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Islamabad

AUTOMOTIVE MECHATRONICS

CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - November, 2019

NAVTTC

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

Published by
National Vocational and Technical Training Commission
Government of Pakistan

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

Responsible
Director General Skills Standard and Curricula, National Vocational and Technical Training Commission
National Deputy Head, TVET Sector Support Programme, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

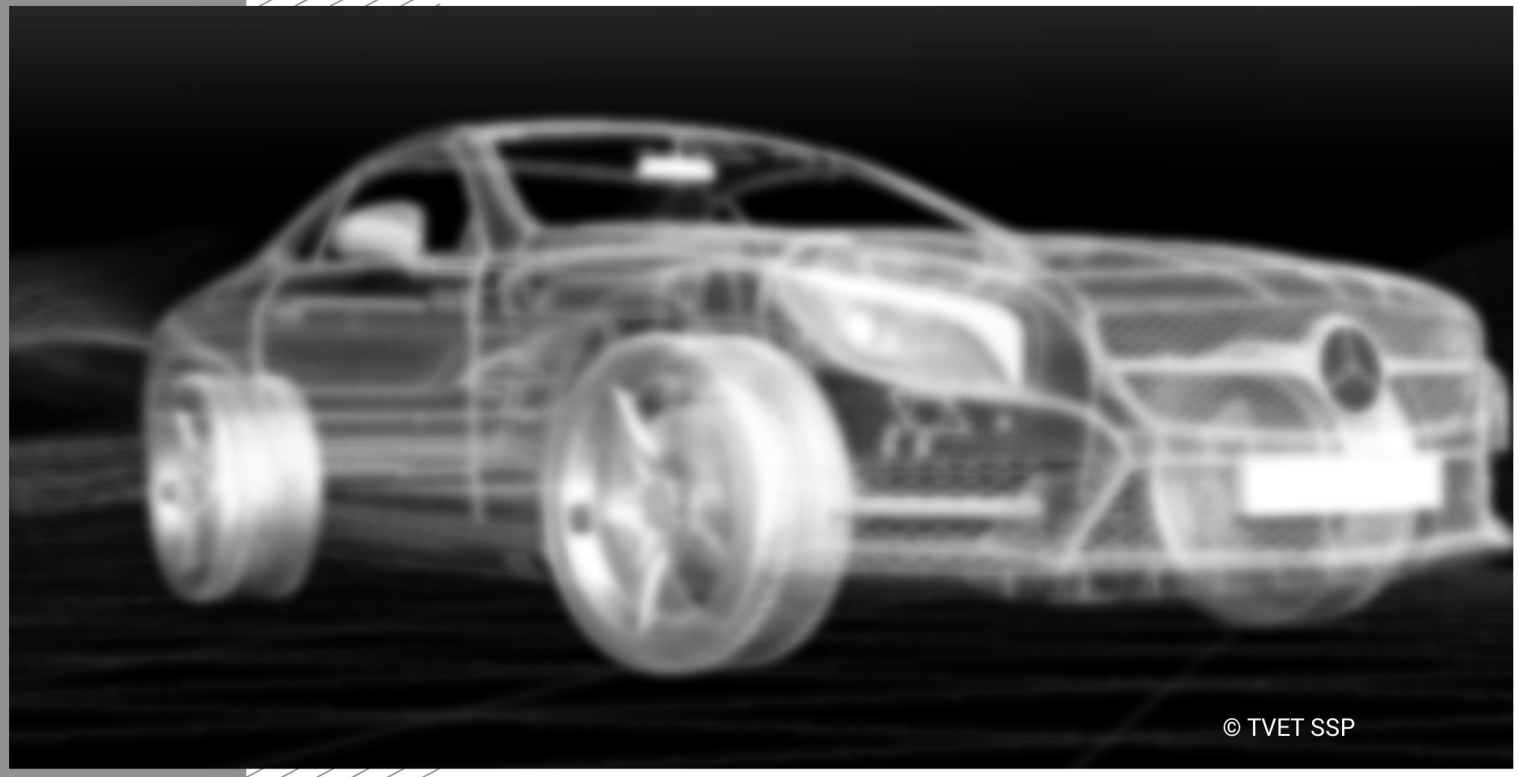
Layout & design
SAP Communications

Photo Credits
TVET Sector Support Programme

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

Document Version
November, 2019
Islamabad, Pakistan

AUTOMOTIVE MECHATRONICS



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Introduction

Definition/ Description of the training program for Automotive Mechatronics Lev-3

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 perform general inspection and engine tuning, maintain ignition system and fuel control system.Trainees will learn to service comfort and safety system, maintain controlled brake system, conserve power transmission and perpetuate controlled electrical & electronics system. They will also learn to ensure health, hygiene & safety of other individuals at work, communicate at workplace and take measures to reduce the pollution, by which they will be able to work in a safe & professional environment.

Purpose of the training program

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. Apply Work Health and Safety Practices (WHS)
2. Identify and Implement Workplace Policy and Procedures
3. Communicate at Workplace

4. Perform Computer Application Skills
5. Manage Personal Finances
6. Perform General Inspection
7. Perform Engine Tuning
8. Maintain Ignition System
9. Maintain Fuel Control System-I
10. Service Comfort and Safety System-I
11. Maintain Controlled Brake System
12. Conserve Power Transmission-I
13. Perpetuate Controlled Electrical & Electronics System-I

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
- Supervisors
- Managers

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

Entry for assessment for this qualification is open. However, entry into formal training institute for this qualification is that the person having National Vocational Certificate level 2, in “Automotive Mechatronics”.

Minimum qualification of trainer

Must hold at least level 4 qualification in Automotive Mechatronics; or

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

Diploma of Associate Engineer (DAE) with 8 years relevant work experience;

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: Apply Work Health and Safety Practices (WHS)			30
Module 2: Identify and Implement Workplace Policy and Procedures			20

Module	Theory hours	Workplace hours	Total hours
Module 3: Communicate at Workplace			30
Module 4: Perform Computer Application Skills			40
Module 5: Manage Personal Finances			30
Module 6: Perform General Inspection	08	32	40
Module 7: Perform Engine Tuning	12	38	50
Module 8: Maintain Ignition System	12	38	50
Module 9: Maintain Fuel Control System-I	12	38	50
Module 10: Service Comfort & Safety System-I	15	35	50
Module 11: Maintain Controlled Brake System	09	36	45
Module 12: Conserve Power Transmission-I	09	36	45
Module 13: Perpetuate Controlled Electrical & Electronic System-I	15	45	60

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 6: perform general inspection, covers knowledge to inspect mechanical/electrical faults and to perform road test. It is very basic learning for student to perform other services/maintenance work. Module 7: perform engine tuning; is relating to clean/replace air filter, adjustment of engine idle speed, tappet clearance, spark plugs, contact breaker point and air fuel ratio. Module 8: maintain ignition system and module 9: maintain fuel control system-I; are generally cover the topics to maintain contact breaker (CB) ignition system, electronic ignition system and Coil-On-Plug (COP) system, to perform maintenance of Electronic Fuel Injection (EFI) system, Common Rail Direct Injection (CRDI) system and motronic control unit for CNG system. Module 10: service comfort & safety system-I describes the various aspects of comfort & safety system for example to perform maintenance of suspension system, inspection & service of power windows & central locking system and seat belts. Candidate will also acquire skills and knowledge to perform service of heat ventilating and Air-Conditioning (AC) System. Module 11: maintain controlled brake system is relating to the knowledge of, to maintain Anti-lock Braking System (ABS), pressure modulator and ABS- Electronic Control Unit (ECU). Module 12: conserve power transmission-I covers the ability to to maintain automatic transmission and electronically controlled transmission, testing their oil pressure, testing/replacing sensors, replacing oil seals and maintaining oil level. Module 13: perpetuate controlled electrical & electronic system-I defines the competences to maintain controlled electrical and electronic system of the vehicle which includes service of windshield washer, wiper system. candidate will also acquire skills and knowledge to perform maintenance of instrument panel, funcntionality of sensors and electrical motors.

5 modules are generic and interdependent with the maintenance and servicing modules 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 6: Perform General Inspection 40 hours	**Module 7:** Perform Engine Tuning 50 hours	**Module 8:** Maintain Ignition System 50 hours	**Module 1:** Apply Work Health and Safety Practices (WHS) 30 hours
Module 9: Maintain Fuel Control System-I 50 hours	**Module 12:** Conserve Power Transmission-I 45 hours	**Module 10:** Service System 50 hours Comfort & Safety	**Module 2:** Identify and Implement Workplace Policy and Procedures 20 hours **Module 3:** Communicate at Workplace 30 hours

Module 11:

Maintain Controlled Brake System

45 hours

Module 13:

Perpetuate Controlled Electrical & Electronic System-I

60 hours

Module 4;

Perform Computer Application Skills

40 hours

Module 5:

Manage Personal Finances

30 hours

Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 1: Apply Work Health and Safety Practices (WHS) **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to apply work health and safety practices (WHS)	**LU 1:** Implement safe work practices at work place **LU 2:** Participate in hazard assessment activities a work place **LU 3:** Follow emergency procedures at workplace **LU 4:** Participate in OHS consultative processes			30 Hrs
Module 2: Identify and Implement Workplace Policy and Procedures **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to identify and implement workplace policy and procedures	**LU 1:** Identify workplace policy & procedures **LU 2:** Implement workplace policy & procedures **LU 3:** Communicate workplace policy & procedures **LU 4:** Review the implementation of workplace policy & procedures			20 Hrs
Module 3: Communicate at Workplace **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to communicate at workplace	**LU 1:** Communicate within the organization **LU 2:** Communicate outside the organization **LU 3:** Communicate effectively in workgroup **LU 4:** Communicate in writing			30 Hrs

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 4: Perform Computer Application Skills **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perform computer application skills	**LU 1:** Prepare In-page documents as per required information **LU 2:** Prepare Spreadsheets as per required information **LU 3:** Use MS Office as per required information **LU 4:** Perform computer graphics in basic applications **LU 5:** Create Email account for communications			40 Hrs
Module 5: Manage Personal Finances **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to manage personal finances	**LU 1:** Develop a personal budget **LU 2:** Develop long term personal budget **LU 3:** Identify ways to maximize future finances			30 Hrs
Module 6: Perform General Inspection **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perform general inspection	**LU 1:** Inspect Mechanical Failure **LU 2:** Inspect Electrical Failure **LU 3:** Perform Road Test **LU 4:** Prepare Job Card/Report	08 Hrs	32 Hrs	40 Hrs

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 7: Perform Engine Tuning **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perform engine tuning	**LU 1:** Clean/Replace Air filter **LU 2:** Adjust Engine Idle Speed **LU 3:** Adjust Air Fuel Ratio **LU 4:** Adjust Tappet Clearance **LU 5:** Clean/Adjust/Replace Spark Plugs **LU 6:** Clean/Adjust/Replace Contact Breaker Point	12 Hrs	38 Hrs	50 Hrs
Module 8: Maintain Ignition System **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain ignition system	**LU 1:** Maintain Contact Breaker Ignition System **LU 2:** Maintain Electronic Ignition System **LU 3:** Maintain Coil-On-Plug (COP) System	12 Hrs	38 Hrs	50 Hrs
Module 9: Maintain Fuel Control System-I **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain fuel control system-I	**LU 1:** Maintain Electronic Fuel Injection (EFI) System **LU 2:** Maintain Common Rail Direct Injection (CRDI) System **LU 3:** Maintain Motronic Control Unit for CNG System	12 Hrs	38 Hrs	50 Hrs

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 10: Service Comfort & Safety System-I **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to service comfort & safety system-I	**LU 1:** Maintain Suspension System **LU 2:** Maintain Power Window & Central Locking System **LU 3:** Verify Seat Belt **LU 4:** Service Heat Ventilating system **LU 5:** Service Air-Conditioning (AC) System	15 Hrs	35 Hrs	50 Hrs
Module 11: Maintain Controlled Brake System **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain controlled brake system	**LU 1:** Maintain Anti-lock Braking System (ABS) **LU 2:** Maintain pressure Modulator **LU 3:** Maintain ABS-Electronic Control Unit (ECU)	09 Hrs	36 Hrs	45 Hrs
Module 12: Conserve Power Transmission-I **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to conserve power transmission-I	**LU 1:** Perform maintenance of Automatic Transmission **LU 2:** Perform maintenance of Electronically Control Transmission (ECT) System **LU 3:** Perform Diagnosis of Electronically Controlled Transmission (ECT) System with OBD II Scanner	09 Hrs	36 Hrs	45 Hrs

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 13: Perpetuate Controlled Electric & Electronic System-I **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perpetuate controlled electric & electronic system-I	**LU 1:** Service Windshield Wash System **LU 2:** Service Wiper System **LU 3:** Check Performance of Instrument Panel **LU 4:** Demonstrate Function of Sensors **LU 5:** Maintain Electrical Motors	15 Hrs	45 Hrs	60 Hrs

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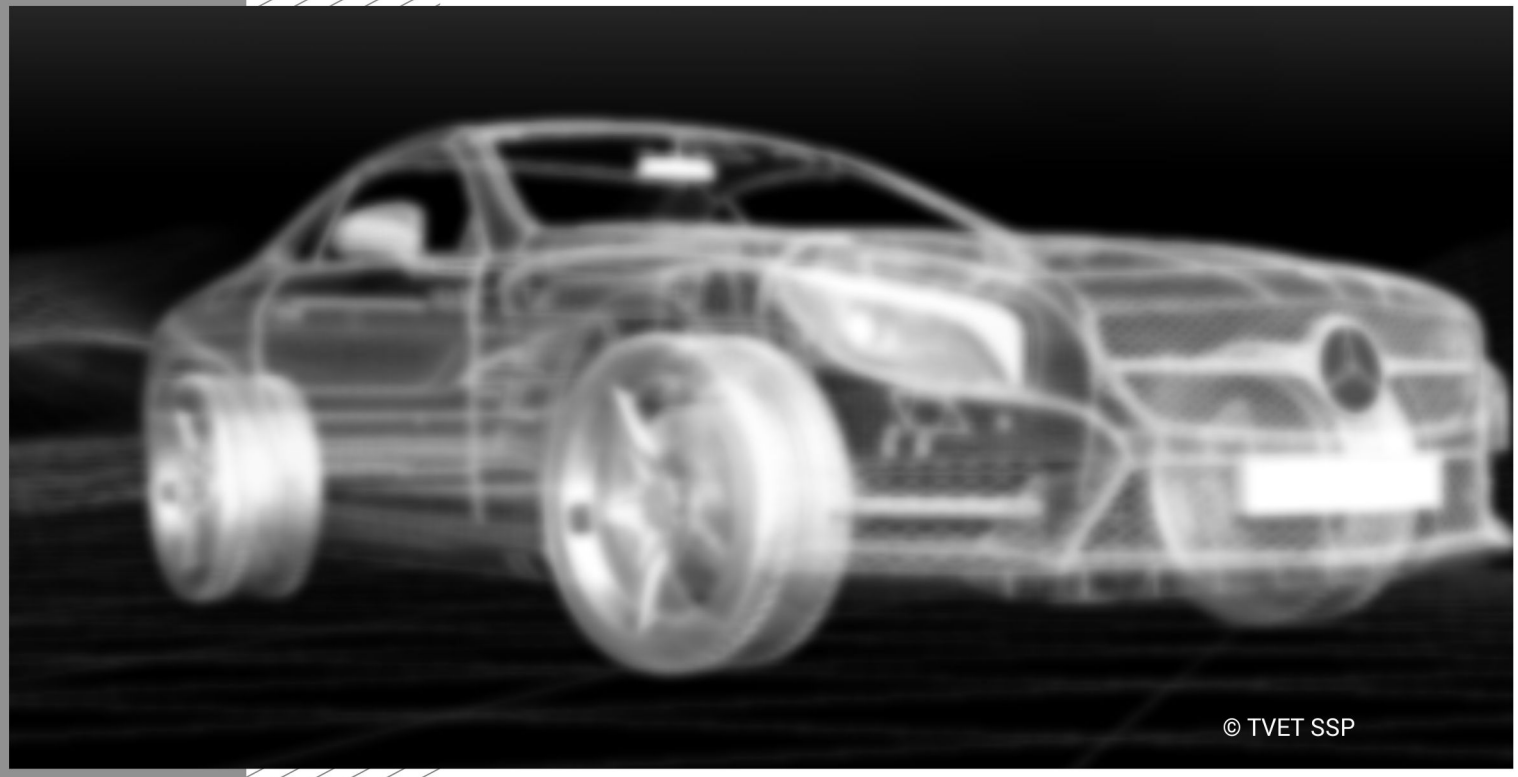

Module-1

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Modules

Module 1: Apply Work Health and Safety Practices (WHS)

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to apply work health and safety practices (WHS)

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Implement safe work practices at work place	**The trainee will be able to:** Implement relevant rules and procedures of WHS at work place. Comply with duty of care requirements Use personal protective equipment according to safe work practices Contribute to WHS consultative activities Raise WHS issues with relevant personnel				
LU 2: Participate in hazard	**The trainee will be able**				

assessment activities a work place	**to:** Identify hazards or WHS issues in the workplace to relevant personnel Assess and control risks according to own level of responsibility, in line with workplace procedures Report hazards or WHS issues in the workplace to relevant personnel Document risk control actions as required				
LU 3 : Follow emergency procedures at workplace	**The trainee will be able to:** Report emergencies or incidents promptly to relevant personnel Deal with emergencies in line with own level of responsibility Implement evacuation				

	procedures as required				
LU 4: Participate in OHS consultative processes	**The trainee will be able to:** Contribute to workplace meetings, inspections or other consultative activities Raise OHS (Occupational Health and Safety) issues with designated persons in accordance with organizational procedures Take actions to eliminate workplace hazards or to reduce risks				

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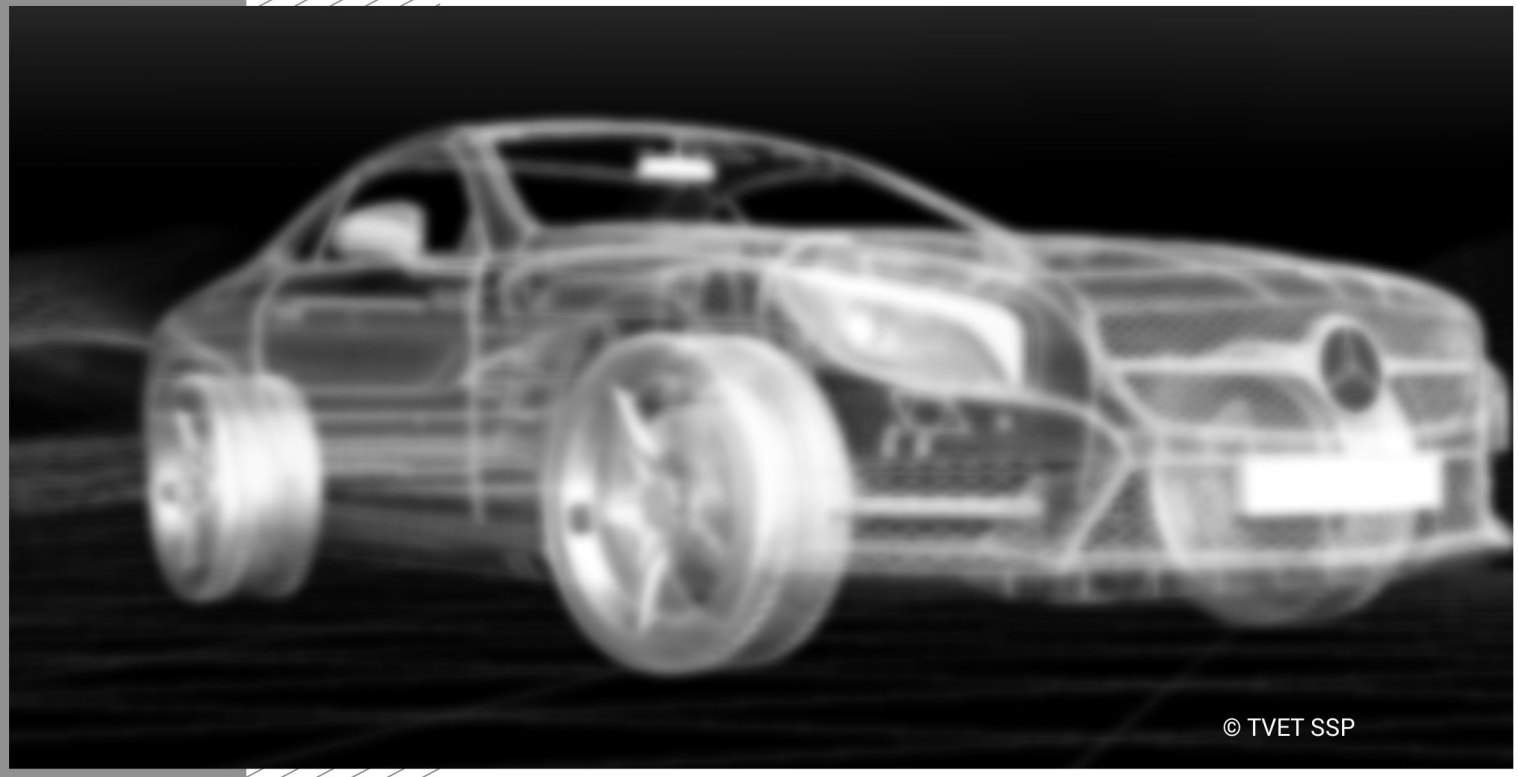

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Module 2: Identify and Implement Workplace Policy and Procedures

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to identify and implement workplace policy and procedures.

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Identify workplace policy & procedures	**The trainee will be able to:** Identify the workplace policy & procedures Apply appropriate strategies that can be used to measure whether your workplace health and safety obligations are being met. Assure the policies are realistic, resources and personnel to implement Implement the policy & procedures that reflects the organizations				

	commitments Ensure the appropriate methods of implementation, outcomes and performance indicators				
LU 2: Implement workplace policy & procedures	**The trainee will be able to:** Apply and assign responsibility for recording systems to track continuous improvements in policy & procedures Implement strategies for continuous improvement in effective and efficient information				
LU 3: Communicate workplace policy & procedures	**The trainee will be able to:** Communicate procedures to help implement workplace policy Inform those involved in				

	implementing the policy about expected outcomes, activities to be undertaken and assigned responsibilities				
LU 4: Review the implementation of workplace policy & procedures	**The trainee will be able to:** Identify the trends that may require remedial actions Record the trends that may require remedial actions. Ensure policy and procedures as required are made for continuous improvement of performance				

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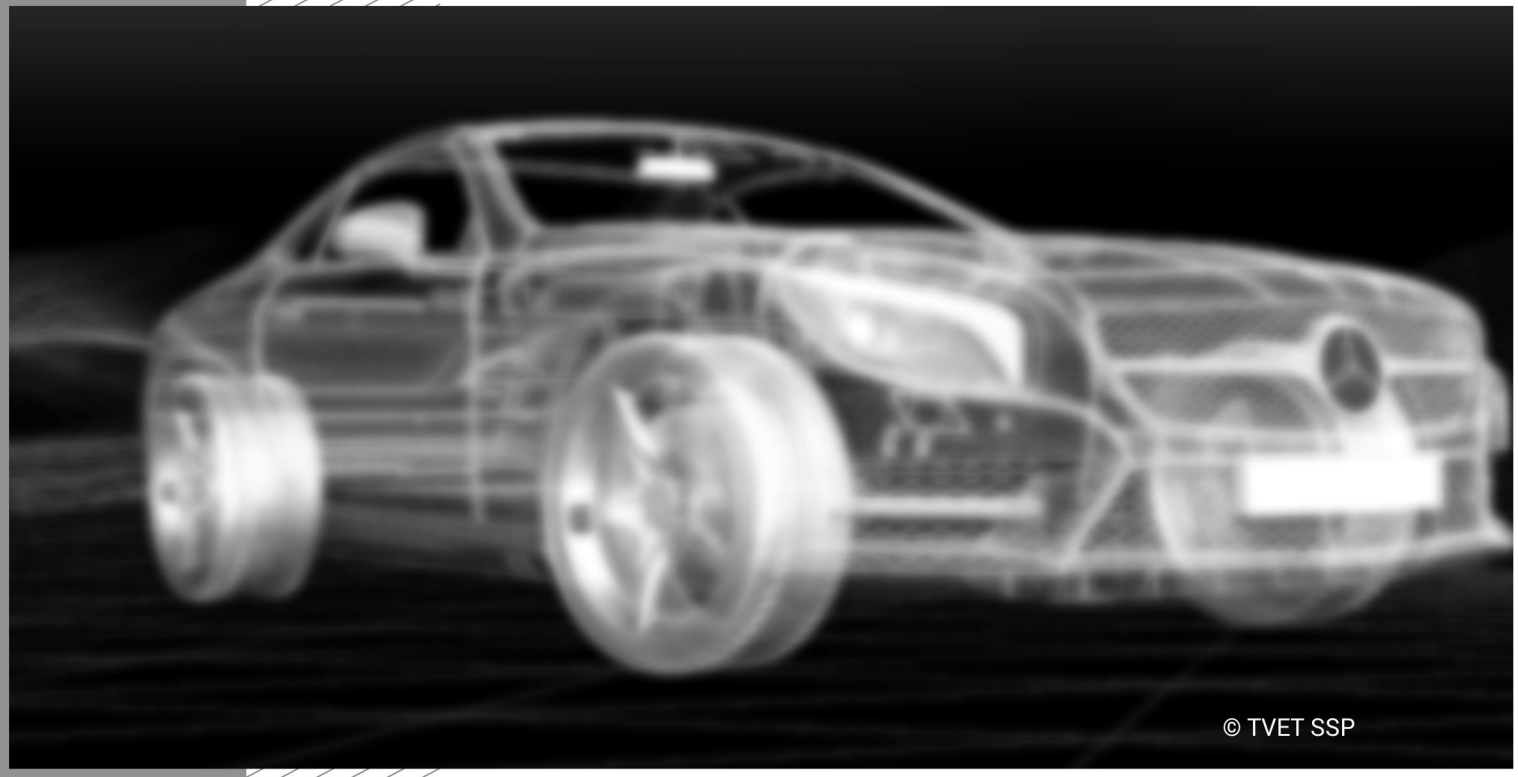

Module-3

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Module 3: Communicate at Workplace

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to communicate at workplace.

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Communicate within the organization	**The trainee will be able to:** Communicate within a department Communicate with other departments. Use various media to communicate effectively Communicate orally and written				
LU 2: Communicate outside the organization	**The trainee will be able to:** Deal with vendors Deal with clients/customers Interact with other organisations Use various media to communicate effectively Work with people of different cultures / backgrounds				
LU 3: Communicate effectively in	**The trainee will be able to:** Assess the issues to provide				

workgroup	relevant suggestion to group members Resolve the issues/ problems /conflicts within the group Arrange group working sessions to increase the level of participation in the group processes Communicate messages to group members clearly to ensure interpretation is valid Communicate style /manner to reflect professional standards/ awareness of appropriate cultural practices Act upon constructive feedback				
LU 4: Communicate in writing	**The trainee will be able to:** Identify relevant procedures for written information Use strategies to ensure correct communication in writing .i.e. • correct composition • clarity • comprehensiveness				

	• accuracy • appropriateness Draft assigned written information for approval, ensuring it is written within designated timeframes Ensure written information meets required standards of style, format and detail Seek assistance / feedback to aid communication skills development				

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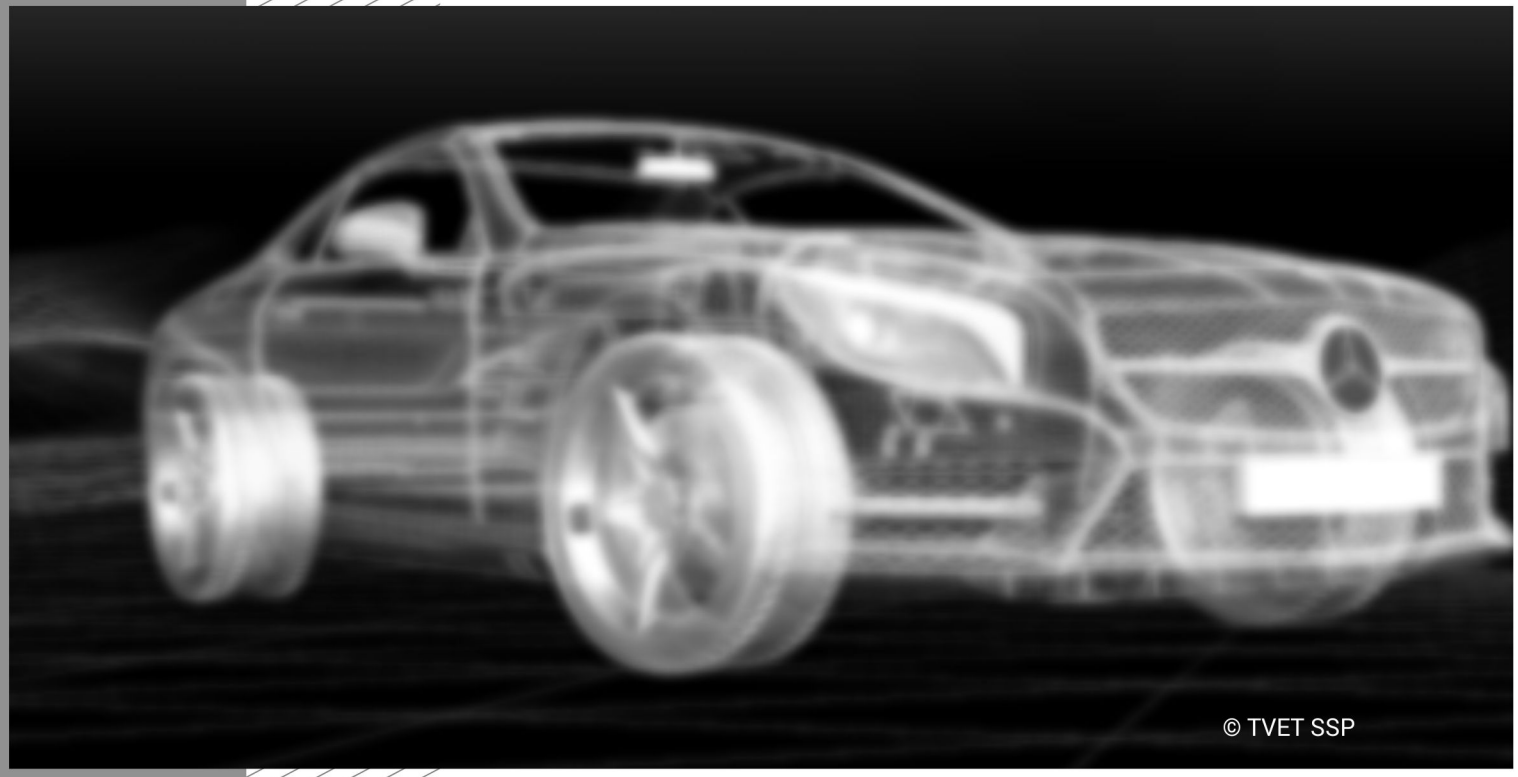

Module-4

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Module 4: Perform Computer Application Skills

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

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Prepare In-page documents as per required information	**The trainee will be able to:** Set keyboard preferences according to information requirements Layout Page according to information requirements Toggle between Languages Identify the usage of tool bar Insert Columns as per requirement Print the document				

LU 2: Prepare Spreadsheets as per required information	**The trainee will be able to:** Create workbook according to information requirements Insert sheet according to information requirements Enter basic formulae / functions using cell referencing when required Correct formulas when error messages occur Use a range of common tools during spreadsheet development Edit columns and rows within the spreadsheet Filter data Save the spreadsheet to a folder on a storage device Format spreadsheet				

	using formatting features as required Incorporate object and chart in spreadsheet Print spreadsheet				
LU 3: Use MS Office as per required information	**The trainee will be able to:** Use Microsoft Word for documentation Use Microsoft Excel for documentation Use Microsoft PowerPoint for presentation Perform OneNote Perform Outlook for emails Perform Publisher applications				
LU 4: Perform computer graphics in basic applications	**The trainee will be able to:** Perform graphic fundamentals in basic				

	applications Draw Points and lines to make images Draw Dots in space to make images Draw lightening blot Shapes to make images Enlarge circles and rectangles to block in forms				
LU 5: Create Email account for communications	**The trainee will be able to:** Make email account for communications Compose text of an email message according to organizational guidelines as required Create an automatic signature for the user Attach files to email				

	message where required Send email message Reply to / forward a received message using available features Save an attachment to the relevant folder Save email message using available settings Adjust email accounts to restrict and quarantine possible email security problems • Print email message as per requirements				

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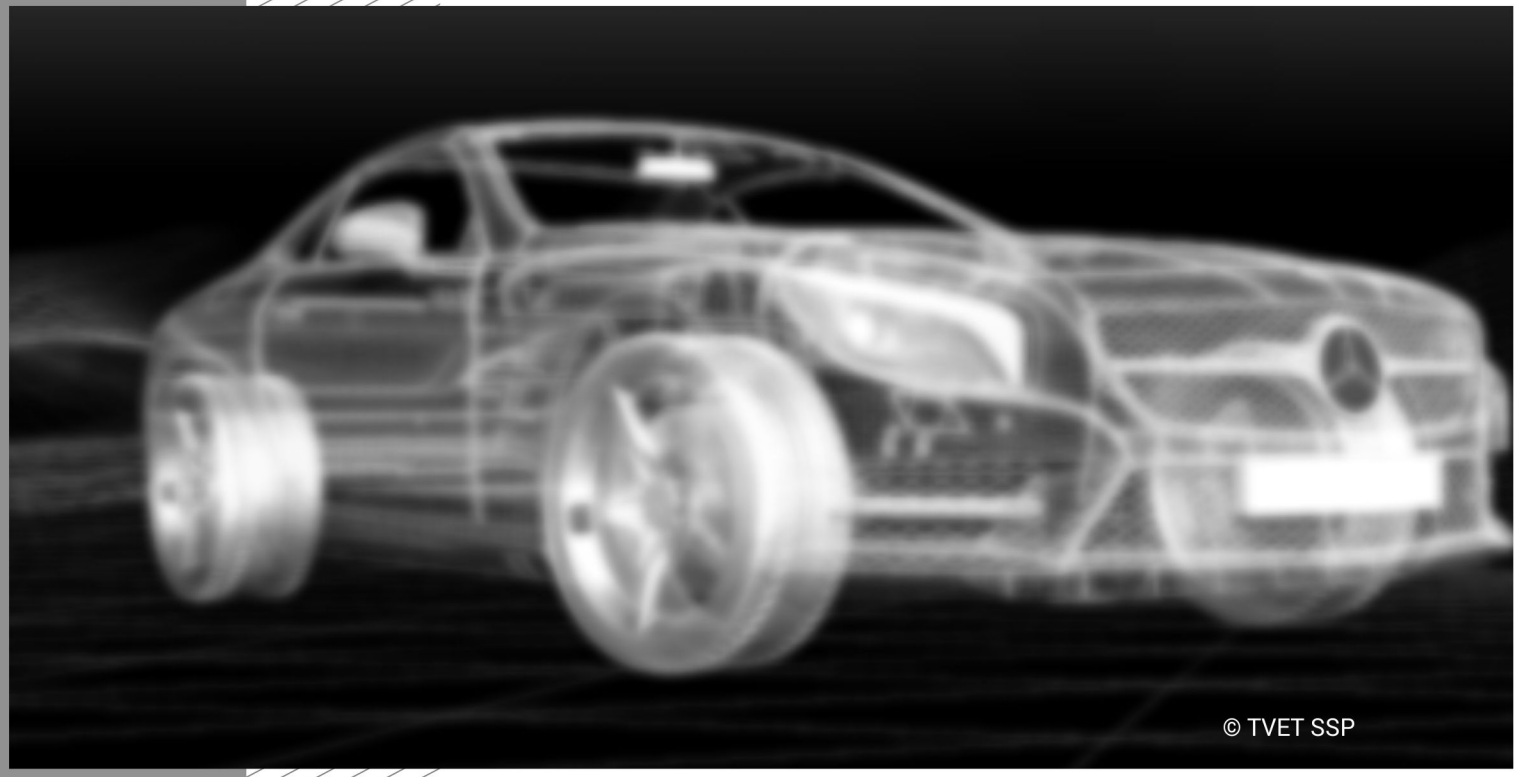

Module-5

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Module 5: Manage Personal Finances

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to manage personal finances.

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Develop a personal budget	**The trainee will be able to:** Calculate current living expenses using available information to prepare a personal budget. Keep a record of all income and expenses for a short period of time to help estimate ongoing expenses. Subtract total expenses from total income to determine a surplus or deficit budget for the specified period. Find reasons for a deficit budget and ways to				

	reduce expenditure identified. Identify ways to increase income				
LU 2: Develop long term personal budget	**The trainee will be able to:** Analyze income and expenditure and set long term personal financial goals. Develop a long-term budget based on the outcomes of short-term budgeting. Identify obstacles that might affect the business Formulate a regular savings plan based on budget				
LU 3: Identify ways to maximize future finances	**The trainee will be able to:** Determine sources to maximize personal income,				

	Get further education or training to maintain or improve future income. Identify the need for debt to finance living and other expenses, Determine the appropriate levels of debt and repayment. Consolidate existing debt, where possible, to minimize interest costs and fees. Seek professional money management services.				

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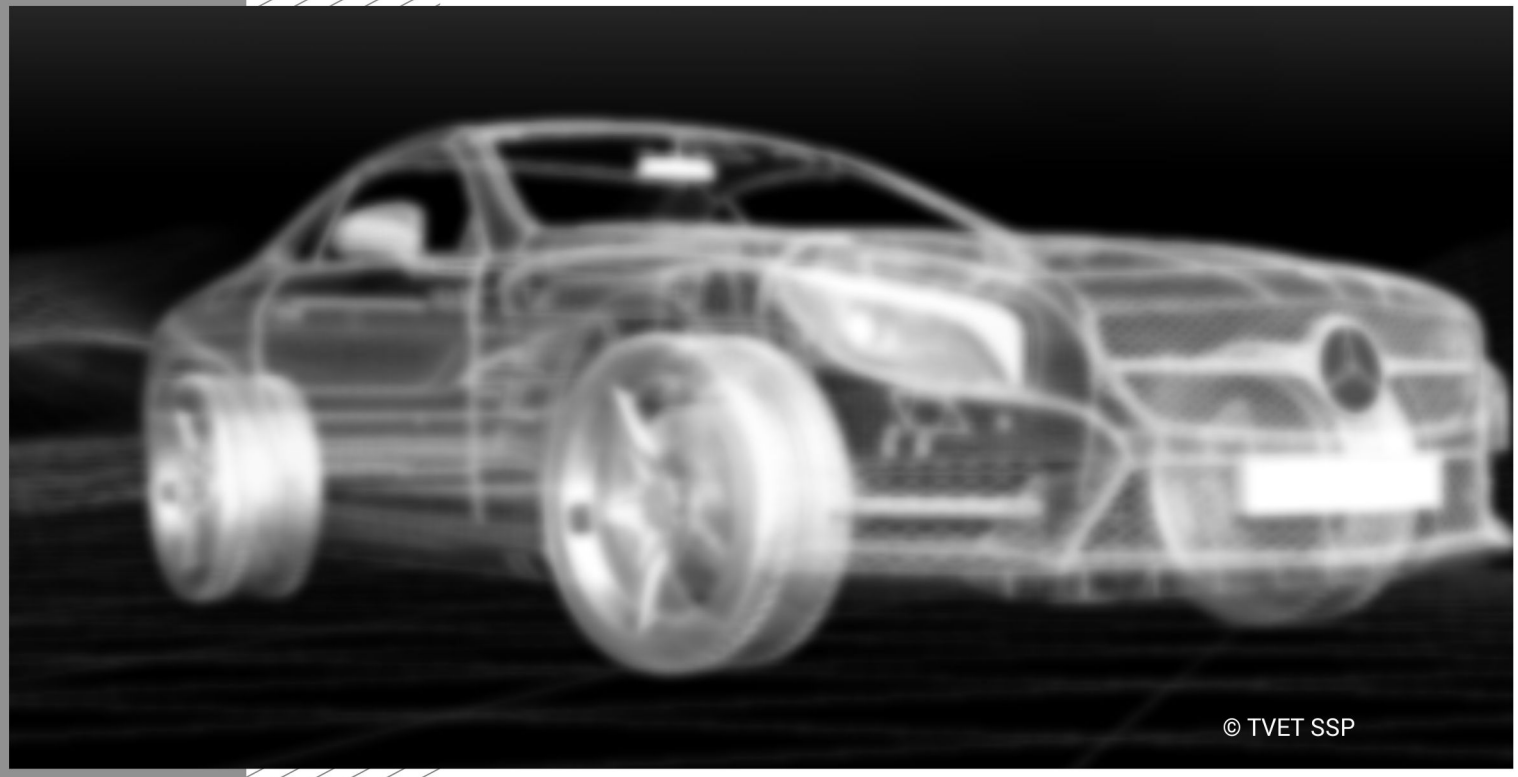

Module-6

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Module 6: 071400951 Perform General Inspection

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to perform general inspection of vehicle.

Duration: 40 Hrs **Theory:** 08 Hrs **Practical:** 32 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Inspect Mechanical Failure	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Inspect Brake failure Check Brake fluid level in reservoir Pump the brake pedal Check the wheels for brake fluid leakage Check the brake lines leakage Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task. Explaining the safety precautions regarding personal health and workplace Describing the vehicle braking system and its components (e.g. master cylinders, brake booster, brake lines, wheel cylinder, brake pads, brake shoes etc.) Explaining the causes of brake failure (i.e. old seals, worn brake shoes and brake pads) Defining the grading of brake fluid Describing the procedure of brake bleeding Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping	**Total** 10 Hrs **Theory:** 02 Hrs **Practical:** 08 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush (Steel Wire) Combination Spanner Set RPM Meter Multi Meter Hydraulic Jack	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 2: Inspect Electrical Failure	**The trainee will be able to:**	Understanding of appropriate tools and equipment for performing this task.	**Total**	Philips/Flat Screw Driver Set	Class room with

	Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Check the Battery voltage Check the electrolyte specific gravity with Hydrometer Check/clean the battery terminals Check/repair the wire harness and connectors Check the alternator output voltage with DMM (digital multi-meter) Analyze the self-starter performance Ensure housekeeping after completion of tasks	Explaining the safety precautions regarding personal health and workplace Explaining about the common electrical failure in a vehicle (for example; Bad Spark Plugs or Wires, Blown Fuse, Dead Battery and Bad Alternator) Determining the function of Battery and its inspection procedures Defining the working of Alternator Explaining the working of Self Stator Motor Knowledge of electric safety (for example electrical systems, protective devices, switchboard cabinets and connection technologies) Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping	10 Hrs **Theory:** 02 Hrs **Practical:** 08 Hrs	Hammer Drill Cotton Rags Emery Paper Wire Brush (Steel Wire) Combination Spanner Set Multi Meter Electric Tester Hydrometer Battery Load Tester WD-40 Combination Plier Nose Plier Hydraulic Jack Relevant PPEs	multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Perform Road Test	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational	Understanding of appropriate tools and equipment for performing this task. Explaining the safety precautions regarding personal health and workplace Explaining the organizational rules,	**Total** 10 Hrs **Theory:** 02 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper	Class room with multimedia aid and flip charts Or Access to an

	health and safety precautions at all times Perform road test applying correct procedure Accelerate the engine to check engine noise Apply brake to check loose parts and noisy suspension Check the wheel alignment during driving Ensure housekeeping after completion of task	regulations and policies regarding road test Checking the performance of vehicle Identifying different types of noises and vibrations Checking wheel alignment Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping	**Practical:** 08 Hrs	Wire Brush Combination Spanner Set RPM Meter Multi Meter Hydraulic Jack	Automobile Workshop with required tools and equipment
LU 4: Prepare Job Card/Report	**The trainee will be able to:** Note down the mechanical faults Note down the electrical faults Note down the electronic faults. Note down the hydraulic faults	Understanding of appropriate tools and equipment for performing this task. Explaining the safety precautions regarding personal health and workplace Introducing the Job card/report Explaining the purpose of Job card/report Describing the procedure to enlist vehicle faults in job card/report Explaining the periodic maintenance schedule and its importance	**Total** 10 Hrs **Theory:** 02 Hrs **Practical:** 08 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set Multi Meter Hydraulic Jack	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

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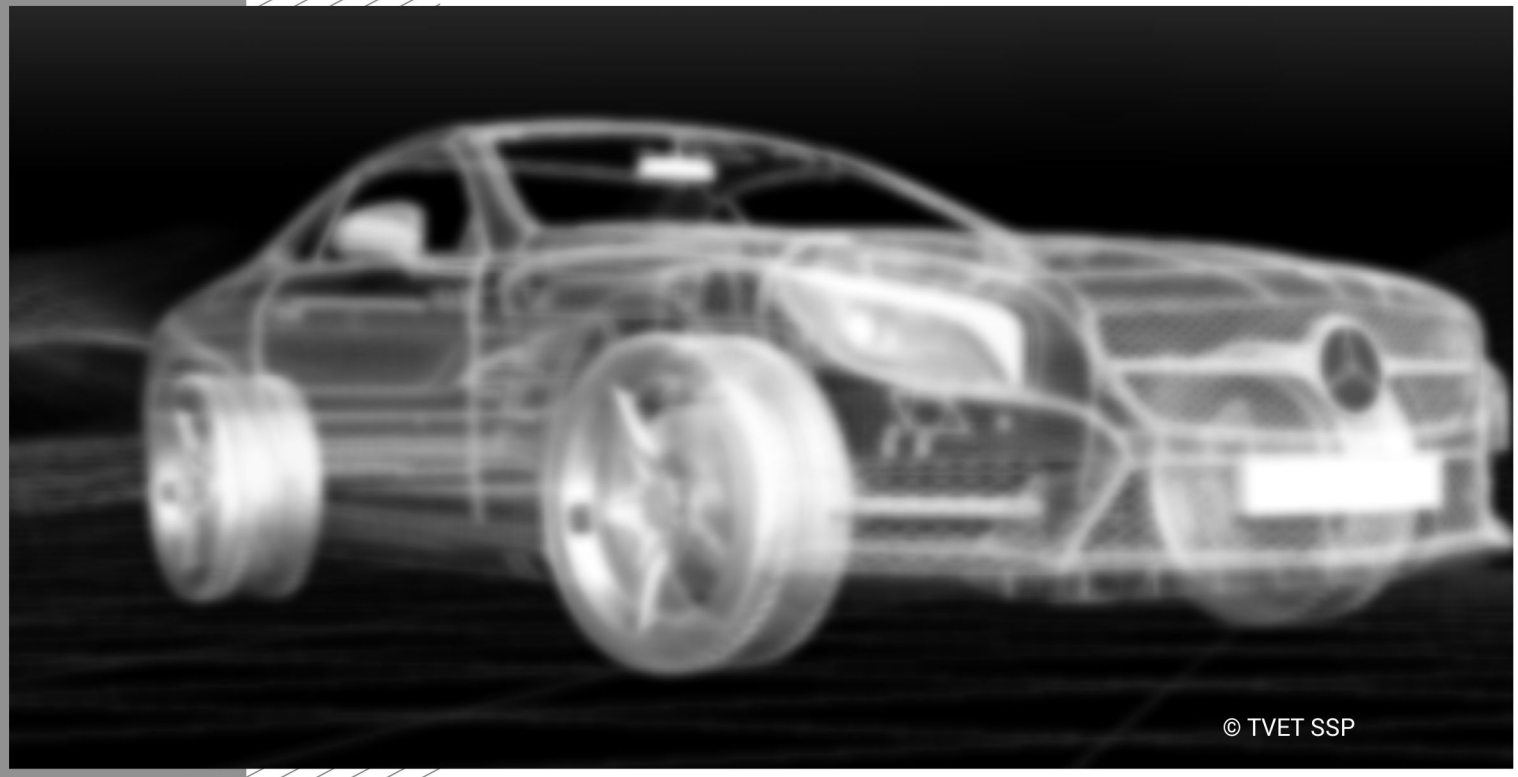

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Module 7: 071400952 Perform Engine Tuning

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to perform engine tuning of vehicle.

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Clean/Replace Air filter	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Locate air filter on the vehicle correctly Remove the air filter Service air filter for clog/dust removal Clean out the canister Fix air filter into the vehicle for normal operation Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task. Explaining the safety precautions regarding personal health and workplace Explaining the function of air filters. (i.e. how filters protect engine from dust particles) Importance of air filter and air cleaner box, how to dissemble the air cleaner box and reassembling procedure Describing timely cleaning and replacing process of air filter. Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping	**Total** 08 Hrs **Theory:** 02 Hrs **Practical:** 06 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Combination Spanner Set Air Compressor	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 2: Adjust Engine	**The trainee will be**		**Total**	Relevant PPEs	Class room

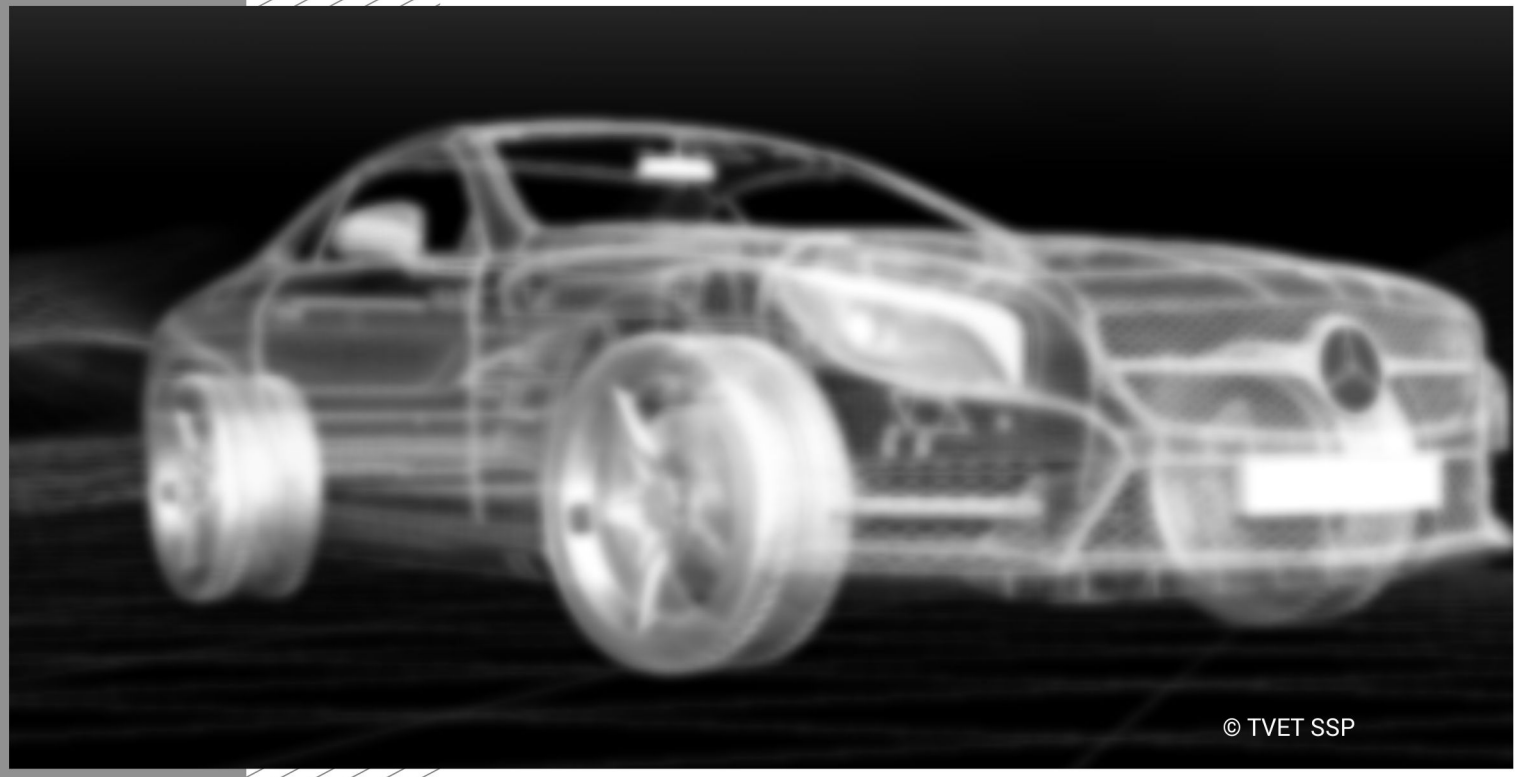
Idle Speed	**able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Find the adjustment screws and start the engine Adjust engine idle speed by adjusting throttle valve adjusting screw Refit all parts to finish the job Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing engine tuning and its purpose Explaining the purpose of engine idle speed Defining the procedure to adjust engine idle to standard RPM. Explaining the importance of engine idle speed for fuel economy. Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping	08 Hrs **Theory:** 02 Hrs **Practical:** 06 Hrs	Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set RPM Meter Multi Meter Allen key set	with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Adjust Air Fuel Ratio	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Locate the air filter and remove it in a	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining the purpose of adjusting air fuel ratio Defining the procedure to adjust standard air fuel ratio. Explaining the importance of air fuel ratio	**Total** 08 Hrs **Theory:** 02 Hrs **Practical:** 06 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	carbureted fuel system. Find the adjustment screws on the carburetor Start the engine and warm-up to normal operating temperature Adjust screw to find the right mixture Refit the air filter assembly Ensure housekeeping after completion of task	for fuel economy. Explaining the effect of too much rich or too much lean air fuel ratio on engine. Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping		RPM Meter Multi Meter Allen keys set	
LU 4: Adjust Tappet Clearance	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Remove tappet cover and related parts Turn the crankshaft to close the intake and exhaust valves Use feeler gauge to adjust tappet clearance	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Understanding the importance of engine tappet adjustment to improve engine efficiency. Explaining the importance of tappet cover seal and how it prevents engine oil leakages. Explaining the standard procedure of tappet adjustment using appropriate tools. Explaining the types of tappets used in	**Total** 10 Hrs **Theory:** 02 Hrs **Practical:** 08 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set Allen keys set Feeler gauges Socket Spanners	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	as per workshop manual Refit all parts with defined procedure Ensure housekeeping after completion of task	different vehicles and their replacement procedures Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping			
LU 5: Clean/Adjust/Replace Spark Plugs	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Disconnect and clean spark plug wire Remove and clean spark plugs Adjust plug gaps as per standard if required Replace spark plugs with new if required Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining the function of spark plug in engine, describe its types and heat ranges and method to clean using appropriate tools. Describing how to adjust spark plug electrodes gap using spark plug gauges according to ignition coil output high voltages Explaining how to inspect the spark plug high voltage cables and to protect it from heated exhaust manifold Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping	**Total** 08 Hrs **Theory:** 02 Hrs **Practical:** 06 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set Allen keys set Spark plug gauges Socket Spanners Multimeter	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 6:	**The trainee will be**	Understanding of appropriate tools and	**Total**	Relevant PPEs	Class or

Clean/Adjust/Replace Contact Breaker Point	**able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Clean and adjust C.B points Replace C.B point if required Clean distributor cap segments Ensure housekeeping after completion of task	equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining the purpose and importance of Contact Breaker point in ignition system. Explaining the dwell angle of C.B point Describing the procedure to replace and adjust C.B point gap range (0.4 ~ 0.5mm) Cleaning of C.B point by using appropriate tools. Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping	08 Hrs **Theory:** 02 Hrs **Practical:** 06 Hrs	Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set Allen keys set Socket Spanners Multimeter	demonstration room **EITHER** Workshop/Lab Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

AUTOMOTIVE MECHATRONICS



Module-8

CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 8: 071400953 Maintain Ignition System

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to maintain ignition system of vehicle.

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

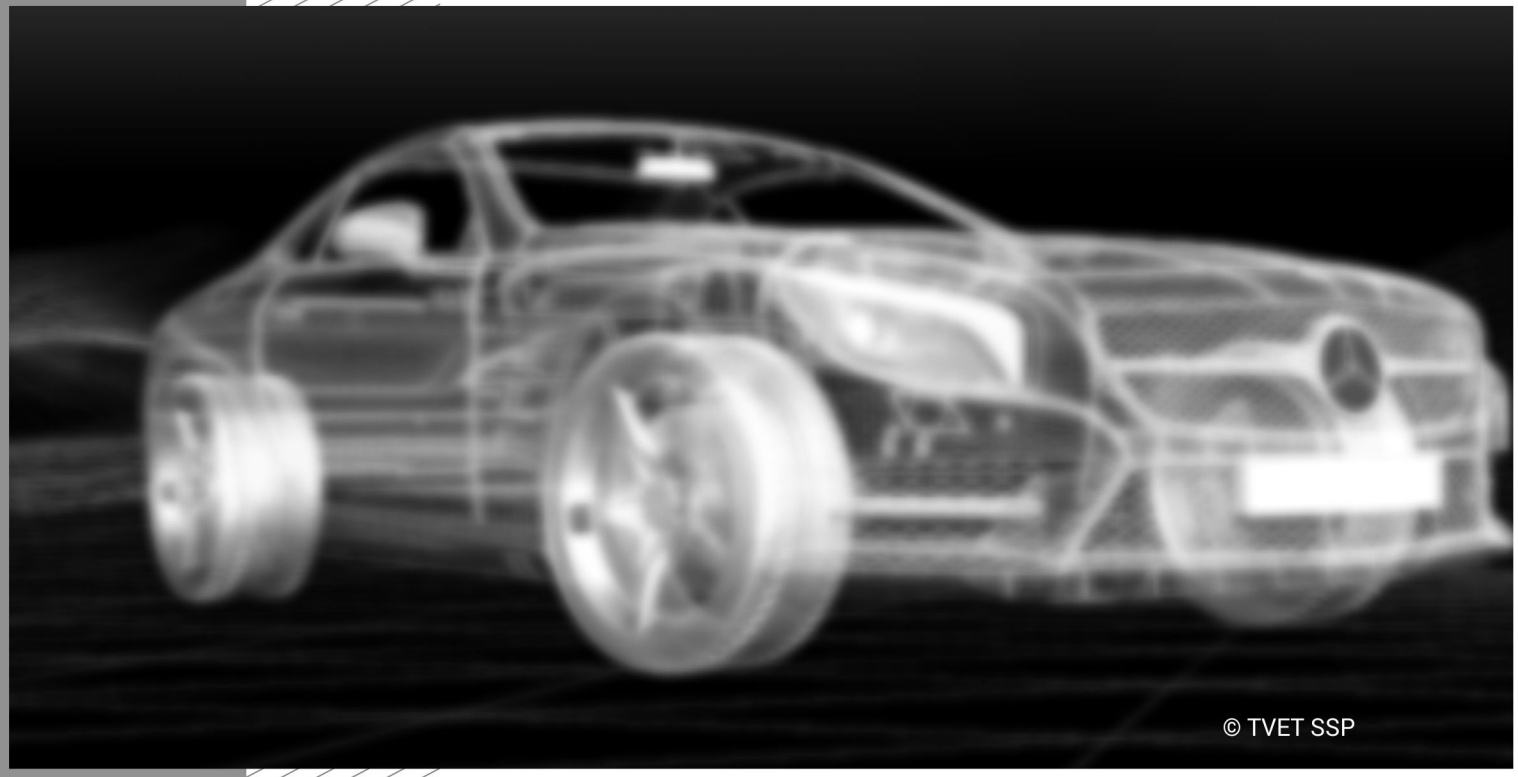
Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Maintain Contact Breaker Ignition System	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Check battery voltage Check ignition switch using Multimeter. Check ignition coil Check/ replace and adjust CB point gap Adjust firing order Clean/adjust/replace spark plugs Check ignition distributor components Replace	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace. Describing main components of ignition distributor (Distributor cap, rotor arm, cam, contact breaker point, base plate, vacuum and centrifugal advance mechanism) Describing the procedure to check battery performance (Voltage, Electrolyte Specific gravity) Describing the working of ignition switch and coil. Testing of ignition switch and coil using Multimeter Describing the procedure to replace and adjust C.B point gap range (0.4 ~ 0.5 mm) and method to clean using appropriate tools Explaining the purpose of firing order	**Total** 18 Hrs **Theory:** 04 Hrs **Practical:** 14 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set RPM Meter Multimeter Allen Keys set WD-40 Grease Oil Gun Electric Tester Socket Spanner	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	capacitor/condenser, if required Ensure housekeeping after completion of task	and procedure to adjust firing order. Describing how to adjust spark plug electrode gap using spark plug gauges according to ignition coil output high voltages Describing the function of capacitor and how to check it by using Multimeter. Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping			
LU 2: Maintain Electronic Ignition System	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Check battery voltage Check ignition switch using Multimeter. Check ignition coil	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing the working of electronic ignition system and how ECU controls the electronic ignition system Describing main components of electronic ignition system (Distributor cap, rotor arm, reluctor, pick-up assembly, base plate, vacuum and	**Total** 16 Hrs **Theory:** 04 Hrs **Practical:** 12 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set RPM Meter Multimeter Allen Keys set	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	Service distributor Check induction coil for resistance Replace ignition module, if required Service spark plugs Ensure housekeeping after completion of task	centrifugal advance mechanism) Describing the working of ignition switch and coil. How to check it using Multimeter Describing the procedure of servicing of ignition distributor Describing how to adjust spark plug electrode gap using spark plug gauges according to ignition coil output high voltages Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping		WD-40 Grease Oil Gun Electric Tester Socket Spanner OBD-II Scanner	
LU 3: Maintain Coil-On-Plug (COP) System	**The trainee will be able to:** Select appropriate tools and equipment. Check battery voltage with Multimeter Check ignition coil resistance Connect OBD-II scanner	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining the advantages of coil on plug system and distributor less ignition system. Describing the procedure to check resistance of ignition coil using	**Total** 16 Hrs **Theory:** 04 Hrs **Practical:** 12 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and

	for scanning engine & note down the code Check performance of sensor Replace the faulty parts Reconnect the OBD-II scanner Verify the maintenance of fault Ensure housekeeping after completion of task	Multimeter. Explaining the usage of OBD-II Scanner for faults diagnosis and rectification of these faults on Coil-On-Plug (COP) ignition system and distributor less ignition system. Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping		Spanner Set RPM Meter Multimeter Allen Keys set WD-40 Grease Oil Gun Electric Tester Socket Spanner OBD-II Scanner	equipment

AUTOMOTIVE MECHATRONICS



Module-9

CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 9: 071400954 Maintain Fuel Control System-I

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to Maintain Fuel Control System-I.

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

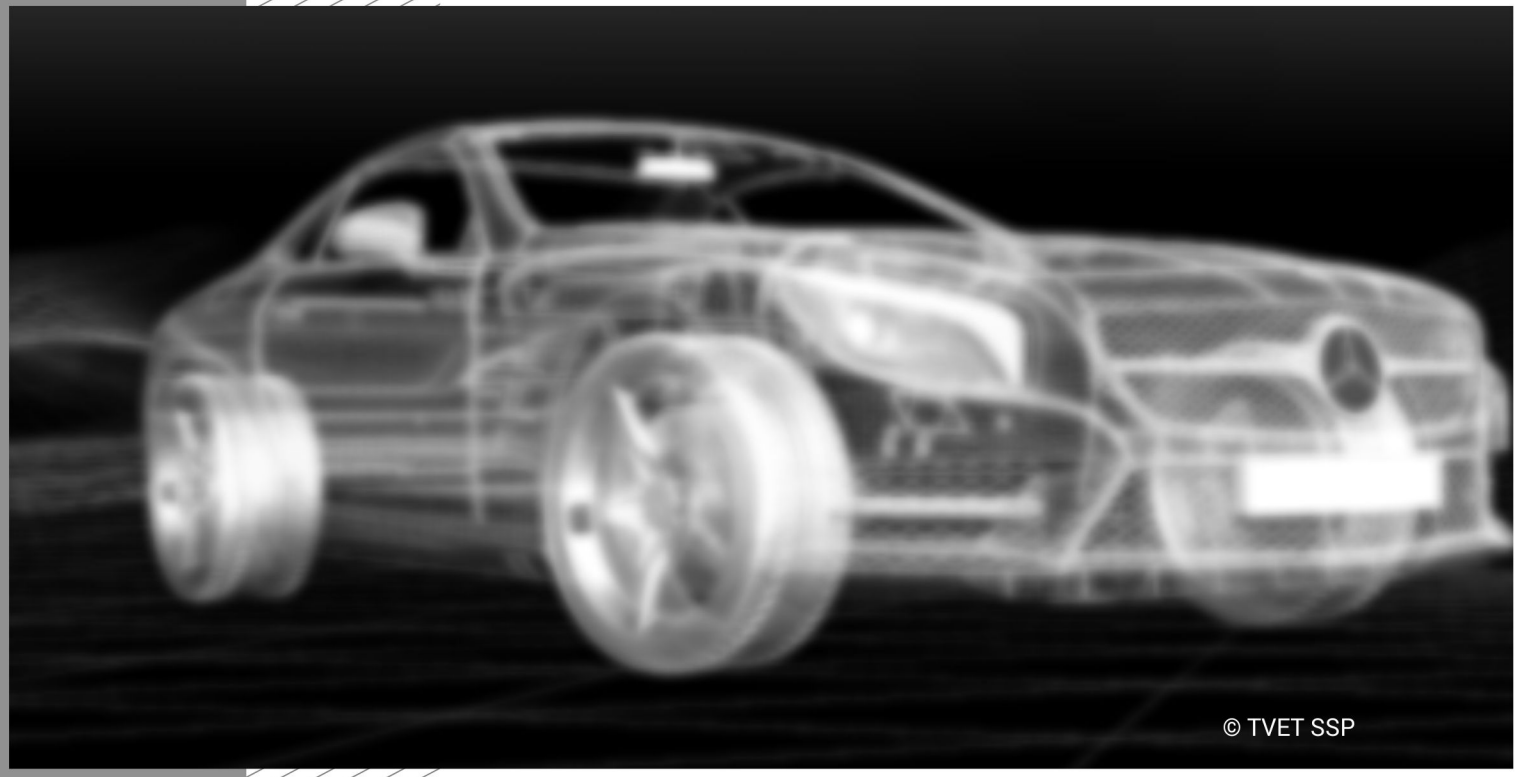
Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Maintain Electronic Fuel Injection (EFI) System	**The trainee will be able to:** Select appropriate Tools and equipment. Ensure work safely at all times, complying with health and safety precautions, regulations and other relevant guidelines. Check performance of Electronics Control Unit (ECU) Check performance of Mass Air Flow (MAF) Sensor Check performance of Oxygen Sensor Check performance of Throttle Valve Position Sensor Check performance of	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining the functions of electronic fuel injection system (EFI). Describing how EFI system plays important role in fuel economy and enhancing engine efficiency Explaining the importance of Electronics Control Unit (ECU) in EFI system. How it can reads the sensors and controls the actuators of vehicle Defining the function of all sensors (Mass Air Flow Sensor, Oxygen Sensor, Throttle Position Sensor and Intake Air Temperature Sensor) of fuel metering system Defining the function of all actuators (Idle air control valve and injectors) of fuel	**Total** 18 Hrs **Theory:** 04 Hrs **Practical:** 14 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set RPM Meter Multimeter Allen Keys set Electric Tester Socket Spanner OBD-II Scanner	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	Intake Air Temperature Sensor Ensure housekeeping after completion of task	metering system Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping			
LU 2: Maintain Common Rail Direct Injection (CRDI) System	**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. Service and Cleaning of Diesel Injectors Check fuel pressure at fuel rail inlet and outlet Check Fuel Pressure Sensor Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining the function of diesel injectors in diesel fuel system. Describing the purpose of servicing diesel injectors. Explaining the function of fuel rails in diesel fuel system. Describing the procedure to check fuel pressure at inlet and outlet ports. Explain the function of fuel pressure sensors and how to check them using Multimeter. Explaining the procedure to connect OBD-II Scanner to perform fault diagnoses and rectification of faults.	**Total** 16 Hrs **Theory:** 04 Hrs **Practical:** 12 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set RPM Meter Multimeter Allen Keys set Electric Tester Socket Spanner OBD-II Scanner	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

		Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping			
LU 3: Maintain Motronic Control Unit for CNG System	**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. Check performance of solenoid valve for fuel selection (CNG / Gasoline) Maintain solenoid valve at CNG kit. Adjust the CNG regulating screw. Maintain pressure setting of CNG Check performance of oxygen Sensor Check performance of	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining the working of CNG system. Describing the function and importance of Motronic Control Unit. Describing the function of solenoid valves and how to check it using Multimeter. Describing the procedure to adjust the CNG regulating screw to desired value. Explaining the working of CNG reducer kit. Explaining the function of all sensors (Oxygen Sensor, Throttle Position Sensor, Camshaft and Crankshaft Position Sensors) and how to check them using OBD-II Scanner. Describing procedure for cleaning and storing of tools and equipment at	**Total** 16 Hrs **Theory:** 04 Hrs **Practical:** 12 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set RPM Meter Multimeter Allen Keys set Electric Tester Socket Spanner OBD-II Scanner	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	throttle valve position sensor Ensure housekeeping after completion of task	workplace. Importance of housekeeping			

AUTOMOTIVE MECHATRONICS



Module-10

CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 10: 071400955 Service Comfort & Safety System-I

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to maintain Suspension System, Power Window & Central Locking System, Seat Belt and Heat Ventilating and Air Conditioning system.

Duration: 50 Hrs **Theory:** 15 Hrs **Practical:** 35 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Maintain Suspension System	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Maintain tie rod Maintain ball Joint Maintain shock absorber coil spring Maintain link rod Maintain lower/upper arm bushing Maintain hub bearing or stud Maintain inner/outer CV	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace. Describing main components of Suspension System (Leaf springs/Coil springs, Shock Absorbers, Suspension Arms & Trailing Arms, Tie rods, Torsion bars, Lateral Rods etc.).Describing types of tie rods, their inspection procedure, Describing types of ball Joint, their inspection procedure, proper removal and refitting procedures Describing types of coil springs according to load capacity and shapes, their inspection procedure, proper removal and refitting procedure Explaining stabilizer bars and their links, their inspection procedure, proper removal and refitting	**Total** 10 Hrs **Theory:** 03 Hrs **Practical:** 07 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set RPM Meter Multimeter Allen Keys set WD-40 Grease Oil Gun Electric Tester	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	joint Ensure housekeeping after completion of task	Describing types of rubber bushing used in lower and upper arms, their inspection procedure, proper removal and refitting procedure Explaining different types of hub/wheel bearings (Ball Bearings with or without spacers, Roller Bearing and Taper roller bearings). Explaining wheel studs repairing and replacing. Explaining different types of CV Joints,(Tripod CV joint, Rzeppa CV joint and Cross Groove CV Joint) their internal parts(Inner and outer race, tripod, cage, balls, boots and their clamps) and inspection procedure, proper removal and refitting preocedures. Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping		Socket Spanner Ball joint remover Pullers.	
LU 2: Maintain Power Window & Central Locking System	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Diagnose failure in	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing different components and their working of power window system (Switches, wiring harness, motors, etc.) Explaining different components and their	**Total** 10 Hrs **Theory:** 03 Hrs **Practical:** 07 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	power window system Diagnose failure in central locking system. Service and re-assemble power window system. Service and re-assemble central locking system. Check fuse, relays, electrical wire harness and connector of power window and central locking system. Check actuator assembly of central locking system. Check motor of power window system. Ensure housekeeping after completion of task	working of central locking system (Remote Switches, wiring harness actuators, etc.) Servicing/replacing the components of power window system (Switches, motors, etc.) Servicing/replacing the components of central locking system (Remote Switches, actuators, etc.) Checking/replacing procedure of fuses, relays, wiring harness, connectors of power window and central locking system. Checking/replacing procedure of actuator assembly of central locking system. Describing procedure for checking motors of power window system Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping		RPM Meter Multimeter Allen Keys set WD-40 Grease Oil Gun Electric Tester Socket Spanner OBD-II Scanner	

LU 3: : Verify Seat Belt	**The trainee will be able to:** Select appropriate tools and equipment. Observe occupational health and safety precautions at all times Check seat belt indication lamp Check fuse, relays, electrical wire harness and connector. Check operation of seat belts. Check function of power seat switches. Check function of power seat motor and rectify failures. Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing the procedure to check seat belt indication lamp (for example; the indication lamp must be OFF when seat belt is fastened and it must go ON when seat belt is not fastened properly). Describing the procedure to check fuse, relays, electrical wire harness and connector by using Multimeter and test lamp. Importance of seat belt while driving. Describing procedures to check the locking of seat belt on jerk or emergency braking. Explaining the working of power seat switches and their location on seats. Explaining the function of ECU which controls adjusting motors of seats according to requirements Diagnosing the power seat motors for proper functioning (tilt, recline, and seat elevation) and replace faulty motors. Describing procedure for cleaning and storing of tools and equipment at workplace. Importance of housekeeping	**Total** 10 Hrs **Theory:** 03 Hrs **Practical:** 07 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set RPM Meter Multimeter Allen Keys set WD-40 Grease Oil Gun Electric Tester Socket Spanner OBD-II Scanner	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

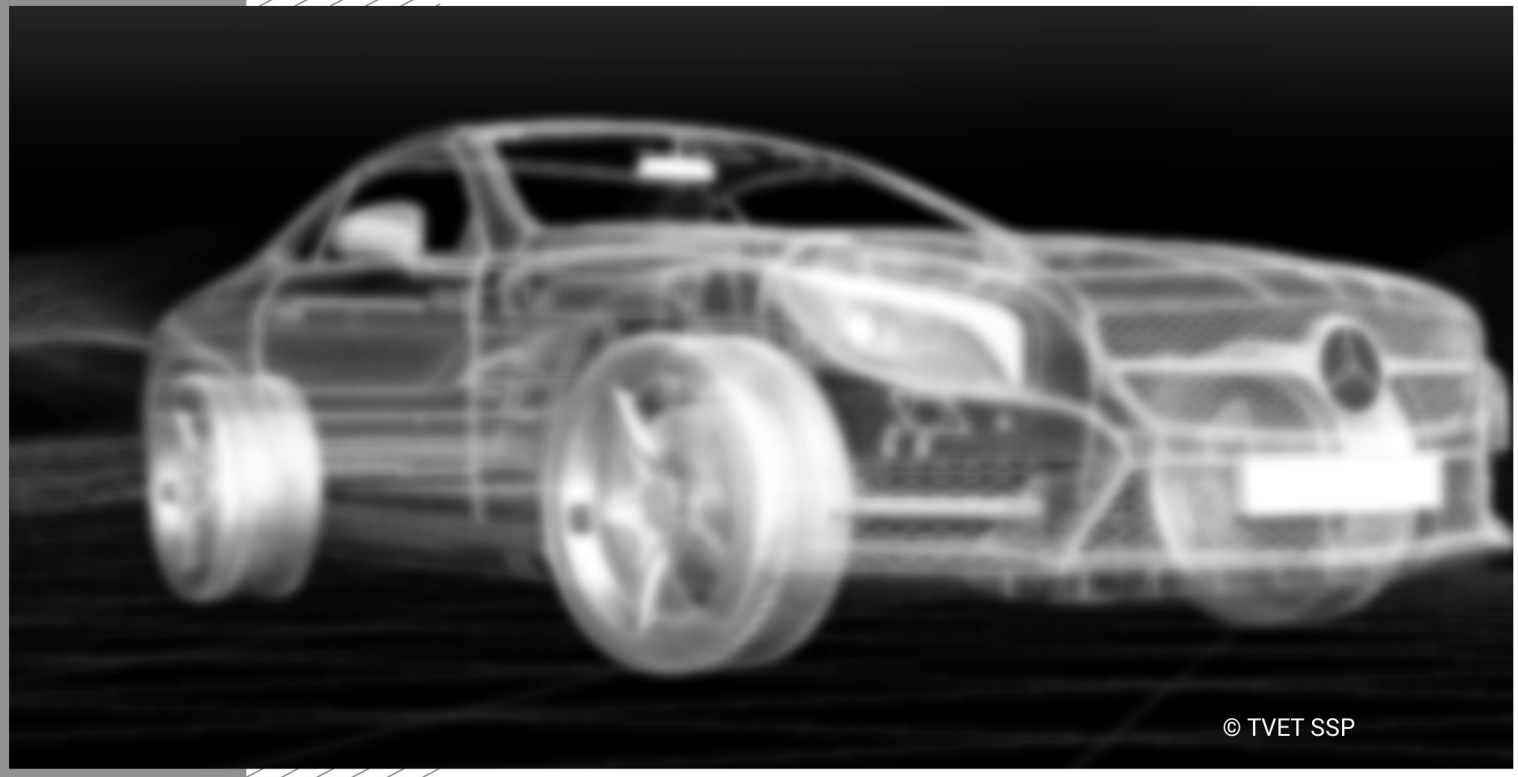
LU 4: Service Heat Ventilating system	Select appropriate tools and equipment. Observe occupational health and safety precautions at all times Check performance of radiator and rectify failures. Check leakages of heater hoses and rectify failures. Check blower fan and rectify failures. Check electrical system of heat ventilation and rectify failures. Check performance of thermostat and rectify failures. Check leakages of heater core and rectify failures. Check performance of heater control valve and rectify failures. Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing various parts of radiator (Radiator neck, tubes and fins, upper & lower tanks, radiator cap). Explaining how to test leakage and condition of radiator. Defining the procedure to perform leakage test of hoses and cooling/heating systems using leakage tester. Describing importance and working of blower fan, procedure to test blower fan motor by using Multimeter and replacing the faulty parts. Describing working of electrical system of heat ventilation using Multimeter and voltage tester and replacing the faulty parts. Explaining the procedure for testing thermostat operation.(thermostat starts to open at about 83 degree Celsius and completely opens at 90 degree Celsius) Explaining the procedure to perform leakage test of heater core using leakage tester and repair/replace the heater core. Explaining the procedure check heater control valve from dashboard knob/switch	**Total** 10 Hrs **Theory:** 03 Hrs **Practical:** 07 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set Socket Spanner Multimeter Allen Keys set WD-40 Grease Oil Gun Voltage Tester Radiator leakage Tester pump.	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

		and repair/replace the faulty knob/switch Describing procedure for cleaning and storing of tools and equipment at workplace Importance of housekeeping			
LU 5: Service Air-Conditioning (AC) System	Select appropriate tools and equipment. Observe occupational health and safety precautions at all times Check performance of AC compressor and rectify failures. Check performance of AC condenser with fittings and rectify failures. Check condensor fan and rectify failures. Check performance receiver/dryer or accumulator and rectify failures. Check blower fan and rectify failures.	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining different types of A/C Compressors and their internal parts(Reciprocating AC Compressor, Scroll AC Compressor, Screw AC Compressor, Rotary AC Compressor, Centrifugal AC Compressor) Describing the procedure of pressure testing of AC condenser and its repairing/replacing. Explaining the procedure of checking radiator fan and its motor using Multimeter and replacing faulty motor. Describing the procedure to check receiver/dryer or accumulator through sight glass Describing importance and working of blower fan. Explaining the procedure to test blower fan motor using Multimeter	**Total** 10 Hrs **Theory:** 03 Hrs **Practical:** 07 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Wire Brush Combination Spanner Set Socket Spanner Multimeter Allen Keys set WD-40 Grease Oil Gun Voltage Tester Manifold Gauge Set with Hose and Manual	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	Check performance of expansion valve and rectify failures. Check leakages of evaporator and rectify failures. Perform refrigerant leak test. Re-charge AC refrigerant. Check electrical system of air conditioning and rectify failures. Ensure housekeeping after completion of task	and replacing the faulty parts. Describing importance and working of expansion valve. Explaining the procedure to test expansion valve and replacing the faulty expansion valve. Describing the procedure to check evaporator leak, refrigerant will collect in the evaporator case, and pass into the passenger compartment through the a/c vents on the dash. Test the vent nearest the evaporator with an electronic leak detector. Explaining dye-based air conditioning leak-down test which uses a colored dye to find Freon leaks in A/C system. In this test, a colored dye is injected into the A/C system which will be visible under ultra-violet light at the point of a leak anywhere in the system. Describing the procedure for repairing leakages and re-charging A/C refrigerant into the system (30 to 40 psi on Low pressure side.) While the high pressure reading 225 to 250 psi for 134 a, When the system is fully charged. Explaining the electrical system checks of car A/C system and their rectification procedure. (Electrical Checks include A/C Compressor clutch testing, Blower fan Testing, Condenser fan, Pressure switch testing using Multimeter).		Couplers A/C Recovery & Recycling Machines A/C Flushing Equipment A/C Vacuum Pumps A/C Manifold Gauge Sets A/C Charging Scales A/C Retrofit Adapters & Gaskets A/C Orifice Tube Tools Clutch A/C Holding Tool Line Disconnect Tools Refrigerant Identifiers Diagnostic Leak Detection	

		Explaining the procedure of pressure testing of evaporator for leakage finding and repairing/replacing the evaporator. Importance of housekeeping		Valve Core Remover/Installer	

AUTOMOTIVE MECHATRONICS



Module-11

CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 11: 071400956 Maintain Controlled Brake System

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

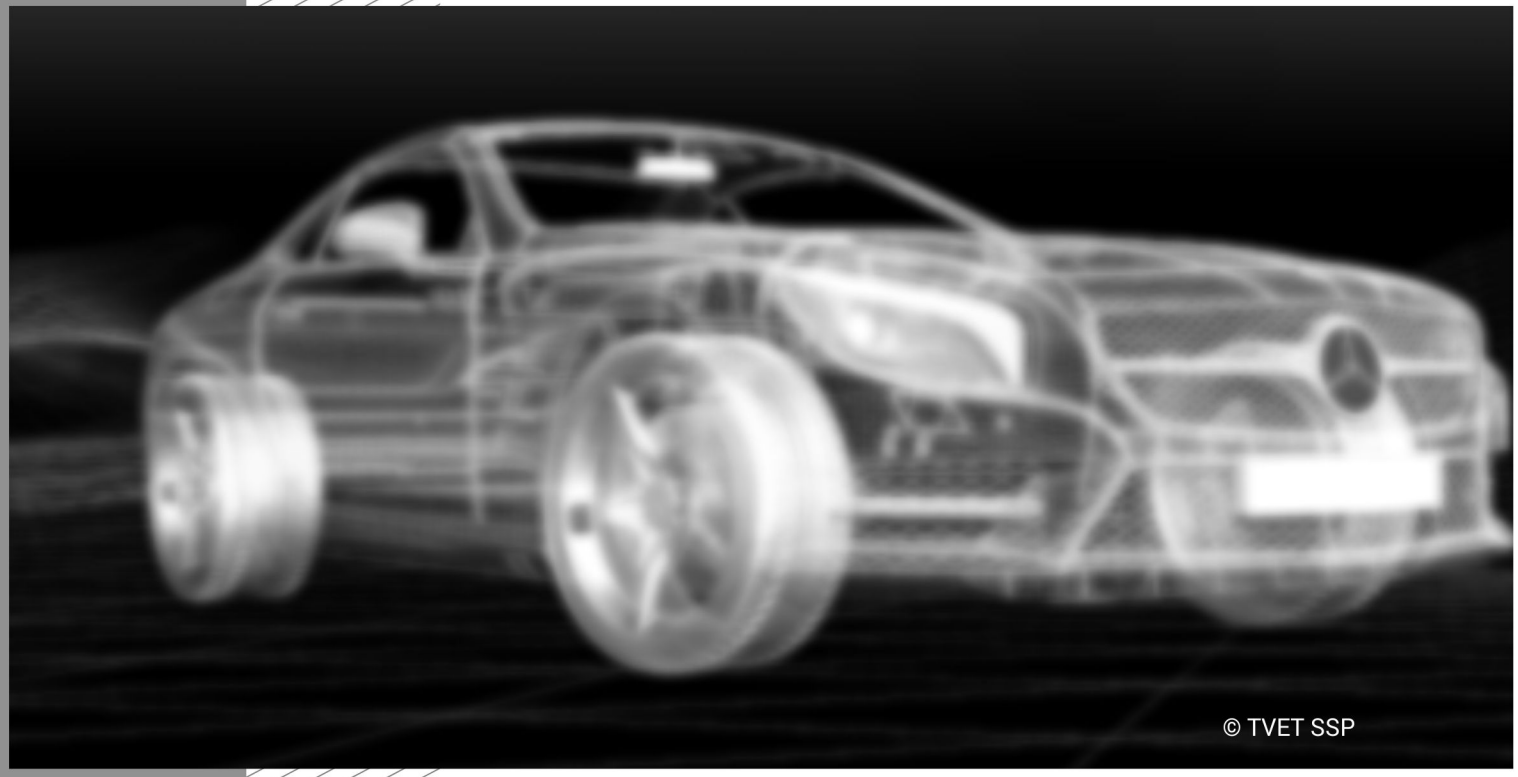
Duration: 45 Hrs **Theory:** 09 Hrs **Practical:** 36 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Maintain Anti-lock Braking System (ABS)	**The trainee will be able to:** Select appropriate Tools and equipment. Follow safety rules regarding the job. Apply OBD-II scanner to check faults in ABS. Check wiring harness of ABS system. Check ABS fuse and relay. Inspect brake lining. Check wheel speed sensors. Check pressure of ABS. Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describe usage of different tools and equipment for fault diagnoses e.g. screw drivers, combination spanner, Clip opener, socket set and DC tester etc. Knowledge of electric standards and relevant safety (for example electrical systems, protective devices and connection technologies Explaining the purpose of ABS system and its main components e.g. wheel speed sensors, gear pulser, ECU and hydraulic pressure modulator Understanding the importance of ABS system in a vehicle Explaining the diagnosis of ABS system with the help of OBD II scanner. Finding Fault with the help of scanner and	**Total** 15 Hrs **Theory:** 03 Hrs **Practical:** 12 Hrs	Relevant PPEs Brake Fluid Brake pads Brake shoe Philips/Flat Screw Driver Set Cotton Rags Needle Nose plier Car Lift Emery Paper Combination Spanner Set Multi Meter	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

		its rectification Describing procedure for cleaning and storing of tools & equipment at work place Importance of housekeeping			
LU 2: Maintain pressure Modulator	**The trainee will be able to:** Ensure safety precautions & adopt PPEs Select tools/equipment/material as per requirement Check the brake fluid inlet lines Check the brake fluid outlet lines Check the return motor connection Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing usage of different tools and equipment for fault diagnoses e.g. screw drivers, combination spanner, Clip opener, socket set and DC tester etc. Explaining the inlet and outlet brake lines and figure out the leakages in these brake lines Explaining the working principle of hydraulic pressure modulator Explaining the the functions of solenoid valves and return motor of Pressure Modulator during braking. Importance of housekeeping	**Total** 15 Hrs **Theory:** 03 Hrs **Practical:** 12 Hrs	Relevant PPEs Brake Fluid Brake pads Brake shoe Philips/Flat Screw Driver Set Cotton Rags Needle Nose plier Car Lift Emery Paper Combination Spanner Set Multi Meter	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 3: Maintain ABS- Electronic Control Unit (ECU)	**The trainee will be able to:** Select appropriate Tools and equipment.	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing usage of different tools and	**Total** 15 Hrs **Theory:** 03 Hrs	Relevant PPEs Brake Fluid Brake pads Brake shoe	Class room with multimedia aid and flip charts Or Access to an

	Follow safety rules regarding the job. Maintain ECU of ABS system Clean and refit the connector. Ensure housekeeping after completion of task	equipment for fault diagnoses e.g. screw drivers, combination spanner, Clip opener, socket set and DC tester etc. Describing the knowledge of electric standards and relevant safety (for example electrical systems, protective devices and connection technologies) Explaining the working of ECU in ABS system. Describing the method how to remove, clean and refit the connector of ECU Explaining how ECU may be replaced if found malfunctioned after scanning by OBD II scanner. Importance of housekeeping	**Practical:** 12 Hrs	Philips/Flat Screw Driver Set Cotton Rags Needle Nose plier Car Lift Emery Paper Combination Spanner Set Multi Meter	Automobile Workshop with required tools and equipment

AUTOMOTIVE MECHATRONICS



Module-12

CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 12: 071400957 Conserve Power Transmission-I

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to conserve power transmission.

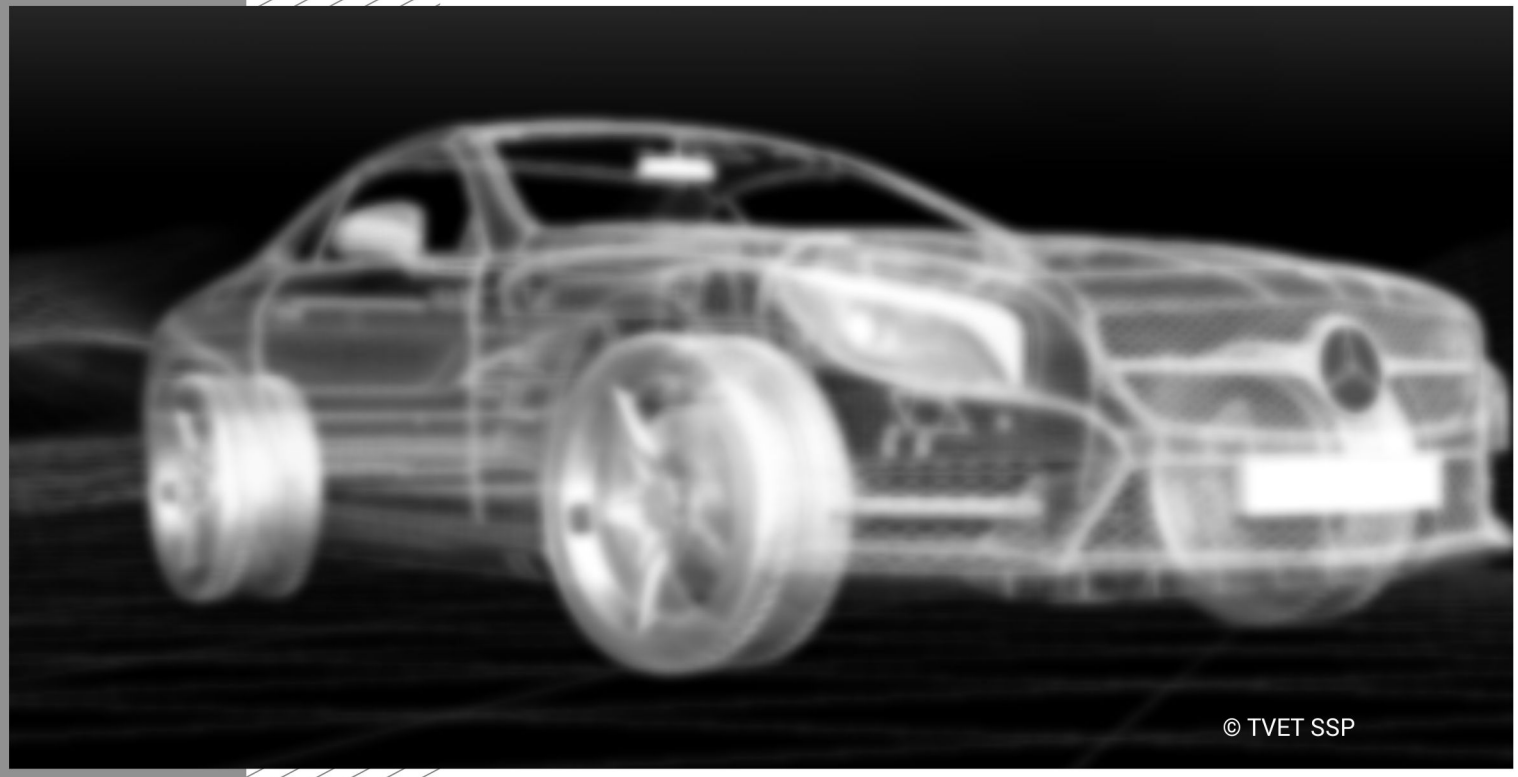
Duration: 45 Hrs **Theory:** 09 Hrs **Practical:** 36 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Perform maintenance of Automatic Transmission	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Test automatic transmission Replace vehicle speed sensor Replace multi-plate clutches Replace transmission fluid strainer Check/replace valve body Replace torque converter Replace transmission oil	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining the working principle of Automatic Transmission Describing the usage of different tools and pressure gauge to check oil pressure of automatic transmission Describing the procedure to replace vehicle speed sensor Explaining working of planetary gear set in reverse gear operation Explaining working of reverse clutch drum, its friction band and servo unit. Elaborating the components of Automatic Transmission and their functions e.g. Drive shaft, driven shaft, multi plate clutches, valve body, governor, oil cooler etc. Describing the purpose of transmission fluid	**Total** 15 Hrs **Theory:** 03 Hrs **Practical:** 12 Hrs	Relevant PPEs Transmission Oil Philips/Flat Screw Driver Set Cotton Rags Grip plier Car Lift Emery Paper Combination Spanner Set Multi Meter Allen Key Set Bearing Puller Housing Puller Tyre Lever Hammer	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	seals Maintain/replace automatic transmission fluid Ensure housekeeping after completion of task	strainer and procedure of its replacement Defining the main parts and their functions of torque converter (namely pump, turbine and stator). Describing procedure for cleaning and storing of tools & equipment at work place Importance of housekeeping			
LU 2: Perform maintenance of Electronically Controled Transmission (ECT) System	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Test ECT fluid pressure Replace vehicle speed sensor Replace input shaft sensor Replace output shaft sensor Check/replace valve body Replace multi-plate clutches Replace transmission oil	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing usage of multi meter and DC tester for testing sensors and solenoid valves. Describing the function of sensor used in automatic transmission Diagnosing the fault with the help of OB II sensor Explaining the procedure to replace the faulty sensor Importance of housekeeping	**Total** 15 Hrs **Theory:** 03 Hrs **Practical:** 12 Hrs	Relevant PPEs Transmission Oil Safety Mask Philips/Flat Screw Driver Set Cotton Rags Coverall Grip plier Ear plug/Ear Muff Car Lift Emery Paper Combination Spanner Set Multi Meter Allen Key Set Bearing Puller	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	seals Maintain/replace ECT fluid Ensure housekeeping after completion of task			Housing Puller Tyre Lever Hammer. Oil Pressure Gauge.	
LU 3: Perform Diagnosis of Electronically Controlled Transmission (ECT) System with OBDII Scanner	**The trainee will be able to:** Select tools and equipment according to job requirement Observe occupational health and safety precautions at all times Connect OBD-II Scanner Monitor function of all sensors. Replace the faulty sensors Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describe usage of different tools and equipment for fault diagnoses e.g. screw drivers, combination spanner, Clip opener, socket set and DC tester etc. Knowledge of electric standards and relevant safety (for example electrical systems, protective devices and connection technologies Describing the function of sensor used in automatic transmission Diagnosing the fault with the help of OB II sensor Explaining the procedure to replace the faulty sensor Importance of housekeeping	**Total** 15 Hrs **Theory:** 03 Hrs **Practical:** 12 Hrs	Relevant PPEs Transmission Oil Safety Mask Philips/Flat Screw Driver Set Cotton Rags Grip plier Ear plug/Ear Muff Car Lift Emery Paper Combination Spanner Set Multi Meter Allen Key Set Bearing Puller Housing Puller Tyre Lever Hammer	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

AUTOMOTIVE MECHATRONICS



Module-13

CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 13: 071400958 Perpetuate Controlled Electric & Electronics System-I

Objective of the module: The aim of this module is to develop advanced knowledge, skills and understanding to perpetuate controlled electrical & electronics system.

Duration: 60 Hrs **Theory:** 15 Hrs **Practical:** 45 Hrs

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1: Service Windshield wash system	**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. Check function of rain sensor. Check hoses of the system Check wire harness and connector. Check performance and service of shower nozzles. Check function of pump	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing usage of multi meter and DC tester for testing sensors and actuators. Explaining working mechanism & location of rain sensor, troubleshooting of rain sensor with the help of OBD II Scanner. Understanding the connection of hoses and their location, nozzle, washer reservoir, along with motor driven centrifugal pump. Understanding of components of motor e.g. armature, magnet and carbon bushes etc. Functioning and servicing of shower nozzles	**Total** 12 Hrs **Theory:** 03 Hrs **Practical:** 09 Hrs	Washer Fluid WD 40 Multipurpose Grease Oil Gun Emery Paper Cotton rags Philips/Flat Screw Driver Set Combination Spanner Set Multi Meter Socket Set Relevant PPEs	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	motor. Service faulty parts. Ensure housekeeping after completion of task	Functioning and connections of Wiper switch and instrument panel wire harness Servicing and re-fixing of faulty parts at their desired location. Describing procedure for cleaning and storing of tools & equipment at work place. Importance of housekeeping			
LU 2: Service Wiper System	**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. Check wire harness and connector. Disconnect wiper motor and its connector. Connect wiper motor with battery and check its functionality. Service of wiper motor Check wiper linkages Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Explaining of main components of wiper system (wiper blade, wiper arm, pivot shaft, linkage, wiper switches etc.). Understanding of intermittent or delay mode and working of wiper motor. Testing wiper motor with the help of battery voltage. Checking the fuses and relays with DMM. Describing procedure for cleaning and storing of tools & equipment at work place. Importance of housekeeping	**Total** 12 Hrs **Theory:** 03 Hrs **Practical:** 09 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Multimeter Combination Spanner Set Socket Spanner 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 Instrument Panel	**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. Check gauges of instrument panel cluster Check performance of CD player, Radio and LCD. Check function of switch buttons and knobs of instrument panel Check performance of indicators and wiring lights in instrument panel Ensure housekeeping after completion of task	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Understanding gauges of instrument panel, their functioning and troubleshooting with the help of OBD II Scanner Fixing and removing of CD player, radio and LCD, understanding of their functions and their performance level. Explaining of panel buttons and knobs of instrument panel Explaining the operation of all indicators and warning lights in instrument panel. Describing procedure for cleaning and storing of tools & equipment at work place. Importance of housekeeping	**Total** 12 Hrs **Theory:** 03 Hrs **Practical:** 09 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Combination Spanner Set RPM Meter Multi Meter OBD II Scanner	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 4: Demonstrate Function of	**The trainee will be able to:** Select appropriate Tools	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding	**Total** 12 Hrs	Relevant PPEs Philips/Flat Screw	Class room with multimedia aid

Sensors	and equipment. Ensure work safely at all times, complying with health and safety precautions, regulations and other relevant guidelines. Connect OBD-II Scanner Monitor functions of all sensors. Replace the faulty sensor. Ensure housekeeping after completion of task	personal health and workplace Explain how to check sensor or troubleshoot the sensor problem with the help of OBD II scanner Monitoring function of all sensors with the help of multi meter and voltage tester Explaining the method how to replace the faulty sensor. Describing procedure for cleaning and storing of tools & equipment at work place Importance of housekeeping	**Theory:** 03 Hrs **Practical:** 09 Hrs	Driver Set Cotton Rags Emery Paper Combination Spanner Set RPM Meter Multi Meter OBD II Scanner	and flip charts Or Access to an Automobile Workshop with required tools and equipment
LU 5: Maintain Electrical Motors	**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. Check wire harness and connectors of all motors. Monitor function of different	Understanding of appropriate tools and equipment for performing this task Explaining the safety precautions regarding personal health and workplace Describing usage of different tools and equipment for fault diagnoses e.g. screw drivers, combination spanner, Clip opener, socket set and DC tester etc. Understanding of electric standards and relevant safety (for example electrical systems, protective devices, connection technologies and) Understanding the connections of wire	**Total** 12 Hrs **Theory:** 03 Hrs **Practical:** 09 Hrs	Relevant PPEs Philips/Flat Screw Driver Set Cotton Rags Emery Paper Combination Spanner Set RPM Meter Multi Meter Voltage Tester.	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment

	motors. Disconnect and remove the faulty motors Connect with the battery and check for its function. Service and maintain/replace the motors. Ensure housekeeping after completion of task	harness and their locations Monitoring the operations of all motors Functioning and location of all motors Explain the method how to replace the faulty motor. Describing procedure for cleaning and storing of tools & equipment at work place Importance of housekeeping		OBD II Scanner	

General assessment guidance for *Automotive Mechatronics Lev-3*

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-3 include:

- Work performances, for example perform general inspection with required safety precautions
- Demonstrations, for example demonstrating to perform engine tuning, including clean/replace air filter, tappet clearance, spark plugs, contact breaker point and air fuel ratio.
- Direct questioning, where the assessor would ask the student about sequence to perform service comfort & safety system
- Paper-based tests, such as multiple choice or short question answer.

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-3 include:

- Work products, such as a maintained ignition 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-3 Curriculum

This curriculum consists of 13 modules:

1. Apply Work Health and Safety Practices (WHS)
2. Identify and Implement Workplace Policy and Procedures
3. Communicate at Workplace
4. Perform Computer Application Skills
5. Manage Personal Finances
6. Perform General Inspection
7. Perform Engine Tuning
8. Maintain Ignition System
9. Maintain Fuel Control System-I
10. Service Comfort and Safety System-I
11. Maintain Controlled Brake System
12. Conserve Power Transmission-I
13. Perpetuate Controlled Electrical & Electronics System-I

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.

5 generic modules shall be assessed comprising with other 8 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	20 nos.
7	A/C Charging Scales	05 nos.
8	A/C Flushing Equipment	06 nos.
9	A/C Manifold Gauge Sets	10 sets
10	A/C Orifice Tube Tools	10 nos.
11	A/C Recovery & Recycling Machines	06 nos.
12	A/C Retrofit Adapters & Gaskets	10 nos.
13	A/C Vacuum Pumps	10 nos.
14	Air Compressor	10 nos.
15	Allen key set	20 nos.
16	Battery Load Tester	10 nos.
17	Bearing Puller	10 nos.

18	Brake Bleeding Equipment	10 nos.
19	Brake Drum Pullers	10 nos.
20	Brake Efficiency Tester	10 nos.
21	Brake fluid collector/container	10 nos.
22	Brake pads	10 nos.
23	Brake shoe	10 nos.
24	Car lifting equipment	06 nos.
25	Clutch A/C Holding Tool	10 nos.
26	Combination Plier	20 nos.
27	Combination Spanner Set	20 nos.
28	Diagnostic Leak Detection	05 nos.
29	Electric Tester	05 nos.
30	Electrical tool kit	05 nos.
31	Exhaust Gas Analyzer	05 nos.
32	Feeler gauges	05 nos.
33	Flare-nut wrench	05 nos.
34	Flaring Tool/Flare Tool for brake tubes repairing	05 nos.
35	Gas leak detector	05 nos.
36	Grip Plier	10 nos.
37	Hammer	10 nos.

38	Hex Wrench(Set)	05 set
39	Housing Puller	05 set
40	Hydraulic Jack	05 set
41	Hydrometer	05 set
42	Lifting Equipment (Service Pit)	05 set
43	Line Disconnect Tools	05 set
44	Manifold Gauge Set with Hose and Manual Couplers	03 set
45	Multi Meter	05 nos.
46	Needle Nose plier	05 nos.
47	Nose Plier	10 nos.
48	OBD II Scanner	06 nos.
49	Oil Gun	05 nos.
50	Philips/Flat Screw Driver Set	05 set
51	Plug Spanner	05 set
52	Refrigerant Identifiers	10 nos.
53	RPM Meter	10 nos.
54	Socket Set	10 nos.
55	Socket Spanner Set	10 nos.
56	Spark plug gauges	10 nos.
57	Special bleed valve tools (only for ABS use)	10 nos.

58	Special service tools	10 nos.
59	Special suction pump or vacuum bleeder	02 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	Valve Core Remover/Installer	06 nos.
68	Vernier caliper	06 nos.
69	Voltage Tester	10 nos.
70	Wheel alignment machine	05 nos.
71	Wheel balancing Machine	05 nos.

List of consumable supplies

1. Battery
2. Brake Fluid
3. Carburetor cleaner (sensor safe)
4. Cleaning Equipment with Detergent
5. Cotton Rags
6. Coverall
7. Ducting Tape
8. Emery Paper
9. Grease
10. Spark plug cleaner
11. Transmission Oil
12. Washer Fluid
13. WD 40
14. Wet towel
15. Wire Brush (Steel Wire)

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 3 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: Apply Work Health and Safety Practices (WHS)	30	03
2: Identify and Implement Workplace Policy and Procedures	20	02
3: Communicate at Workplace	30	03
4: Perform Computer Application Skills	40	04
5: Manage Personal Finances	30	03
6: Perform General Inspection	40	04
7: Perform Engine Tuning	50	05
8: Maintain Ignition System	50	05
9: Maintain Fuel Control System-I	50	05

Competency Standard	Estimate of hours	Credit
10: Service Comfort and Safety System-I	50	05
11: Maintain Controlled Brake System	45	4.5
12: Conserve Power Transmission-I	45	4.5
13: Perpetuate Controlled Electrical & Electronics System-I	60	06

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