve as per the workshop manual. Replace thermostat if found faulty Refit the valve into the housing Ensure housekeeping after completion of task	The importance of PPEs when evaluate thermostat valve performance Importance of health and safety Importance of housekeeping		Relevant PPEs	
LU 4: Evaluate Water Pump Performance	**The trainee will be able to:** Select the tool and equipment according to the job requirement Disconnect the water and electric connections from water pump. Remove Water pump from engine Check water pump pressure, seals and bearings Replace water pump Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to evaluate water pump performance Explaining parts of water pump (i.e. Propeller, Bearing, Fan pulley) Describing procedure of disassembly and assembly of water pump including its connections (i.e. Water connections) The importance of PPEs when evaluate water pump performance Importance of health and safety Importance of housekeeping	**Total** 05 Hrs **Theory:** 02 Hr **Practical:** 03 Hrs	Combination Pliers Nose Plier Spanner set Coolant drain tray Phillips Screw Driver Set Flat Screw Driver Set Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

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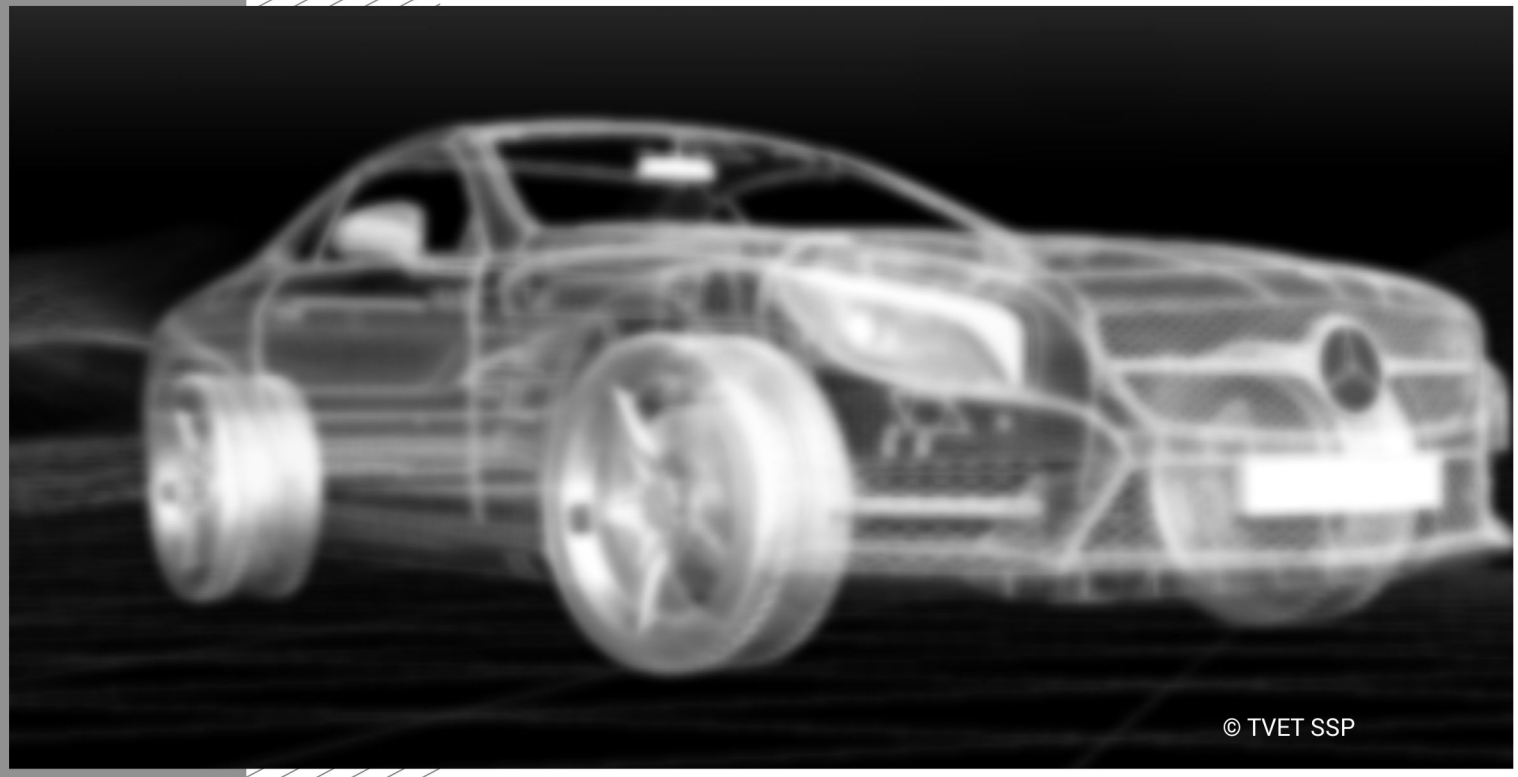

Module-8

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - November, 2019

Module 8: 071400945 Maintain Engine Lubrication System

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to maintain engine lubrication system.

Duration: 30 Hrs **Theory:** 06 Hrs **Practical:** 24 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Test Performance of Oil Pressure Switch	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Switch on the ignition-switch/key and observe the oil indicator lamp on instrument panel Start the engine and observe the oil indicator lamp Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to test performance of oil pressure switch Explaining types of lubrication system (i.e. splash system, pressure feed system, combined splash and pressure feed system) Describing main functions of engine lubrication system (i.e. reducing frictional effect, cooling effect, sealing effect and cleaning effect) Explaining parts of lubrication system (oil sump, oil pump, oil filter, oil galleries, oil pressure switch and pressure relief valve etc.) Describing main purpose of oil pressure relief valve. Explaining function of oil pressure switch The importance of PPEs when test performance of oil pressure switch Importance of health and safety Importance of housekeeping	**Total** **10 Hrs** **Theory:** **02 Hrs** **Practical:** **08 Hrs**	Oil filter Kerosene oil Silicon Tube Spanner set Socket set Screw driver set Combination Plier Hammer Seals Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 2: Service Oil Pump	**The trainee will be able to:** Select tools and equipment	Operational knowledge and understanding of tools/equipment, required for service of oil pump	**Total** **10 Hrs**	Oil filter Kerosene oil	Class room with multimedia aid and flip charts

	according to job requirement Observe occupational health and safety precautions at all times Remove oil sump safely Inspect oil strainer Inspect oil pump Inspect oil pressure relief valve Ensure housekeeping after completion of task	Explaining different types of oil pumps (rotor type, gear type) Operational knowledge and understanding of function of oil pump Defining structure and parts of oil pump (i.e. oil strainer , oil pump rotor and shaft ,oil seals) Describing about pressure and pressure of oil pump(which ranges from 30-40 PSI) The importance of PPEs when service oil pump Importance of health and safety Importance of housekeeping	**Theory:** **02 Hrs** **Practical: 08 Hrs**	Silicon Tube Spanner set Socket set Screw driver set Combination Plier Hammer Seals and gasket Relevant PPEs	Or Access to an Automobile Workshop with required tools and equipment
LU 3: Investigate & Repair Oil Leakages	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health & safety precautions at all times Locate the oil leakages Replace tappet cover seal Replace oil sump gasket/seal Replace ignition distributor “O” ring (seal)	Operational knowledge and understanding of tools/equipment, required for investigate & repair oil leakages Explaining the reasons of oil leakage Explaining signs of oil leakage (black spot, wet parts) Explaining function of oil cooler Ensuring repair of oil leakages The importance of PPEs when investigate & repair oil leakages Importance of health and safety Importance of housekeeping	**Total** **10 Hrs** **Theory:** **02 Hrs** **Practical: 08 Hrs**	Oil filter Kerosene oil Silicon Tube Spanner set Socket set Screw driver set Combination Plier Hammer Seals Engine oil Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

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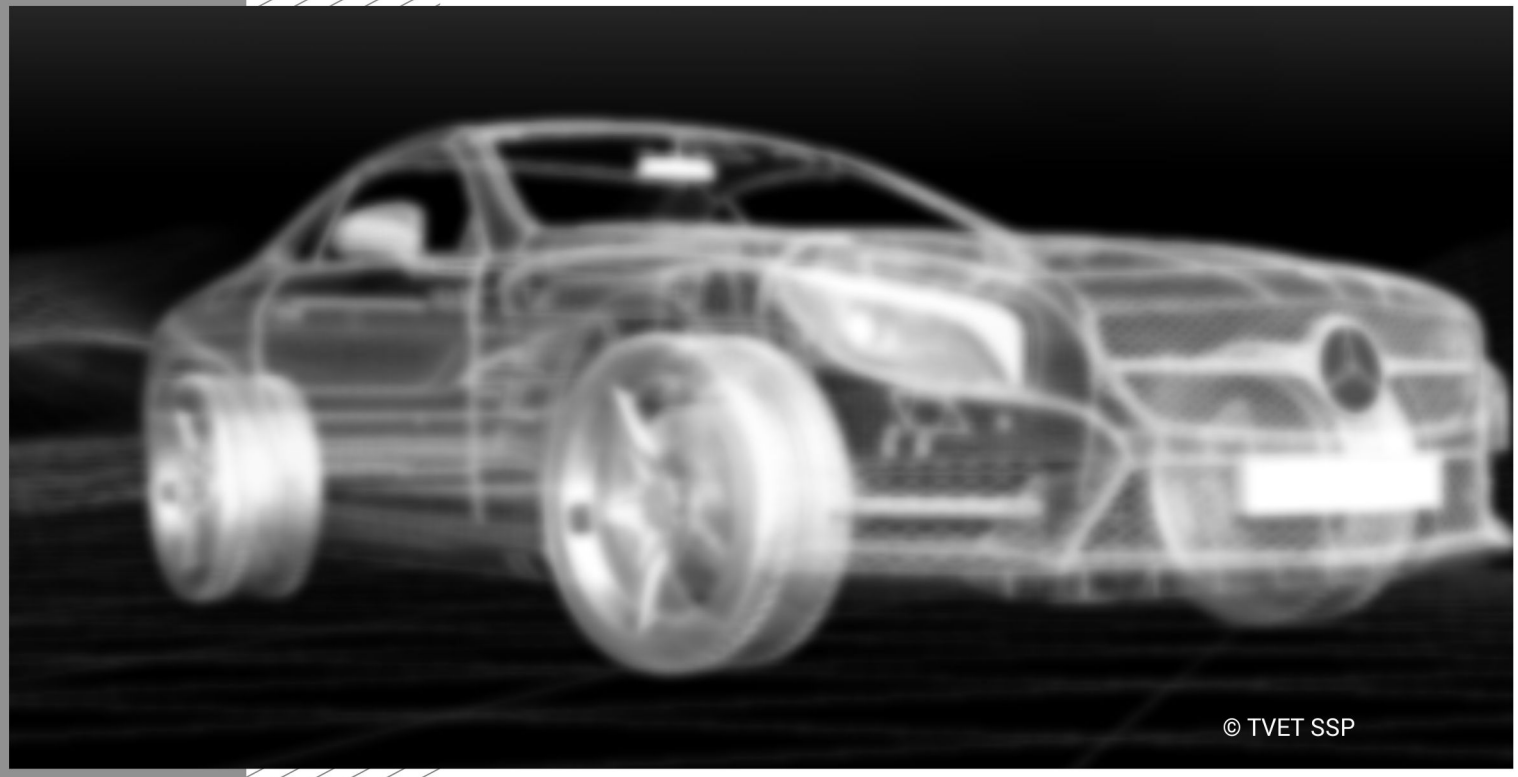

Module-9

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - November, 2019

Module 9: 071400946 Maintain Brake System

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to maintain brake system.

Duration: 50 Hrs **Theory:** 16 Hrs **Practical:** 34 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Perform Maintenance of Mechanical Brake System	**The trainee will be able to:** Select appropriate tools and equipment. Remove, clean, inspect and measure drum/disc diameter Repair brake drum/disc Inspect wheel cylinders for leakage and proper operation Adjust brake shoes and parking brake Install brake drums or hub assembly Install wheel bearing as per workshop manual Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to perform maintenance of mechanical brake system Identifying brake system Describing the function of brake system Defining types of brake system (i.e. Mechanical, Pneumatic, Hydraulic, Power Brake, ABS) Identifying the components of mechanical brake system (i.e. Hand lever, cable, Brake assembly) Explaining types of brake assembly (i.e. Shoe/Drum type, Disc/Pad type) Inspecting and servicing of mechanical brake systems Defining method of installing wheel bearing The importance of PPEs when perform maintenance of mechanical brake system Importance of health and safety Importance of housekeeping	**Total** 15 Hrs **Theory:** 05 Hrs **Practical:** 10 Hrs	Cotton waste Brake Shoes Brake Pads Petrol Emery paper Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 2: Perform Maintenance of Hydraulic Brake	**The trainee will be able to:** Select appropriate tools and equipment.	Operational knowledge and understanding of tools/equipment, required to perform maintenance of hydraulic brake system Describing types of hydraulic brake system	**Total** 20 Hrs **Theory:**	Brake fluid Cotton waste Brake Shoes	Class room with multimedia aid and flip charts Or

System	Measure brake pedal height Adjust brake pedal travel and free play Check master cylinder for external leakages and proper operation. Inspect brake lines, hose pipes and fittings Select and fill brake fluids to proper level. Perform brake bleeding Perform road test Ensure housekeeping after completion of task	(i.e. Calliper assembly, Wheel cylinder) Explaining the procedure of maintaining hydraulic brake system including disassembly and assembly of related components Describing the importance and procedure of brake bleeding Explaining the purpose of brake master cylinder, Wheel cylinder and brake booster Defining the purpose, characteristics and importance of brake fluid The importance of PPEs when perform maintenance of hydraulic brake system Importance of health and safety Importance of housekeeping	06 Hrs **Practical:** 14 Hrs	Brake Pads Master cylinder kit Wheel cylinder seal Petrol Emery paper 0 No. Relevant PPEs	Access to an Automobile Workshop with required tools and equipment
LU 3: Perform Maintenance of Pneumatic Brake System	**The trainee will be able to:** Select appropriate Tools and equipment. Measure brake pedal height Adjust brake pedal travel and free play Check master cylinder for external leakages and proper operation. Inspect brake lines, hose pipes and fittings Inspect air reservoir, safety valve, water drain	Operational knowledge and understanding of tools/equipment, required to perform maintenance of pneumatic brake system Explaining types of pressure (i.e. Atmospheric pressure, Negative pressure) Explaining parts of pneumatic brake system (i.e. Compressor, Storage tanks, Brake booster, Valves, Diaphragm etc.) Explaining procedure of maintaining pneumatic brake system including disassembly and assembly of related components The importance of PPEs when perform maintenance of pneumatic brake system Importance of health and safety	**Total** 15 Hrs **Theory:** 05 Hrs **Practical:** 10 Hrs	Cotton waste Brake Shoes Brake Pads Petrol Emery paper 0 No. Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	plugs Start vehicle and check the air leakage. Perform road test Ensure housekeeping after completion of task	Importance of housekeeping			

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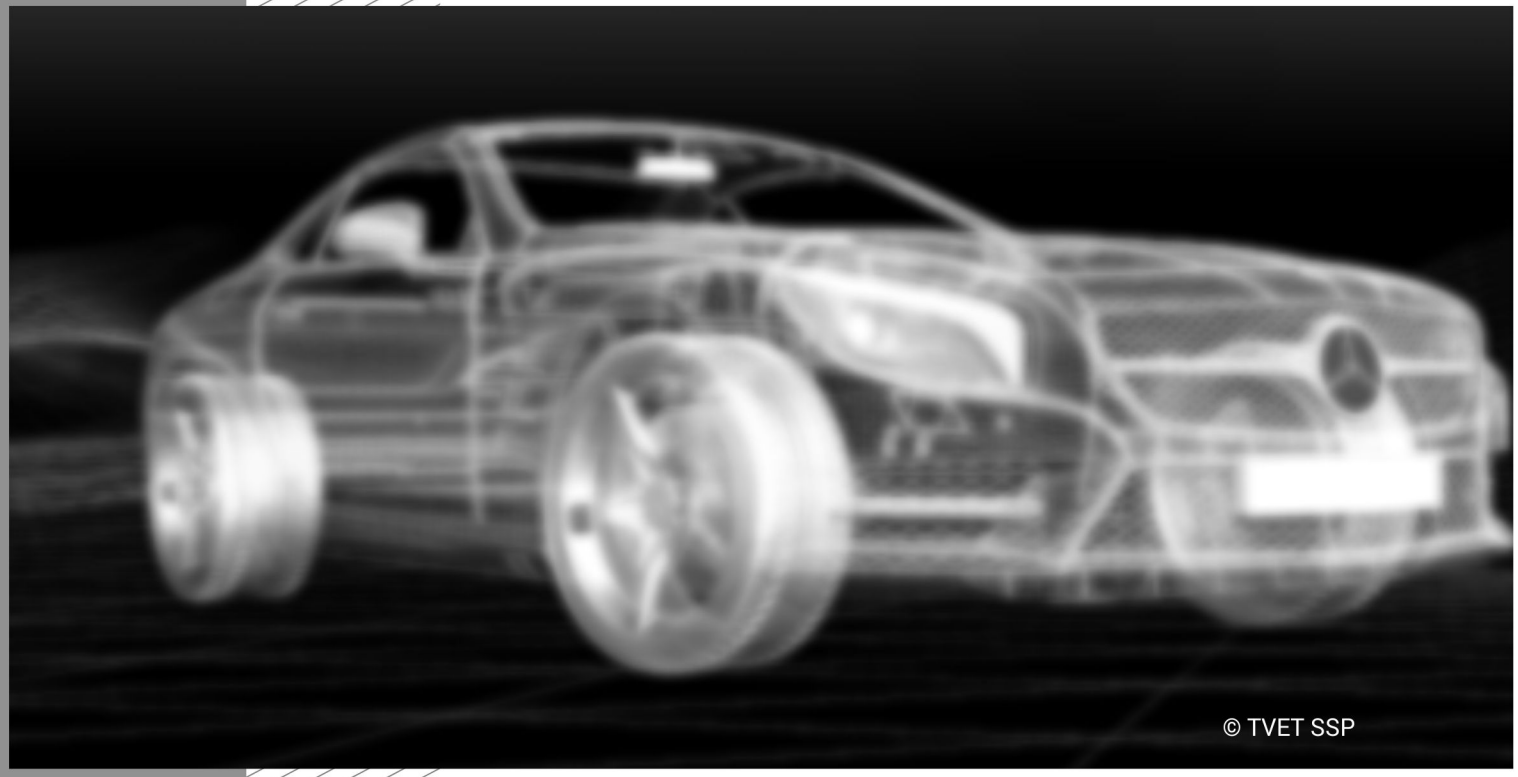

Module-10

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - November, 2019

Module 10: 071400947 Maintain Suspension System

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to maintain various types of suspensions and their component parts.

Duration: 60 Hrs **Theory:** 20 Hrs **Practical:** 40 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Check Performance of McPherson Strut	**The trainee will be able to:** Select the tool and equipment according to the job requirement. Ensure safety precaution. Check for damaged or sagging springs. Check the steering mounts and linkages. Remove McPherson strut. Check the McPherson strut pivot bearing Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to check performance of McPherson strut Defining suspension system and its types Describing sprung and un-sprung weight Describing coil spring and its damages Identifying steering linkages and their location Explaining procedure of disassembling and assembling of steering and linkages Explaining about McPherson pivot bearing and purpose of its placement. Procedure of removal of McPherson strut from car, including assessment of its performance. The importance of PPEs when check performance of McPherson strut Importance of health and safety Importance of housekeeping	**Total** **06 Hrs** **Theory:** **02 Hrs** **Practical:** **04 Hrs**	Rubber seal Hydraulic oil Cotton clothes Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

LU 2: Check Tie Rod Performance	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Check play in ball joint Replace ball joint Inspect tie rod end, tie rod/rack-end and ball joints at the end Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to check tie rod performance Identifying ball joint, Tie rod, tie rod end, rack end inspection Describing purpose of ball joint Explaining function of ball joint and their types. Defining performance of ball joint including free play Describing procedure to replace ball joint The importance of PPEs when check tie rod performance Importance of health and safety Importance of housekeeping	**Total** **06 Hrs** **Theory:** **02 Hrs** **Practical:** 04 Hrs	Rubber bushes Staring oil Oil seal Cotton cloths Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Check Performance of Coil Spring Sagging	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Inspect coil spring height Replace cracked/ damaged rubber cushion Replace cracked/	Operational knowledge and understanding of tools/equipment, required to check performance of coil spring sagging Explaining Types of coil spring Defining coil spring and explaining coil spring height, diameter, wire diameter and number of turns. Explaining coil spring rubber cushion including replacement of cracked/damaged rubber cushion Explaining spring rate and calculating	**Total** **06 Hrs** **Theory:** **02 Hr** **Practical:** **04 Hrs**	Rubber bush Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	damaged coil spring Ensure housekeeping after completion of task	loading capacity of the coil spring. Explaining of Coil spring replacement as per manufacture's specification. The importance of PPEs to check performance of coil spring sagging Importance of health and safety Importance of housekeeping			
LU 4: Test Performance of Stabilizer Bar	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Inspect/replace the stabilizer bar mounting bush Inspect/replace stabilizer bar links Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to test performance of stabilizer bar Defining components of stabilizer bar including linkage. Explaining inspection procedure for stabilizer bar and linkage Describing replacement sequence of Stabilizer bar including Stabilizer bar linkages. Explaining Stabilizer bar adjustment Defining operation of Stabilizer bar Defining procedure of transverse (or side-to-side) wheel supporting. Defining procedure of longitudinal (front-to-back) wheel supporting. The importance of PPEs when test performance of stabilizer bar Importance of health and safety Importance of housekeeping	**Total** **06 Hrs** **Theory:** **02 Hrs** **Practical:** **04 Hrs**	Grease and oil Stabilizer bush kit Cotton cloth Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

LU 5: Test Knuckle Assembly Operations	**The trainee will be able to:** Select the tool and Select the tool and equipment according to the job requirement Ensure safety precaution Check performance of knuckle assembly Replace wheel bearing Replace wheel hub Replace knuckle assembly Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to test Knuckle assembly operations Describing inspection procedure for knuckle assembly Explaining the reasons and rectification of excessive play in knuckle assembly. Defining replacement procedure of wheel bearing. Determining wheel hub replacement procedure including safety precautions taken. Explaining types of wheel hub bearings and oil seals. Explaining function of Tapper roller bearing including ball bearing. The importance of PPEs when test Knuckle assembly operations Importance of health and safety Importance of housekeeping	**Total** **06 Hrs** **Theory:** **02 Hrs** **Practical:** **04 Hrs**	Grease and kerosene oil Cotton cloth Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 6: Check Performance of Upper & Lower Suspension Arms	**The trainee will be able to:** Select the tool and equipment according to the job requirement	Operational knowledge and understanding of tools/equipment, required to check performance of upper & lower suspension arms Describing inspection procedure of suspension, upper and lower arms ball	**Total** **06 Hrs** **Theory:**	Grease and oil Rubber bushes Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an

	Ensure safety precaution Replace mounting bush Replace ball joint Inspect upper & lower arms bush Replace suspension arms Ensure housekeeping after completion of task	joints. Defining replacement procedure of suspension arm rubber bushes. Explaining of suspension, upper and lower arms ball joint replacement. Explaining replacement procedure of upper and lower Suspension arm. Procedure of shock absorber rubber bush replacement including their types (single acting, double acting, Oil filled/Gas filled) The importance of PPEs when check performance of upper & lower suspension arms Importance of health and safety Importance of housekeeping	**02 Hrs** **Practical:** **04 Hrs**		Automobile Workshop with required tools and equipment
LU 7: Test Differential System	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Check oil level Replace differential oil with specified grade oil Clean/ replace axle case breather	Operational knowledge and understanding of tools/equipment, required to test differential system Describing differential axle types and their purpose (Hypoid gear & Spiral Bevel) Explaining differential oil level inspecting/ checking procedures Importance of oil grade Explaining of differential oil level replenishment. Explaining of differential air breather service/working procedure. Explaining of differential axle oil seals	**Total** **06 Hrs** **Theory:** **02 Hrs** **Practical:** **04 Hrs**	Oil and grease Rubber bushes Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	Replace axle seals Ensure housekeeping after completion of task	replacement procedure. The importance of PPEs when test differential system Importance of health and safety Importance of housekeeping			
LU 8: Test Axle Assembly	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Replace inner/outer CV (constant velocity) joint Replace inner/outer axle boots Inspect/ replace axle nut and lock Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to test axle assembly Explaining procedure of inner/outer CV Joint replacement including CV Joint excessive play and noisy determine. Defining procedure of inner/outer CV Joint rubber boot replacement Explaining procedure of assembling Wheel hub lock & nut for proper securing wheel. The importance of PPEs when test axle assembly Importance of health and safety Importance of housekeeping	**Total** **06 Hrs** **Theory:** **02 Hrs** **Practical:** **04 Hrs**	Axle oil Grease Cotton cloth Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 9: Maintain Wheel Alignment	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Perform pre-alignment	Operational knowledge and understanding of tools/equipment, required to maintain wheel alignment Describing types of tires and rims (Radial & Bias tyre, tubeless tyres, RFT, Alloy rims) Explaining procedure to inspect and replace tires and rims	**Total** **06 Hrs** **Theory:** **02 Hrs**	Wheel balancing weight Cotton cloth Relevant PPEs Camber gauge Caster gauge	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	inspection Inspect wheel alignment Adjust camber, caster and toe in/toe out Perform road test Ensure housekeeping after completion of task	Explaining wheel alignment and steering geometry Wheel alignment procedure for proper wheel alignment. Explaining inspection procedure for camber, caster, toe-in/ toe-out Demonstrating adjusting/measuring procedure for camber, caster, toe-in/ toe-out on wheel alignment machine. Importance of road testing after the wheel alignment procedure. The importance of PPEs when maintain wheel alignment Importance of health and safety Importance of housekeeping	**Practical:** **04 Hrs**	Trim gauge	
LU 10: Maintain Wheel Balancing	**The trainee will be able to:** Select the tool and equipment according to the job requirement Ensure safety precaution Inspect tyre conditions and specifications Balance wheel assembly on wheel balancing machine	Operational knowledge and understanding of tools/equipment, required to maintain wheel balancing Checking of vehicle tires conditions including specification. Explaining alloy wheel balancing procedure on wheel balancing machine. Describing procedure of wheel assembling & disassembling on wheel balancing machine. The importance of PPEs when maintain wheel balancing	**Total** **06 Hrs** **Theory:** **02 Hr** **Practical:** **04 Hrs**	Wheel balancing Machine Balancing weight (different weight set) Cotton cloth Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	Ensure housekeeping after completion of task	Importance of health and safety Importance of housekeeping			

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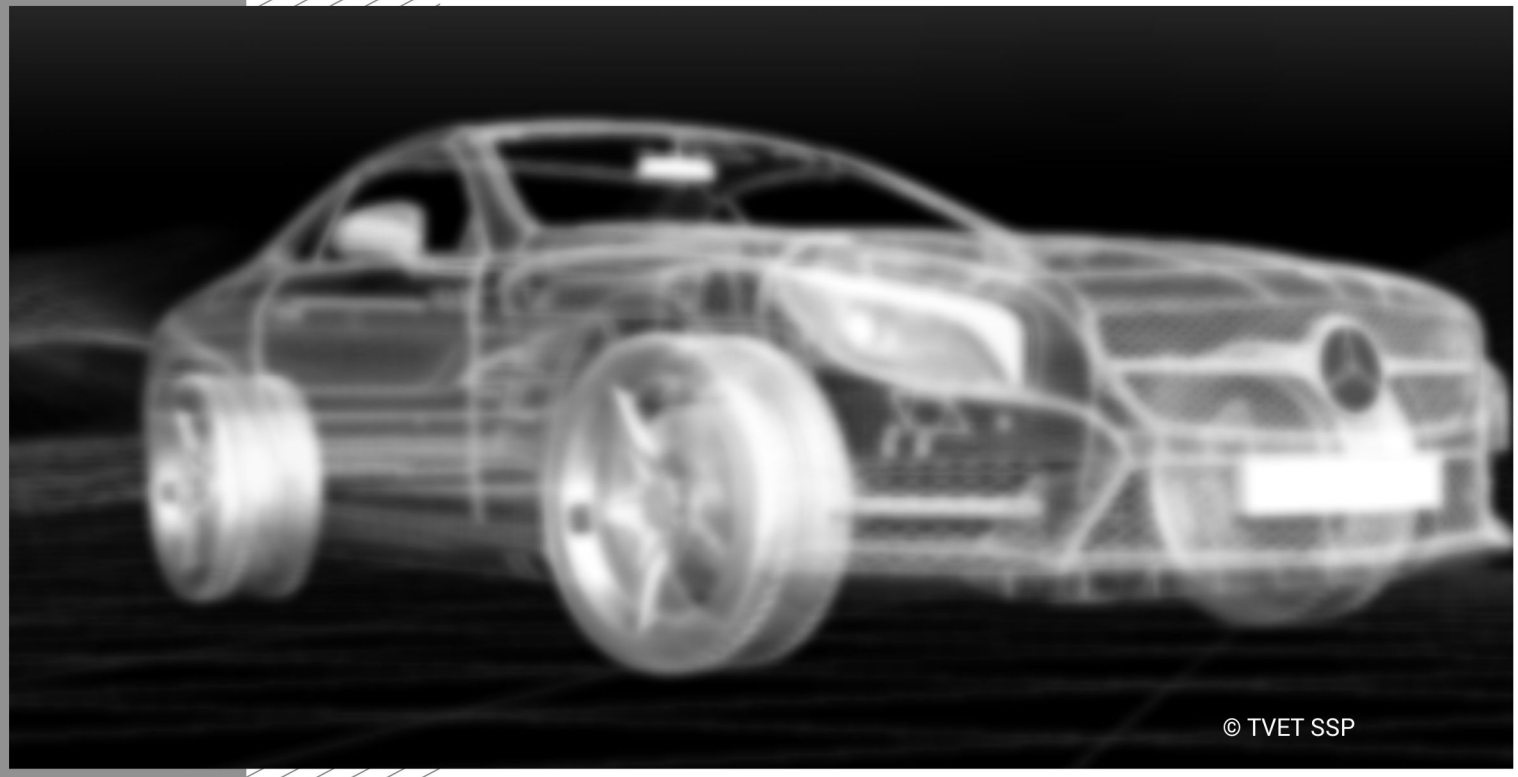

Module-11

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - November, 2019

Module 11: 071400948 Check Vehicle Transmission System

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to Check Vehicle Transmission System.

Duration: 50 Hrs **Theory:** 10 Hrs **Practical:** 40 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Check Performance of Manual Transmission	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Check and replace gear oil Check performance of manual transmission Replace Transmission seals Replace synchronizer ring gears Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to check performance of manual transmission Explaining Gear types and their usage in different transmissions. Defining transmission types (for example manual, automatic, semi-automatic, CVT) Explaining transmission oil replacement procedure (including oil seals). Explaining transmission gear shifting methods/procedure. Identifying transmission noises during driving operation. Describing inspection and replacement procedure of synchronizer ring gears Importance of gear ratios for torque or speed in gearbox The importance of PPEs when check performance of manual transmission	**Total** **18 Hrs** **Theory:** 04 Hrs **Practical:** 14 Hrs	Cotton cloth for cleaning. Gear oil. Relevant PPEs Socket box set Spanner set Sound detector	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

		Importance of health and safety Importance of housekeeping			
LU 2: Check Performance of Mechanical Clutch System	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Inspect clutch system components Adjust clutch cable Remove components from clutch system of vehicle Remove gearbox assembly Diagnose faulty/damaged/broken part related with clutch system Replace faulty components Refit gearbox assembly Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to check performance of mechanical clutch system Identifying components of mechanical clutch system (clutch cable, release bearing). Explaining disassembling/assembling process of clutch components Describing procedure of clutch cable adjustment Explaining gearbox assembly removal /installation procedure. The importance of PPEs when check performance of mechanical clutch system Importance of health and safety Importance of housekeeping	**Total** **16 Hrs** **Theory:** **03 Hrs** **Practical:** **13 Hrs**	Oil can for lubricating joints. Gear oil as recommended by OEM. Cotton cloth for cleaning Relevant PPEs Combination ring set Socket box set Screw driver set Plier set	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Check Performance of Hydraulic Clutch System	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all	Operational knowledge and understanding of tools/equipment, required to check performance of hydraulic clutch system Explaining of Hydraulic clutch components Describing hhydraulic clutch operating	**Total** **16 Hrs** **Theory:**	DOT-4 Hydraulic/Brake Oil Oil Seal Size: As	Class room with multimedia aid and flip charts Or Access to an

	times Replace clutch master cylinder seal Replace slave cylinder seal Perform clutch bleeding Ensure housekeeping after completion of task	method/procedure. Explaining clutch master cylinder oil seal replacement. Defining clutch slave cylinder oil seal replacement Describing hydraulic clutch bleeding procedure. The importance of PPEs when check performance of hydraulic clutch system Importance of health and safety Importance of housekeeping	**03 Hr** **Practical:** **13 Hrs**	recommended by the OEM. Cotton cloth for cleaning Relevant PPEs Combination set Socket box set Screw driver set Plier set	Automobile Workshop with required tools and equipment

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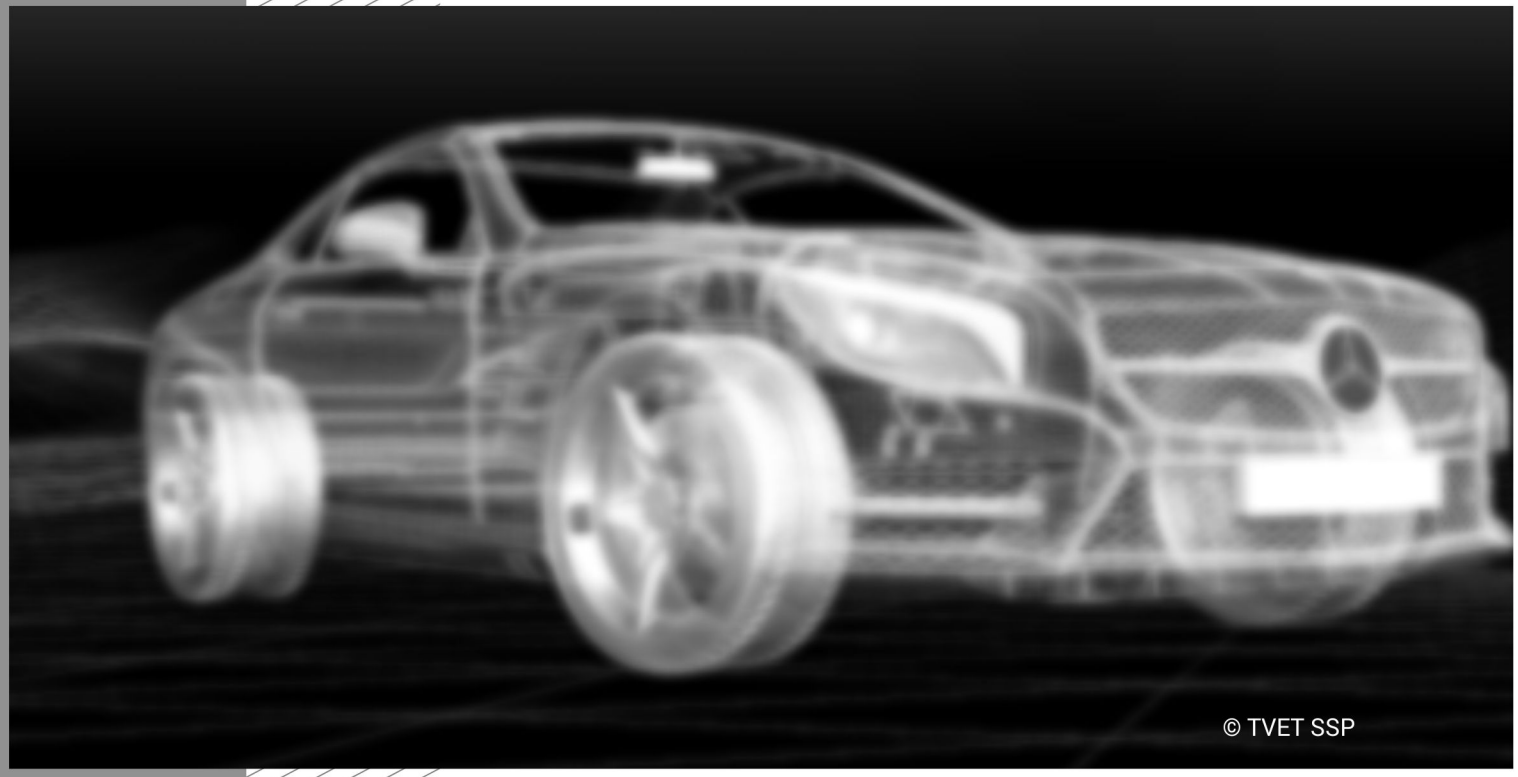


Module-12

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - November, 2019

Module 12: 071400949 Service Electrical System

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to service electrical system.

Duration: 70 Hrs **Theory:** 20 Hrs **Practical:** 50 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Check Performance of Ignition System	**The trainee will be able to:** Select appropriate tools and equipment. Ensure work safely at all times. Check performance of battery and Indication light. Check operation of ignition switch Check wire harness and connectors Check spark plug and rectify faulty parts. Check distributor and distributor cap Check performance of CB (contact breaker) point Check ignition system sensor Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to check performance of ignition system Reading and interpreting manufacturer's repair manual Identifying and explaining different types of ignition system (i.e. direct ignition system, IDS ignition system, distributor system, distributor less system, mechanical ignition system, electronic ignition system) Explaining operation of ignition switch Defining the spark plug types (i.e. cold type plug, hot type plug) Describing function of plugs (i.e. troubleshooting and rectify faulty parts) Explaining distributor and distributor caps with its operation, function and location of components (i.e. rooter, point, condenser and mechanical weight) Defining function of contact breaker (CB) point and its location Identifying sensors of ignition system Describing types of sensors The importance of PPEs when check	**Total** **14 Hrs** **Theory:** 04 Hrs **Practical:** 10 Hrs	Service Creeper Digital Multimeter Flat / Philips Screwdriver Set Combination Spanner Set Repair Manual Combination Plier Needle Nose Plier Test Lamp Bearing puller OBD – II scanner Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

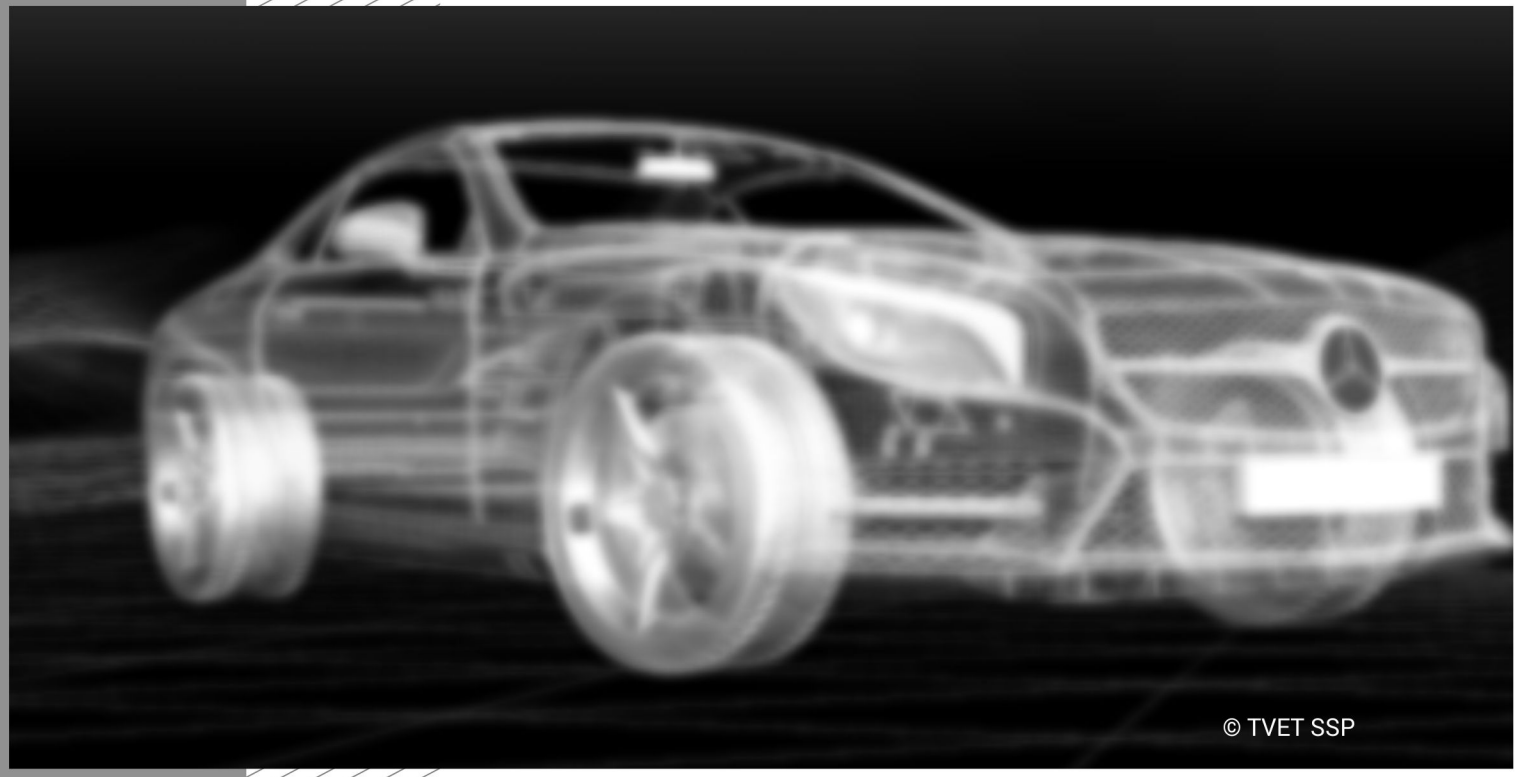
		performance of ignition system Importance of health and safety Importance of housekeeping			
LU 2: Test Performance of Fuses & Relays	**The trainee will be able to:** Select appropriate tools and equipment Check performance of battery Check fuses of Instrument panel Check relays of Instrument panel Check wire harness and connectors Ensure work safely at all times. Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to test performance of fuses & relays Identifying fuses and relays and their purpose Checking fuses and relays (i.e. under dash fuse box, under hood fuse box) Explaining wiring harness and wiring circuit diagram Checking all wiring harness and connectors of an electrical system of cars Describe use of Scanners Diagnosing fault with the help of OBD – II scanner (i.e. troubleshooting, repair and maintenance) The importance of PPEs when test performance of fuses & relays Importance of health and safety Importance of housekeeping	**Total** 14 Hrs **Theory:** 04 Hrs **Practical:** 10 Hrs	Service Creeper Trolley Digital Multimeter Flat / Philips Screwdriver Set Combination Spanner Set Repair Manual Combination Plier Needle Nose Plier Test Lamp Bearing puller OBD – II scanner Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Service Lighting System	**The trainee will be able to:** Select appropriate Tools and equipment. Ensure work safely at all times.	Operational knowledge and understanding of tools/equipment, required for service lighting system Checking method of the condition of head lights, tail lights/bulbs and replacing Checking and replacing method of the	**Total** 14 Hrs **Theory:** 04 Hrs **Practical:**	Service Creeper Trolley Digital Multimeter Flat / Philips Screwdriver Set	Class room with multimedia aid and flip charts Or Access to an Automobile

	Check the headlights and tail lights and replace faulty parts Check reverse lights and reverse gear switch and replace Check fog lights and replace faulty parts Check roof and reading lights and replace in case of any fault Check brake switch and replace faulty parts Check turn signals (indicators) and replace faulty parts	reverse light and the reverse gear switch Checking and replacing method of fog lights and their bulbs Checking and replacing method of roof light, reading lights and their bulbs Checking and replacing method of break switch and its function Checking signals with test lamp and replace their faulty parts Checking and replacing method of parking lights with their bulbs Explaining about instrument panel light with their bulbs Explaining combination switch with its function and its parts Explaining how to check wiring harness of lighting system The importance of PPEs when service lighting system Importance of health and safety Importance of housekeeping	10 Hrs	Combination Spanner Set Repair Manual Combination Plier Needle Nose Plier Test Lamp Bearing puller OBD – II scanner Relevant PPEs	Workshop with required tools and equipment
LU 4: Test Performance of Alternator	**The trainee will be able to:** Select appropriate tools and equipment. Ensure work safely at all times. Check charging warning light Check alternator output	Operational knowledge and understanding of tools/equipment, required for test performance of alternator Describing method to check charging warning light on odometer Describing uses of DMM (digital multi-meter) Defining method to check the alternator output voltage and ampere with the help of	**Total** 14 Hrs **Theory:** 04 Hrs **Practical:** 10 Hrs	Service Creeper Digital Multimeter Flat / Philips Screwdriver Set Combination Spanner Set	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	voltage and ampere Check wire harness and electrical connection Check tension of belt. Replace faulty components according to procedure. Ensure housekeeping after completion of task	DMM Explaining the function of alternator with voltage regulator Checking the wiring harness and electrical connectors Defining the tension belt of alternator Method to replace the faulty components of the alternator according to standard procedure Explaining how to check the wiring harness of alternators with the help of DMM The importance of PPEs when test performance of alternator Importance of health and safety Importance of housekeeping		Repair Manual Combination Plier Needle Nose Plier Test Lamp Bearing puller OBD – II scanner Relevant PPEs	
LU 5: Service Self-Starting System	**The trainee will be able to:** Select appropriate tools and equipment. Select appropriate tools and equipment. Ensure work safely at all times, complying with health and safety precautions, regulations and other relevant guidelines. Check performance of battery. Check electrical wire harness,	Operational knowledge and understanding of tools/equipment, required for service self-starting system Explaining how to check the self-starting components (i.e. self-starter, self-solenoid, wiring harness, self-relay and fuse) Defining the function of solenoid in self-starter Knowledge of different types of batteries (including Hybrid Batteries) Operational knowledge and understanding of the function of relay in self-starter and starter motor	**Total** 14 Hrs **Theory:** 04 Hrs **Practical:** **10 Hrs**	Service Creeper Digital Multimeter Flat / Philips Screwdriver Set Combination Spanner Set Repair Manual Combination Plier Needle Nose Plier	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	relays and connection of starter motor. Check alignment of starter motor pinion with fly wheel. Ensure the fault is removed and starter motor is functioning properly. Ensure housekeeping after completion of task	Defining the function of starter motor Explaining the wiring harness of self-starting system Explaining how to troubleshoot the fault of self-starter system with OBD – II scanner The importance of PPEs when service self-starting system Importance of health and safety Importance of housekeeping		Test Lamp Bearing puller OBD – II scanner Relevant PPEs	

AUTOMOTIVE MECHATRONICS



Module-13

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - November, 2019

Module 13: 071400950 Perform On-Board Diagnostic (OBD-II) Scanner Operations

Objective of the module: The aim of this module is to develop knowledge, skills and understanding needed to perform On-Board Diagnostic (OBD-II) scanner operations.

Duration: 50 Hrs **Theory:** 11 Hrs **Practical:** 39 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Perform Scanning & Diagnoses	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Connect the required connector with car of OBD-II Switch on the ignition switch Enter the Car's detail in OBD-II scanner Diagnose Engine and Electronically Controlled Transmission Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to perform scanning & diagnoses Introducing OBD-II scanner Explaining function of OBD-II scanner Identifying main parts of OBD-II scanner Explaining procedure of connecting OBD-II scanner Defining complete procedure of scanning by OBD-II Identifying different types of sensor and their location (i.e. engine coolant temperature sensor, O2 sensor, TP sensor, crank shaft position sensor, cam shaft position sensor, MAF sensor, MAP sensor, Knock sensor, vehicle speed sensor etc.) Defining ECT (Electronically Controlled Transmission) The importance of PPEs when perform scanning & diagnoses Importance of health and safety Importance of housekeeping	**Total** 14 Hrs **Theory:** 03 Hrs **Practical:** 11 Hrs	Relevant PPEs OBD-II Scanner Digital Multimeter Manual	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

LU 2: Investigate OBD-II for Fault Analysis	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Check the DTC (Diagnostic trouble code) with OBD-II scanner Remove faults and ensure with OBD-II scanner Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required to remove & refit various sensors and actuators. Explaining DTC (Diagnostic trouble code) Describing different DTC codes (for example P 1120 and P 1125 for air fuel control) Describing to remove faults and ensure with OBD-II scanner The importance of PPEs to remove and refit various sensors and actuators. Importance of health and safety Importance of housekeeping	**Total** 14 Hrs **Theory:** 03 Hrs **Practical:** 11 Hrs	Relevant PPEs OBD-II Scanner Digital Multimeter Manual	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Check Vehicle's Mechanical Parameters of OBD-II Operations	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Set idle speed through adjustment screw on throttle body Diagnose the adjusted RPM with OBD-II Diagnose engine coolant temperature with OBD-II scanner	Operational knowledge and understanding of tools/equipment, required to remove & refit various sensors and actuators. Explaining complete procedure for scanning faults with OBD-II Defining Actuators Explaining different Type of Actuator (IAC Valve, solenoid, stepper motors etc.) The importance of PPEs to remove and refit various sensors and actuators. Importance of health and safety Importance of housekeeping	**Total** 14 Hrs **Theory:** 03 Hrs **Practical:** 11 Hrs	Relevant PPEs OBD-II Scanner Digital Multimeter Manual	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	Check the mass air flow with OBD-II scanner at different engine speed Ensure housekeeping after completion of task				
LU 4: Maintain OBD-II Scanner	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Ensure availability of required connectors of OBD-II scanner Clean OBD-II scanner on regular basis Replace battery of OBD-II scanner when required Store OBD-II scanner safely Ensure housekeeping after completion of task	Operational knowledge and understanding of tools/equipment, required for remove & refit engine head assembly Handling and cleaning techniques of OBD-II scanner Ensuring the good working condition of OBD-II Storing OBD-II scanner safely at allocated place The importance of PPEs when remove and refit engine head assembly Importance of health and safety Importance of housekeeping	**Total** 08 Hrs **Theory:** 02 Hrs **Practical:** 06 Hrs	Relevant PPEs OBD-II Scanner Digital Multimeter Manual	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

General assessment guidance for *Automotive Mechatronics Lev-2*

Good practice in Pakistan makes, use of sessional and final assessments, the basis of which is described below. Good practice by vocational training providers in Pakistan, is to use a combination of these sessional and final assessments, combined to produce the final qualification result.

Sessional assessment is going on all the time. Its purpose is to provide feedback on what students are learning:

- to the student: to identify achievement and areas for further work
- To the teacher: to evaluate the effectiveness of teaching to date, and to focus future plans.

Assessors need to devise sessional assessments for both theoretical and practical work. Guidance is provided in the assessment strategy

Final assessment is the assessment, usually on completion of a course or module, which says whether or not the student has "passed". It is – or should be – undertaken with reference to all the objectives or outcomes of the course, and is usually fairly formal. Considerations of security – ensuring that the student who gets the credit is the person who did the work – assume considerable importance in final assessment.

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted. For workplace lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process.

Methods include direct assessment, which is the most desirable form of assessment. For this method, evidence is obtained by direct observation of the student's performance.

Examples for direct assessment of an Automotive Mechatronics Lev-2 include:

- Work performances, for example servicing engine cooling system
- Demonstrations, for example performing on-board diagnostic (OBD-II) scanner operations
- Direct questioning, where the assessor would ask the student about the procedure to maintain suspension system
- Paper-based tests, such as multiple choice or short answer questions on health & safety, fabrication and installation of pipes etc.

Indirect assessment is the method used where the performance could not be watched and evidence is gained indirectly.

Examples for indirect assessment of an Automotive Mechatronics Lev-2 include:

- Work products, such as a complete maintained engine lubrication system
- Workplace documents, such as note book or practical activity journal

Indirect assessment should only be a second choice. (In some cases, it may not even be guaranteed that the work products were produced by the person being assessed.)

Principles of assessment

All assessments should be valid, reliable, fair and flexible:

Fairness means that there should be no advantages or disadvantages for any assessed person. For example, it should not happen that one student gets prior information about the type of work performance that will be assessed, while another candidate does not get any prior information.

Validity means that a valid assessment assesses what it claims to assess.

Reliability means that the assessment is consistent and reproducible.

Flexibility means that the assessor has to be flexible concerning the assessment approach.

For example, if there is a mishap during the assessment, the assessor should modify the arrangements to accommodate the students' needs.

Assessment strategy for Automotive Mechatronics Lev-2 Curriculum

This curriculum consists of 13 modules:

1. Comply Personal Health and Safety Guidelines
2. Communicate the Workplace Policy and Procedure
3. Perform Basic Communication (Specific)
4. Perform Basic Computer Application (Specific)
5. Maintain Engine Assembly
6. Maintain Fuel System
7. Service Engine Cooling System
8. Maintain Engine Lubrication System
9. Maintain Brake System
10. Maintain Suspension System
11. Check Vehicle Transmission System
12. Service Electrical System
13. Perform On-Board Diagnostic (OBD-II) scanner Operations

Sessional assessment

The sessional assessment shall be conducted after completion of each module in two parts: theoretical assessment and practical assessment.

Theoretical assessment for all learning modules must consist of a written paper lasting at least 30 minutes per module. This can be a combination of multiple choice and short answer questions.

For practical assessment, all procedures and methods for the modules must be assessed on a sessional basis. Guidance is provided below under Planning for assessment.

Final assessment

Final assessment shall also be in two parts: theoretical assessment and practical assessment.

For the final practical assessment, each student shall be assessed over a period of 4-5 hours session. During this period, each student must be assessed on his ability to perform a complete job for each of the technical modules.

4 generic modules shall be assessed comprising with other 9 modules at the time of final assessment. Practical work for these modules shall be assessed on a sessional basis only.

The assessment team

The number of assessors must meet the needs of the students and the training provider. For example, where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 20 students shall therefore require

assessments to be carried out over a four-day period. For a group of only 10 students, assessments would be carried out over a two-day period only.

Planning for assessment

Sessional assessment: assessors need to plan in advance how they will conduct sessional assessments for each module. The tables on the following pages are for assessors to use to insert how many hours of theoretical and practical assessment will be conducted and what the scheduled dates are.

Final assessment: Training providers need to decide ways to combine modules into a cohesive two-day final assessment program for each group of five students. Training providers must agree the dishes for practical assessments in advance.

Complete list of tools and equipment

S. No	Description	Quantity
1	Cotton Gloves	20 pairs
2	Goggles	20 nos.
3	Safety mask	100 pcs
4	Safety Shoes	25 pairs
5	Ear plug / Ear Muff	25 pcs
6	Coverall/Overall	20 nos.
7	Allen key Set	20 nos.
8	Bearing puller	10 nos.
9	Brake Bleeding Equipment	10 nos.
10	Brake Drum Pullers	10 nos.
11	Brake Efficiency Tester	10 nos.
12	Brake fluid collector/container	10 nos.
13	Brake Pads	10 nos.
14	Brake Shoes	10 nos.
15	Car lifting equipment	06 nos.
16	Clutch plate alignment tool	10 nos.
17	Combination Plier	20 nos.

18	Combination Spanner Set	20 nos.
19	Compression Tester	08 nos.
20	Coolant drain tray	05 nos.
21	Digital Multimeter	06 nos.
22	Electrical tool kit	05 sets
23	Engine Gasket Set	10 sets
24	Engine Hoist	02 nos.
25	Engine mounts	05 nos.
26	Exhaust Gas Analyzer	05 nos.
27	Flare-nut wrench	05 nos.
28	Flaring Tool/Flare Tool for brake tubes repairing	05 nos.
29	Flat / Philips Screwdriver Set	05 nos.
30	Gas leak detector	05 nos.
31	Grip Plier	05 nos.
32	Hammer	10 nos.
33	Hex Wrench(Set)	05 set
34	Hydraulic Jack	05 set
35	Lifting Equipment (Service Pit)	02 nos.
36	Lock Tight	03 nos.
37	Mallet	10 nos.

38	Master cylinder kit	05 set
39	Needle Nose Plier	05 nos.
40	Nose Plier	05 nos.
41	OBD – II scanner	04 nos.
42	Oil can	06 nos.
43	Oil filter	20 nos.
44	Oil filter spanner	05 nos.
45	Oil Seal	05 nos.
46	Plier set	10 sets
47	Plug Spanner	06 nos.
48	Pressure Cap Tester	05 nos.
49	Ring Compressor	05 nos.
50	Ring Expander	05 nos.
51	Rubber bushes	10 nos.
52	Screw driver set	10 sets
53	Service Creeper	05 nos.
54	Socket Set	10 sets
55	Spanner set	10 sets
56	Special bleed valve tools (only for ABS use)	10 nos.
57	Special service tools	10 nos.

58	Special suction pump or vacuum bleeder	02 nos.
59	Stabilizer bush kit	05 nos.
60	Stethoscope	05 nos.
61	Test lamp	05 nos.
62	Thermometer	06 nos.
63	Tool Trolley	10 nos.
64	Torque Wrench	10 nos.
65	Tube Bender	10 nos.
66	Tyre Lever	06 nos.
67	Vacuum Gauge	06 nos.
68	Valve Lifter	06 nos.
69	Vernier caliper	10 nos.
70	Wheel alignment machine	02 nos.
71	Wheel balancing Machine	01 nos.
72	Wheel balancing weight	10 sets
73	Wheel cylinder seal	10 nos.
74	Wheel Spanner	10 nos.
75	Car	01 no.
76	Engine (petrol)	01 no.
77	Engine (diesel)	02 nos.

78	Battery (lead acid)	02 nos.
79	Laptop 5th generation	01 no.
80	Printer scanner USB	
81		
82		
83		
84		
85		
86		

List of consumable supplies

1. Axle oil
2. Battery
3. Brake fluid
4. Carburetor cleaner (sensor safe)
5. Cleaning Equipment with Detergent
6. Cotton cloth
7. Cotton Waste
8. DOT-4 Hydraulic/Brake Oil
9. Ducting Tape
10. Emery Paper
11. Engine Oil
12. Fiber brush
13. Gear oil
14. Grease
15. Hydraulic oil
16. Injector cleaner
17. Kerosene Oil
18. Petrol
19. Rubber seal
20. Seals
21. Seals and gasket

22. Silicon Tube
23. Spark plug cleaner
24. Staring oil
25. Teflon tape
26. Wet towel
27. Wire Brush
28. Emery paste
29. WD-40 (carburetor cleaner)

List of Stationary

1. Process SOPs
2. Equipment Maintenance Manuals
3. Log Book
4. Handbooks
5. Design Books/ Sheets
6. Pencils
7. Erasers
8. Pencil Sharpeners
9. Paper Cutter
10. Scissors
11. Color Pencils
12. White chart paper
13. Brown Sheets
14. White Board Markers (red, blue, green, black)
15. Permanent markers (black)
16. File covers

Credit values

The credit value of the National Certificate Level 2 in Automotive Mechatronics is defined by estimating the amount of time/ instruction hours required to complete each competency unit and competency standard. The NVQF uses a standard credit value of 1 credit = 10 hours of learning (Following Higher Education Commission (HEC) guidelines.

The credit values are as follows:

Competency Standard	Estimate of hours	Credit
1. Comply Personal Health and Safety Guidelines	30	03
2. Communicate the Workplace Policy and Procedure	20	02
3. Perform Basic Communication (Specific)	30	03
4. Perform Basic Computer Application (Specific)	40	04
5. Maintain Engine Assembly	50	05
6. Maintain Fuel System	50	05
7. Service Engine Cooling System	50	05
8. Maintain Engine Lubrication System	30	03
9. Maintain Brake System	50	05

Competency Standard	Estimate of hours	Credit
10. Maintain Suspension System	60	06
11. Check Vehicle Transmission System	50	05
12. Service Electrical System	70	07
13.Perform On-Board Diagnostic (OBD-II) Scanner Operations	50	05

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