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AUTOMOTIVE MECHATRONICS

TRAINER GUIDE

National Vocational Certificate Level 4

Version 1 - October, 2019

NAVTTC

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AUTOMOTIVE MECHATRONICS

TRAINER GUIDE

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Introduction

Competence-based training helps to bridge the gap between what is taught in training and what tasks will be performed on the job. Training trainees to perform actual job functions helps to ensure that future front-line workers have the skills, knowledge and abilities required to perform their jobs properly, safely and effectively. In addition to competence-based training, assessment based on the performance of actual work competencies helps to ensure that:

- trainees are performing their work tasks as safely as possible
- performance gaps are recognized prior to serious incidents
- Training can be implemented to improve competence.

There are significant benefits to competence-based training:

1. **Cost effectiveness**

   Since training activities and assessments in a competence-based approach are goal-oriented, trainers focus on clearly defined areas of skills, knowledge and understanding that their own industry has defined in the competence standards. At the same time, trainees are more motivated to learn when they realize the benefits of improved performance.

2. **Efficiency**

   The transfer gap between the training environment and working on the job is reduced substantially in a competence-based approach. This is because training and assessment are relevant to what needs to be done on the job. As a result, it takes less time for trainees to become competent in the required areas. This, in turn, contributes to improved efficiency where training and assessment are concerned.

3. **Increased productivity**

   When trainees become competent in the competence standards that their own industry has defined, when they know what the performance expectations are and receive recognition for their abilities through successful assessments, they are likely to be more motivated and experience higher job satisfaction. The result is improved productivity for organizations. The communication and constructive feedback between future employers and employees will improve as a result of a competence-based approach, which can also increase productivity.

4. **Reduced risk**

   Using a competence-based approach to training, development, and assessment, employers are able to create project teams of people with complementary skills. A trainee's record of the skills, knowledge and understanding relating to the competence standards they have achieved can be used by a future employer to identify and provide further relevant training and assessment for new skills areas. Competence standards can shape employee development and promotional paths within an organization and give employees the opportunity to learn more competencies beyond their roles. It can also provide organizations with greater ability to scale and flex as needed, thereby reducing the risk they face.

5. **Increased customer satisfaction**

   Employees who have been trained and assessed using a competence-based approach are, by the definition of the relevant competence standards, able to perform the required tasks associated with a job. The knock-on effect is that, in service-related industries, they are able to provide high service levels, thereby increasing customer satisfaction. In production or manufacturing industries, they are able to work closely to industry standards in a more effective and efficient way.

Lesson plans

This manual provides a series of lesson plans that will guide delivery of each module for the *automotive mechatronics* qualification. It is important for trainers to be flexible and be ready to adapt lesson plans to suit the context of the subject and the needs of their trainees.

Good teachers acknowledge that CBT means each and every trainee in the class learns at a different speed. The good teacher is prepared to throw aside the day's lesson plan and do something different (and unplanned) for the class even if it means 'writing' a lesson plan for each trainee to match their learning pace for that day or week.

Learning by doing is different from learning theory and then applying it. To learn to do something, trainees need someone looking over their shoulder saying 'it's not quite like that, it's like this', and 'you do it like this because …', or even 'tell me why you chose to do it like this?'

In this way, trainees learn that theoretical knowledge is meaningless if it is not seen in the context of what they are doing. In other words, if a trainee doesn't know why they do something, they will not do it competently (skills underpinned by knowledge = competent performer).

This is how an *automotive mechatronics* acquires a practical grasp of the standards expected. It's not by learning it in theory, but because those standards are acquired through correction by people who show what the standards are, and correct the trainee where they do not meet those standards, and where they repeat it correction until they have internalized those standards.

Demonstration of skill

Demonstration or modeling a skill is a powerful tool, which is used, in vocational training. The instructions for trainers for demonstration are as under:

a) Read the procedure mentioned in the Trainer Guide for the relevant Learning Unit before demonstration.
b) Arrange all tools, equipment and consumable material, which are required for demonstration of a skill.
c) Practice the skill before demonstration to trainees, if possible.
d) Introduce the skill to trainees clearly at the commencement of demonstration.
e) Explain how the skill relates to the skill(s) already acquired and describe the expected results or show the objects to trainees.
f) Carry out demonstration in a way that can be seen by all trainees.
g) Use the same tools and materials that the learner will be using.
h) Go through EACH of the steps involved in performing the skill.
i) Go SLOWLY - describe each step as it is completed.
j) Encourage the learners to move around and watch what you are doing from a number of different angles.

k) Identify critical or complex steps, or steps that involve safety precautions to be followed.
l) Explain theoretical knowledge where applicable and ask questions to trainees to test their understanding.
m) Try to involve the learners: Ask them questions about why they think the process may work that way.
n) Repeat critical steps in demonstration, if required.
o) Summarize the demonstration by asking questions to trainees.

Involvement in the process (actively seeing) is important at this stage. When you work on getting involved, getting people to participate, you make them a part of what is happening. Questions for clarification or explanation are important throughout the demonstration. It is up to the learners to ask questions about things they do not understand, but it is also important for trainers to seek out and elicit questions from learners. A trainer may need to do repeated demonstrations of difficult or complex skills.

Frequently Asked Questions

1. What is Competency Based Training (CBT) and how is it different from currently offered trainings in institutes?	Competency-based training (CBT) is an approach to vocational education and training that places emphasis on what a person can do in the workplace as a result of completing a program of training. Compared to conventional programs, the competency based training is not primarily content based; it rather focuses on the competence requirement of the envisaged job role. The whole qualification refers to certain industry standard criterion and is modularized in nature rather than being course oriented.
2. What is the passing criterion for CBT certificate?	You shall be required to be declared "Competent" in the summative assessment to attain the certificate.
3. How can I progress in my educational career after attaining this certificate?	You shall be eligible to take admission in the National Vocational Certificate in a level-5, DAE or equivalent course. In certain case, you may be required to attain an equivalence certificate from The Inter Board Committee of Chairmen (IBCC).
4. What is the importance of this certificate in National and International job market?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). These standards are also recognized worldwide as all the standards are coded using international methodology and are accessible to the employers worldwide through NAVTTC website.
5. Which jobs can I get after attaining this certificate? Are there job for this certificate in public sector as well?	You shall be able to take up jobs as an automotive mechatronics technician, spare parts dealers, supervisors and managers
6. What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the management level after attaining sufficient experience, knowledge and skills during the job. Attaining additional relevant qualifications may aid your career advancement to even higher levels.
7. Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). The official

	certificates shall be awarded by the relevant certificate awarding body.
8. Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
9. What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
10. Does this certificate enable me to work as freelancer?	You can start your small business as a pipe fitter. You may need additional skills on entrepreneurship to support your initiative.

Overview of the program

Course: Automotive Mechatronics Lev 4 **Total Course Duration:** 6 months

Course Overview:

The purpose of the Automotive Mechatronics course is to provide knowledge, skills and understanding to start this career in Pakistan. This qualification will not only build the capacity of existing workers of this Automobile industry but also support the youth to acquire skills best fit for this sector. The benefits and impact of development of these qualifications will be on both demand and supply side. The qualification mainly cover competencies along with related knowledge and professional skills which are essential for getting a job or being self-employed.

Module	Learning Unit	Duration
Module 1 : Contribute to Work Related Health and Safety (WHS) Initiatives **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to contribute to work related health and safety (WHS) initiatives	**LU 1:** Contribute to initiate work-related health and safety measures **LU 2:** Contribute to establish work-related health and safety measures **LU 3:** Contribute to ensure legal requirements of WHS measures **LU 4:** Contribute to review WHS measures **LU 5:** Evaluate the organization's WHS system	30 Hrs
Module 2 : Analyze workplace policy and procedures **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to analyze workplace policy and procedures	**LU 1:** Manage work timeframes **LU 2:** Manage to convene meeting **LU 3:** Decision making at workplace **LU 4:** Set and meet own work priorities at instant **LU 5:** Develop and maintain professional competence **LU 6:** Follow and implement work safety requirements	30 Hrs

Module	Learning Unit	Duration
Module 3 : Perform Advanced Communication **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perform advanced communication	**LU 1:** Demonstrate professional skills **LU 2:** Plan and Organize work **LU 3:** Provide trainings at workplace	30 Hrs
Module 4 : Develop Advance Computer Application Skills **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to develop advance computer application skills	**LU 1:** Manage Information System to complete a task **LU 2:** Prepare Presentation using computers **LU 3:** Use Microsoft Access to manage database **LU 4:** Develop graphics for Design	40 Hrs
Module 5 : Manage Human Resource Services **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to manage human resource services	**LU 1:** Determine strategies for delivery of human resource services **LU 2:** Manage the delivery of human resource services **LU 3:** Evaluate human resource service delivery **LU 4:** Manage integration of business ethics in human resource practices	20 Hrs
Module 6 : Develop Entrepreneurial Skills **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to Develop Entrepreneurial Skills	**LU 1:** Develop a business plan **LU 2:** Collect information regarding funding sources **LU 3:** Develop a marketing plan **LU 4:** Develop basic business communication skills	30 Hrs

Module	Learning Unit	Duration
Module 7:Maintain Fuel Control System-II **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain fuel control system	**LU 1:** Maintain Gasoline Direct Injection (GDI) **LU 2:** Maintain Common Rail Direct Injection (CRDI) **LU 3:** Maintain Eco-idle System	50 Hrs
Module 8: : Maintain Emission Control System **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain emission control system	**LU 1:** Analyze Exhaust Gas Operation **LU 2:** Adjust Exhaust Gas Recirculation (EGR) System **LU 3:** Perform Re-generation Process for Diesel System	40 Hrs
Module 9 Conserve Power Transmission-II **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to conserve power transmission	**LU 1:** Perform Diagnosis of CVT with OBD-II **LU 2:** Maintain Continuous Variable Transmission (CVT) system **LU 3:** Perform Road Test to check performance of CVT	60 Hrs

Module	Learning Unit	Duration
Module 10 Service Comfort & Safety System-II **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to service comfort & safety system	**LU 1:** Check Cruise Control System **LU 2:** Maintain Supplementary Restraint System (SRS)	40 Hrs
Module 11: Perpetuate Controlled Electric & Electronic System-II **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to perpetuate controlled electric & electronic system	**LU 1:** Service Controlled Wiper & Washer System **LU 2:** Repair Electric Power Steering (EPS) System **LU 3:** Test Function of Sensors	60 Hrs
Module 12: Maintain Network System **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain network system	**LU 1:** Verify Navigation System **LU 2:** Maintain Control Area Network (CAN) System **LU 3:** Verify electric Parking System	50 Hrs

Module	Learning Unit	Duration
Module 13: Maintain Hybrid System **Aim:** The aim of this module is to develop advanced knowledge, skills and understanding to maintain hybrid system	**LU 1:** Maintain Series Hybrid **LU 2:** Maintain Parallel Hybrid **LU 3:** Maintain Combined Hybrid System	50 Hrs

FORMAT FOR LESSON PLAN

Module 9: Conserve Power Transmission-II

Learning Unit 1: Perform Diagnosis of CVT with OBD-II

Methods	Key Notes	Media	Time

The tools, techniques and processes used for Performing Diagnosis of CVT with OBD-II

Introduction

This session will introduce learners to the tools, techniques and processes used for Performing Diagnosis of CVT with OBD-II, using presentation, demonstration, question and answer, and practical skills development.

Main Body

- Understanding of appropriate tools and equipment
- Explaining the safety precautions regarding personal health and workplace
- Explaining the components of continuous variable transmission (CVT) (i.e. steel belt, planetary gear assembly, forward clutch, reverse brake, start clutch, fly wheel, ATF pump, hydraulic control unit and electronic control unit)
- Defining bodies used in continuous variable transmission (CVT) (Manual, Governor, Main)
- Defining different types of Clutches in CVT
- Describing working, location and fault diagnosing of clutch in continuous variable transmission (CVT)
- Importance of housekeeping

Conclusion

To conclude the session, review the tools, techniques and processes used for Performing Diagnosis of CVT with OBD-II. Give learners the opportunity to ask questions.

Assessment

Question and answer, discussion groups with feedback, observation of practice skills development

Total time:

Trainer's guidelines

Module 1 : Contribute to Work Related Health and Safety (WHS) Initiatives

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Contribute to initiate work-related health and safety measures			
LU 2: Contribute to establish work-related health and safety measures			
LU 3: Contribute to ensure legal requirements of WHS measures			
LU 4: Contribute to review WHS measures			
LU 5: Evaluate the organization's WHS system			

Module 2 : Analyze workplace policy and procedures

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Manage work timeframes			
LU 2: Manage to convene meeting			
LU 3: Decision making at workplace			
LU 4: Set and meet own work priorities at instant			
LU 5: Develop and maintain professional competence			
LU 6: Follow and implement work safety requirements			

Module 3 : Perform Advanced Communication

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Demonstrate professional skills			
LU 2: Plan and Organize work			
LU 3: Provide trainings at workplace			

Module 4 : Develop Advance Computer Application Skills

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Manage Information System to complete a task			
LU 2: Prepare Presentation using computers			
LU 3: Use Microsoft Access to manage database			
LU 4: Develop graphics for Design			

Module 5 : Manage Human Resource Services

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Determine strategies for delivery of human resource services			
LU 2: Manage the delivery of human resource services			
LU 3: Evaluate human resource service delivery			
LU 4: Manage integration of business ethics in human resource practices			

Module 6 : Develop Entrepreneurial Skills

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Develop a business plan			
LU 2: Collect information regarding funding sources			
LU 3: Develop a marketing plan			
LU 4: Develop basic business communication skills			

Module 7: 071400959 Maintain Fuel Control System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Maintain Gasoline Direct Injection (GDI)	Deliver an illustrated presentation regarding maintenance of Gasoline Direct Injection (GDI). Ensure you address the importance of the following points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Describing Gasoline Direct Injection (GDI) • System and its advantages, function, and structure • Explaining working principle of pressure control circuit of Gasoline Direct Injection (GDI) system • Defining components of Gasoline Direct Injection (GDI) System, their location and function for better understanding • Defining pressure controlled circuit and its working principle • Importance of housekeeping The learner activity is a collaborative activity on maintaining of Gasoline Direct Injection (GDI). The tutor should display a slide or flip chart with a key question relating to maintaining of Gasoline Direct Injection (GDI). **Step 1 – Think**	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Appropriate PPEs Scanner OBD-II Repair Manual Socket Set Screwdriver Set Combination Spanner Set/ Spanner set Pressure Gauge Digital Multimeter WD 40 Petrol Kerosene Oil Grease Cotton Rug Fender Covers Floor Mats Creeper Trolley Tool Trolley Lamp

Module 7: 071400959 Maintain Fuel Control System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	Working on their own, each learner **thinks** about the question and makes notes of their responses or key points which they believe to be important. **Step 2 – Pair** For the next step, each learner **pairs** up with a partner. The two learners exchange their ideas and make further notes to add clarity to their own ideas. **Step 3 – Share** The final step is for the tutor to invite different pairs to share the ideas they have discussed in response to the key question relating to maintaining of Gasoline Direct Injection (GDI). After the activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to installation of low pressure fitting in a practical environment. Ensure that learners have the opportunity to ask questions to support their understanding.		
LU 2: Maintain Common Rail Direct Injection (CRDI)	Begin this session with an illustrated presentation on maintaining of Common Rail Direct Injection (CRDI). Ensure that the presentation addresses the following points, including demonstrations of equipment, preparation and methods: • Understanding of appropriate tools and	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop	Appropriate PPEs Scanner OBD-II Repair Manual Socket Set Screwdriver Set

Module 7: 071400959 Maintain Fuel Control System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	equipment • Explaining the safety precautions regarding personal health and workplace • Explaining common rail direct injection system (CRDI) to better understanding of its function, structure and method • Describing components of common rail direct injection system (CRDI), their location and function • Working principle of pressure control valve • Servicing and replacement procedure of pressure control valve • Importance of housekeeping This activity is a 'gallery walk' based on maintaining Common Rail Direct Injection (CRDI) Your tutor will divide you and other learners into seven groups. Your tutor will then display three sheets of flip chart paper, prepared as a T-Chart and labelled as follows:	with required tools and equipment	Combination Spanner Set/ Spanner set Pressure Gauge Digital Multimeter WD40 Diesel Kerosene Oil Grease Cotton Rag Fender Covers Floor Mats Creeper Trolley Tool Trolley Lamp

What we already know about maintaining Common Rail Direct Injection (CRDI)'	What we want to know about maintaining Common Rail Direct Injection (CRDI)'

Module 7: 071400959 Maintain Fuel Control System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	Each flip chart will also have some details of the maintaining process for Common Rail Direct Injection (CRDI). Your tutor will allocate your group to one of the flipcharts. Your group needs to add your thinking about '*What we already know about maintaining Common Rail Direct Injection (CRDI)*' and '*What we want to know about maintaining Common Rail Direct Injection (CRDI)*' onto the piece of chart paper. When your group has completed adding what you know or want to know to the chart paper, you will be asked to move to the next sheet of flip chart paper. Your group should review the thinking of the previous group and add any additional thinking to it. Your group should rotate further until you have covered all the flipcharts.		

Module 7: 071400959 Maintain Fuel Control System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	To finish, write at least one question you still have about maintaining Common Rail Direct Injection (CRDI) onto a sticky note. The question can be related to a topic on one of the charts, or may be a question that you have personally about maintaining Common Rail Direct Injection (CRDI) Post your final questions on one of the flip charts. After the activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to maintaining of Common Rail Direct Injection (CRDI) in a practical environment. Ensure that learners have the opportunity to ask questions to support their understanding.		
LU 3: Maintain Eco-idle system	Invite an experienced Automobile expert to deliver a presentation to maintain Eco-idle system. Ensure that the presentation focuses on the following key points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Explaining eco-idle system and its components (i.e. gasoline engine, electric starter/	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools	Appropriate PPEs Scanner OBD-II Repair Manual Socket Set Screwdriver Set Combination Spanner Set/ Spanner set

Module 7: 071400959 Maintain Fuel Control System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	generator, battery etc.) • Describing working parameters of eco-idle system's components and their location • Diagnosing eco-idle system with the help of OBD – II scanner for troubleshooting • Importance of housekeeping Use examples from the *Media* column to reinforce various points. The tutor needs to prepare either: • A flip chart • A PowerPoint slide • A handout …showing the key topics about maintaining Eco-idle system . Go through all the key topics briefly and then allocate **one key topic** to each group. Learners need to work in their small groups discussing the key topic that has been allocated to their group. Each group should use a sheet of flip chart paper to record **three main points** from their discussions that relate to **their key topic**. After the discussion, begin the feedback session. Ask one group to come to the front of the class with their flipchart. Put up the flipchart where it can be easily seen by other learners. Ask the group to share the main points they have recorded for their key topic for maintaining Eco-idle system	and equipment	Pressure Gauge Digital Multimeter WD40 Petrol Kerosene Oil Grease Cotton Rag Fender Covers Floor Mats Creeper Trolley Tool Trolley Lamp

Module 7: 071400959 Maintain Fuel Control System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified. Then ask the next group to share their flipchart showing the main points they have recorded for the next key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. Photograph or scan all the flipcharts and use these to create a handout to distribute to all learners. After the activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to maintaining Eco-idle system in a practical environment. After the practical sessions are completed, lead a feedback session. Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions.		

Module 8: 071400960 Maintain Emission Control System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Analyse Exhaust Gas Operation	Deliver an illustrated presentation about analysis of exhaust gas operation. Ensure that the presentation focuses on the following key points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Defining main components of emission control system (e.g. catalytic converter, EGR valve, and charcoal canister and purge valve, PCV valve), their location and functions • Explaining how to use tools and equipment for servicing emission control system i.e. catalytic converter, EGR valve • Describing the chemistry of toxic gases (e.g. nitrogen oxide, carbon mono oxide, nitrogen di oxide, carbon di oxide) in exhaust system. • Describing how to reduce these toxic gases, soot particles, and noise in exhaust system • Describe how to reduce fuel consumption in gasoline engine/ GDI • Inspecting catalytic converter for damages to understand its faults • Describing the function of catalytic convertor • Explaining the cleaning method of catalytic converter with a cat cleaner • Importance of housekeeping Learners need to devise 5 quiz questions with	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Appropriate PPEs Scanner OBD-II Digital Multimeter Wheel skids wooden Jack/ trolley jack Jack stands different size/height Ratchet and Sockets Set Screwdriver Set Pliers Hammer Ramps Hand Cleaner Exhaust Gas Analyser Combination Spanner Set/ Spanner set Fire extinguisher WD 40 Petrol Kerosene Oil Grease Cotton Rug Creeper Trolley Tool Trolley Lamp

Module 8: 071400960 Maintain Emission Control System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	answers based on analyzing exhaust gas operation. They must make sure their questions cover key topics for analyzing exhaust gas operation. Issue each learner with 5 blank cards. Each learner should number the cards and write their name on one side with a question about analyzing exhaust gas operation. On the reverse of the card, they should write an appropriate answer to their question. For the quiz, arrange learners in two equal teams. Ask one learner to keep score using a suitable score-card. Player 1 for Team A asks one of their questions to Player 1 of Team B, who needs to answer the question. Discuss the answer with the group and ask the group to determine if the answer is correct. Player 1 of Team A then confirms the answer they had devised. (You need to correct answers if the learner's answer was not wholly correct.) The scorekeeper records 1 mark for a correct answer under the appropriate team's score column. Play then passes to Player 1 of Team B, who asks their question to Player 1 of Team A, and so on. Total the scores at the end of the quiz to see which team won. After the quiz, collect learners' question/answer cards and check that answers provided were correct. Return any incorrect answers to learners and ask them to change their answer to the correct one. After activity, demonstrate the above stated		

Module 8: 071400960 Maintain Emission Control System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	competence for better understanding of the trainees. Use appropriate resources (see Media column) to reinforce various points. Learners must be able to demonstrate their knowledge and skills relating to analysis of exhaust gas operation in a practical environment. Ensure that learners have the opportunity to ask questions to support their understanding.		
LU 2: Adjust Exhaust Gas Recirculation (EGR) System	Begin this session with an illustrated presentation on adjusting Exhaust Gas Recirculation (EGR) System. Ensure the presentation addresses the following important points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Describing the function and location of exhaust gas recirculation (EGR) valve • Defining the types of EGR valve (for example vacuum controlled valve) for better knowledge • Explaining the cleaning method EGR valve • Diagnosing the faults of (EGR) valve with the help of OBD – II scanner • Importance of housekeeping	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Appropriate PPEs Scanner OBD-II Digital Multimeter Wheel skids wooden Ratchet and Sockets Set Screwdriver Set Pliers Hand Cleaner Potentiometer Combination Spanner Set/ Spanner set WD40 Petrol Kerosene Oil

Module 8: 071400960 Maintain Emission Control System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	Use examples from the *Media* column to reinforce various points. Divide the group into pairs. Working with their partner, learners will brainstorm strategies for adjusting Exhaust Gas Recirculation (EGR) System. Besides just listing strategies, encourage learners to think about how they adjust Exhaust Gas Recirculation (EGR) System. Pairs will write their thinking onto a sticky note and add these to a sheet of flip chart paper. When pairs have completed the activity, link two pairs together to make up groups of four. Partners share their brainstorm, and each small group creates a list of the various strategies on flip chart paper. When the small group work is completed, each small group will share out at least one strategy for tagging out of system fittings. As a whole group, discuss explicitly how strategies for adjusting Exhaust Gas Recirculation (EGR) System will work, by asking questions related to the competence. After the activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to adjust Exhaust Gas Recirculation (EGR) System in a practical environment. Arrange a question and answer session to clarify		Cotton Rag Tool Trolley Lamp

Module 8: 071400960 Maintain Emission Control System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	trainee understanding. To prepare for the practical sessions, divide trainees in group of 3 and ask each group to adjust Exhaust Gas Recirculation (EGR) System. Check that each trainee understands his task		
LU 3: Perform Re-generation Process for Diesel System	Invite an experienced Automobile expert to deliver a presentation on performance of Re-generation process for diesel system Ensure you focus on the following key points: • Use relevant tools and materials. • Knowledge of pipe threads & weld pipe joints as per SOP. • Recognize and use of different types of valves, flanges, couplings, gaskets and pipe supports. • Knowledge of repairing Electric Power Steering (EPS) System and tag out all system fitting as per manual • Condensate line sizing that factors condensate liquid, and flash steam quantities. • Location of the condensate line with respect to the process equipment. • Locations of the condensate branch line connection into the main condensate headers. • Insulation techniques • The importance of PPEs when carrying out	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Appropriate PPEs Scanner OBD-II Repair Manual Digital Multimeter Ad-blue Diesel Cotton Rag Fender Covers Tool Trolley Lamp

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	installation work. • Importance of health and safety Use appropriate resources (see Media column) to reinforce various points. The learner activity is a 'silent conversation' on performance of Re-generation process for diesel system Display a flip chart showing the following key question related to performance of Re-generation process for diesel system *'What problems can be encountered when dealing with performance of Re-generation process for diesel system?'* Give each learner a sheet of paper and asked them to write their name at the top. Explain to learners that they will be sharing their work with other learners. Ask learners to write silently for 3-5 minutes answering the question displayed on the flip chart. When learners have completed writing, instruct them to pass their paper to the learner on their left. Each learner will read what their partner has passed to them and write a response. This will also be done silently. After another 2-3 minutes, instruct the learners to pass the paper to their left a second time. Repeat the same procedure, also done in silence. At the end of the activity, ask the learners to return the		

Module 8: 071400960 Maintain Emission Control System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	paper to the original writer. Allow learners a few moments to read over the responses to their writing. Ask learners to work in pairs to reflect on and discuss the responses to the question on the flip chart. When this activity is concluded, collect the papers and make copies for each learner. Learners must be able to demonstrate their knowledge and skills relating to performance of Re-generation process for diesel system in a practical environment. Ensure that learners have the opportunity to ask questions to support their understanding.		

Module 9: 071400961 Conserve Power Transmission-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Perform Diagnosis of CVT with OBD-II	Deliver an illustrated presentation on how to perform diagnosis of CVT with OBD-II. Ensure you address the importance of the following points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Explaining the components of continuous variable transmission (CVT) (i.e. steel belt, planetary gear assembly, forward clutch, reverse brake, start clutch, fly wheel, ATF pump, hydraulic control unit and electronic control unit) • Defining bodies used in continuous variable transmission (CVT) (Manual, Governor, Main) • Defining different types of Clutches in CVT • Describing working, location and fault diagnosing of clutch in continuous variable transmission (CVT) • Importance of housekeeping Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for performing diagnosis of CVT with OBD-II. Learners need to work in small groups discussing the key topics. Each group should make	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Scanner OBD-II Digital Multimeter Wheel skids wooden Jack/ trolley jack Jack stands different size/height Ratchet and Sockets Set Screwdriver Set Pliers Hammer Ramps Hand Cleaner Combination Spanner Set/ Spanner set WD.40 Petrol Kerosene Oil Grease Cotton Rug Creeper Trolley Tool Trolley Lamp Appropriate PPEs

Module 9: 071400961 Conserve Power Transmission-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	notes from their discussions that identify **three main points** that related to **each key topic**. After the discussion, begin the feedback session. Ask one group to share the main points they have recorded for the first key topic for performing diagnosis of CVT with OBD-II. Discuss these main points briefly with the whole group. Learners should make additional notes to record additional points their group had not identified. Then ask the next group to share the main points they have recorded for the second key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. After activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to perform diagnosis of CVT with OBD-II in a practical environment. After the practical sessions are completed, lead a feedback session. Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions.		
LU 2: Maintain Continuous Variable Transmission (CVT) system	Lead a brainstorm on ways to maintain continuous variable transmission (CVT) system. Use ideas from the brainstorm to explain the following key points: • Understanding of appropriate tools and	Class room with multimedia aid and flip charts Or	Scanner OBD-II Digital Multimeter Wheel skids wooden

Module 9: 071400961 Conserve Power Transmission-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	equipment • Explaining the safety precautions regarding Explaining the safety precautions regarding personal health and workplace • Describing working of pulleys in continuous variable transmission (CVT) • Explaining different types of sensors in continuous variable transmission (CVT) (i.e. drive shaft sensor, driven shaft sensor, clutch control solenoid valve, Vehicle sped sensor (VSS). • Defining the function of planetary gear system (i.e. Working principle, troubleshooting) • Importance of housekeeping Learners need to devise 5 quiz questions with answers based on maintaining Continuous Variable Transmission (CVT) system. They must make sure their questions cover key topics for maintaining Continuous Variable Transmission (CVT) system. Issue each learner with 5 blank cards. Each learner should number the cards and write their name on one side with a question about maintaining Continuous Variable Transmission (CVT) system. On the reverse of the card, they should write an appropriate answer to their question. For the quiz, arrange learners in two equal teams. Ask one learner to keep score using a suitable score-card. Player 1 for Team A asks one of their questions to Player 1 of Team B, who needs to answer the	Access to an Automobile Workshop with required tools and equipment	Jack/ trolley jack Jack stands different size/height Oil pressure gauge Ratchet and Sockets Set Screwdriver Set Pliers Hammer Ramps Hand Cleaner Combination Spanner Set/ Spanner set WD.40 Petrol Kerosene Oil Grease Cotton Rag Creeper Trolley Tool Trolley Lamp Appropriate PPEs

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	question. Discuss the answer with the group and ask the group to determine if the answer is correct. Player 1 of Team A then confirms the answer they had devised. (You need to correct answers if the learner's answer was not wholly correct.) The scorekeeper records 1 mark for a correct answer under the appropriate team's score column. Play then passes to Player 1 of Team B, who asks their question to Player 1 of Team A, and so on. Total the scores at the end of the quiz to see which team won. After the quiz, collect learners' question/answer cards and check that answers provided were correct. Return any incorrect answers to learners and ask them to change their answer to the correct one. After activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to maintaining of Continuous Variable Transmission (CVT) system in a practical environment. After the practical sessions are completed, lead a feedback session. Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions		

Module 9: 071400961 Conserve Power Transmission-II

<table>
<tr><th>Learning Unit</th><th>Suggested Teaching/
Learning Activities</th><th>Delivery Context</th><th>Media</th></tr>
<tr><td>LU 3:Perform Road Test to check performance of CVT</td><td>Lead a discussion about how to perform road test to check performance of CVT. Use real examples to support the discussion and ensure the discussion considers:
Understanding of appropriate tools and equipment
Explaining the safety precautions regarding personal health and workplace
Explaining the final inspection of the continuous variable transmission (CVT) for noise, performance by the road test.
Importance of housekeeping
This activity is a ‘gallery walk’ based on performing Road Test to check performance of CVT.
Your tutor will divide you and other learners into seven groups. Your tutor will then display three sheets of flip chart paper, prepared as a T-Chart and labelled as follows:
<table><tr><th>What we already know about performing Road Test to check performance of CVT’</th><th>What we want to know about performing Road Test to check performance of CVT’</th></tr></table></td><td>Class room with multimedia aid and flip charts
Or
Access to an Automobile Workshop with required tools and equipment</td><td>Petrol
Scanner OBD-II
Digital Multimeter
Appropriate PPEs</td></tr>
</table>

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	Each flip chart will also have some details of the road test to check performance of CVT. Your tutor will allocate your group to one of the flipcharts. Your group needs to add your thinking about '*What we already know about performing Road Test to check performance of CVT*' and '*What we want to know about performing Road Test to check performance of CVT*' onto the piece of chart paper. When your group has completed adding what you know or want to know to the chart paper, you will be asked to move to the next sheet of flip chart paper. Your group should review the thinking of the previous group and add any additional thinking to it. Your group should rotate further until you have covered all the flipcharts. To finish, write at least one question you still have		

Module 9: 071400961 Conserve Power Transmission-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	about performing Road Test to check performance of CVT onto a sticky note. The question can be related to a topic on one of the charts, or may be a question that you have personally about performing Road Test to check performance of CVT. Post your final questions on one of the flip charts. After activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to performing road test to check performance of CVT in a practical environment. Ensure that learners have the opportunity to ask questions to support their understanding. Answer any question and confirm their understandings		

Module 10: 071400962 Service Comfort & Safety System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Check Cruise Control System	Invite an experienced Automobile expert to deliver a presentation on how to check cruise control system. Ensure you address the importance of the following points Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Explaining principal of cruise control system • Explaining components of cruise control system (i.e. main relay, panel switch, cruise motor throttle body and wiring harness) • Explaining fault diagnosing with the help of OBD – II scanner (i.e. location of components, repair and maintenance) • Importance of housekeeping Prepare either: • A flip chart • A PowerPoint slide • A handout …showing the key topics about checking cruise control system. Go through all the key topics briefly and then allocate **one key topic** to each group. Learners need to work in their small groups discussing the key topic that has been allocated to their group. Each group should use a sheet of flip chart paper to record **three main points** from their discussions that relate to **their key topic**. After the discussion, begin the feedback session. Ask	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Scanner OBD-II Digital Multimeter Screwdriver Set Socket Spanner Set Repair Manual Combination Plier Allen Keys set Star Keys set Hand Cleaner Combination Spanner Set/ Spanner set Ratchet and Sockets Set WD.40 Kerosene Oil Grease Cotton Rug Tool Trolley Lamp Appropriate PPEs

Module 10: 071400962 Service Comfort & Safety System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	one group to come to the front of the class with their flipchart. Put up the flipchart where it can be easily seen by other learners. Ask the group to share the main points they have recorded for their key topic for checking control cruise system. Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified. Then ask the next group to share their flipchart showing the main points they have recorded for the next key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. Photograph or scan all the flipcharts and use these to create a handout to distribute to all learners. After activity, demonstrate the above stated competence for better understanding of the trainees.		
LU 2: Maintain Supplementary Restraint System (SRS)	Lead a brainstorm on ways to maintain supplementary restraint system (SRS). Use ideas from the brainstorm to explain the following key points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Explaining working principles of supplementary • Restraint system (SRS). • Describing components of supplementary Restraint system (SRS) (i.e. crash sensor, air	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Scanner OBD-II Digital Multimeter Screwdriver Set Socket Spanner Set Repair Manual Combination Plier Allen Keys set Star Keys set

Module 10: 071400962 Service Comfort & Safety System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	bags, seat belts, inflator units, ECU) and their location • Defining function of components of supplementary Restraint system (SRS) • Describing installing procedure of seat belts and Air Bag Module assembly • Explaining procedure of supplementary Restraint system (SRS) troubleshooting • Explaining safety legal precautions of supplementary Restraint system (SRS) (i.e. operation and repair maintenance) • Importance of housekeeping Learners need to devise 5 quiz questions with answers based on maintaining Supplementary Restraint System (SRS). They must make sure their questions cover key topics for maintaining Supplementary Restraint System (SRS). Issue each learner with 5 blank cards. Each learner should number the cards and write their name on one side with a question about maintaining Supplementary Restraint System (SRS). On the reverse of the card, they should write an appropriate answer to their question. For the quiz, arrange learners in two equal teams. Ask one learner to keep score using a suitable score-card. Player 1 for Team A asks one of their questions to Player 1 of Team B, who needs to answer the question. Discuss the answer with the group and ask the group to determine if the answer is correct. Player		Hand Cleaner Combination Spanner Set/ Spanner set Ratchet and Sockets Set WD.40 Kerosene Oil Grease Cotton Rag Tool Trolley Lamp Appropriate PPEs

Module 10: 071400962 Service Comfort & Safety System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	1 of Team A then confirms the answer they had devised. (You need to correct answers if the learner's answer was not wholly correct.) The scorekeeper records 1 mark for a correct answer under the appropriate team's score column. Play then passes to Player 1 of Team B, who asks their question to Player 1 of Team A, and so on. Total the scores at the end of the quiz to see which team won. After the quiz, collect learners' question/answer cards and check that answers provided were correct. Return any incorrect answers to learners and ask them to change their answer to the correct one. After activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to maintenance of Supplementary Restraint System (SRS) in a practical environment. Ensure that learners have the opportunity to ask questions to support their understanding.		

Module 11: 071400963 Perpetuate Controlled Electric & Electronic System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Service Controlled Wiper & Washer System	Lead a discussion about service controlled wiper & washer system. Use real examples to support the discussion and ensure the discussion considers: • Understanding Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Recognize and use proper PPEs for the activity • Defining rain sensor system and calibration. • Explaining wiper controlled system, including the washer system with the service requirement. • Describing wind screen washer system and service requirement. • Explaining the procedure of wiper motor service. • Understanding of dismantling of wiper & washer system • Explaining function of combination switch • Describing how to keep the work area clean during and after the activity • Importance of housekeeping Display a flip chart showing the following key question: *'What problems can be encountered when servicing controlled wiper & washer system?'* Give each learner a sheet of paper and asked them to write their name at the top. Explain to learners that they will be sharing their work with other learners.	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Appropriate PPEs Fender cover WD-40 Cotton Rug OBD-II Scanner Multi meter Repair Manual Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel Spanner Service creeper Tool Trolley

Module 11: 071400963 Perpetuate Controlled Electric & Electronic System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	Ask learners to write silently for 3-5 minutes answering the question displayed on the flip chart. When learners have completed writing, instruct them to pass their paper to the learner on their left. Each learner will read what their partner has passed to them and write a response. This will also be done silently. After another 2-3 minutes, instruct the learners to pass the paper to their left a second time. Repeat the same procedure, also done in silence. At the end of the activity, ask the learners to return the paper to the original writer. Allow learners a few moments to read over the responses to their writing. Ask learners to work in pairs to reflect on and discuss the responses to the question on the flip chart. When this activity is concluded, collect the papers and make copies for each learner. After activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to service controlled wiper & washer system in a practical environment.		
LU 2: Repair Electric Power Steering (EPS) System	Lead a discussion about how to repair electric power steering (EPS) system. Use real examples to support the discussion and ensure the discussion considers: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Recognizing and using proper PPEs for the	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools	Appropriate PPEs Fender cover WD-40 OBD-II Scanner Multi meter Repair Manual

Module 11: 071400963 Perpetuate Controlled Electric & Electronic System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	activity • Defining electrical power steering system and its maintenance procedure • Defining electrical power steering system's performance and system examination parameters • Maintaining electrical power steering system • Repairing electrical power steering system • Performing work area cleans during and after the activity. • Importance of housekeeping Display a slide or flip chart with a key question relating to repairing Electric Power Steering (EPS) System **Step 1 – Think** Working on their own, each learner **thinks** about the question and makes notes of their responses or key points which they believe to be important. **Step 2 – Pair** For the next step, each learner **pairs** up with a partner. The two learners exchange their ideas and make further notes to add clarity to their own ideas. **Step 3 – Share** The final step is for you to invite different pairs to share the ideas they have discussed in response to the key question relating to repairing Electric Power Steering (EPS) System. After activity, demonstrate the above stated competence for better understanding of the trainees. Trainees need to practice their skills to repair Electric	and equipment	Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel Spanner Service creeper Tool Trolley

Module 11: 071400963 Perpetuate Controlled Electric & Electronic System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	Power Steering (EPS) System, in a real or realistic environment. After the practical sessions are complete, lead a feedback session. Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions.		
LU 3: Test Function of Sensors	Invite an experienced Automobile expert to deliver a presentation on how to test function of sensors. Ensure you address the importance of the following points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Recognizing and use proper PPEs for the activity • Describing different types of sensors in electric & electronic system • Describing function of oxygen sensor • Explaining function of crank positioning sensor • Defining function of cam scanner • Checking and replacing procedure of throttle position sensor • Describing function of mass air flow and air pressure sensor • Explaining function of mass intake air temperature sensor	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Appropriate PPEs Fender cover WD-40 Cotton Rug OBD-II Scanner Multi meter Repair Manual Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel Spanner Service creeper

Module 11: 071400963 Perpetuate Controlled Electric & Electronic System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	• Performing work area cleaning during and after the activity • Importance of housekeeping Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for testing function of sensors. Learners need to work in small groups discussing the key topics. Each group should make notes from their discussions that identify **three main points** that related to **each key topic**. After the discussion, begin the feedback session. Ask one group to share the main points they have recorded for the first key topic for testing function of sensors. Discuss these main points briefly with the whole group. Learners should make additional notes to record additional points their group had not identified. Then ask the next group to share the main points they have recorded for the second key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. After activity, demonstrate the above stated competence for better understanding of the trainees. Trainees need to practice their skills in using basic		Tool Trolley

Module 11: 071400963 Perpetuate Controlled Electric & Electronic System-II

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	methods and equipment to test function of sensors, in a real or realistic environment. After the practical sessions are completed, lead a feedback session. Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions.		

Module 12: 071400964 Maintain Network System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Verify Navigation System	Lead a discussion about how to verify navigation system. Use real examples to support the discussion and ensure the discussion considers: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Recognizing and use proper PPEs for the activity • Defining navigation system • Explaining global positioning system (GPS) • Describing navigation programming • Performing work area cleaning during and after the activity • Importance of housekeeping Learners need to devise 5 quiz questions with answers based on verifying Navigation system They must make sure their questions cover key topics for verifying Navigation system. Issue each learner with 5 blank cards. Each learner should number the cards and write their name on one side with a question about verifying Navigation system On the reverse of the card, they should write an appropriate answer to their question. For the quiz, arrange learners in two equal teams. Ask one learner to keep score using a suitable score-card. Player 1 for Team A asks one of their questions to Player 1 of Team B, who needs to answer the question. Discuss the answer with the group and ask the group to determine if the answer is correct. Player	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Fender cover WD-40 OBD-II Scanner Multi meter Repair Manual Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel Spanner Service creeper Appropriate PPEs

Module 12: 071400964 Maintain Network System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	1 of Team A then confirms the answer they had devised. (You need to correct answers if the learner's answer was not wholly correct.) The scorekeeper records 1 mark for a correct answer under the appropriate team's score column. Play then passes to Player 1 of Team B, who asks their question to Player 1 of Team A, and so on. Total the scores at the end of the quiz to see which team won. After the quiz, collect learners' question/answer cards and check that answers provided were correct. Return any incorrect answers to learners and ask them to change their answer to the correct one. After activity, demonstrate the above stated competence for better understanding of the trainees. Trainees need to practice their skills in using basic methods and equipment to verify Navigation system, in a real or realistic environment. After the practical sessions are completed, lead a feedback session.		
LU 2: Maintain Control Area Network (CAN) System	Lead a brainstorm on ways to maintain control area network (CAN) system. Use ideas from the brainstorm to explain the following key points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace	Class room with multimedia aid and flip charts Or Access to an	Fender cover WD-40 Cotton Rug OBD-II Scanner Multi meter

Module 12: 071400964 Maintain Network System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	• Recognizing and use proper PPEs for the activity • Explaining Control Area Network (CAN) • Describing location of CAN connector • Servicing and refitting CAN connector • Performing work area cleaning during and after the activity • Importance of housekeeping Display a slide or flip chart with a key question relating to maintaining Control Area Network (CAN) System **Step 1 – Think** Working on their own, each learner **thinks** about the question and makes notes of their responses or key points which they believe to be important. **Step 2 – Pair** For the next step, each learner **pairs** up with a partner. The two learners exchange their ideas and make further notes to add clarity to their own ideas. **Step 3 – Share** The final step is for you to invite different pairs to share the ideas they have discussed in response to the key question relating to maintaining Control Area Network (CAN) System. After activity, demonstrate the above stated competence for better understanding of the trainees. Trainees need to practice their skills to maintain Control Area Network (CAN) System, in a real or realistic environment.	Automobile Workshop with required tools and equipment	Repair Manual Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel panner Service creeper Tool Trolley Appropriate PPEs

Module 12: 071400964 Maintain Network System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	After the practical sessions are complete, lead a feedback session. Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions.		
LU 3: Verify Electric Parking System	Invite an experienced Automobile expert to deliver a presentation to verify electric parking system. Ensure you address the importance of the following points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Recognizing and using proper PPEs for the activity • Recognizing and use proper PPEs for the activity • Understanding DTC for ABS System • Verifying procedure of different component of electric parking system (e.g. parking switch, wiring harness, fuses) • Explaining Hill Assist System and its functioning • Describing ABS Modulator system and its verification method • Performing work area cleans during and after the activity	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Fender cover WD-40 Cotton Rug OBD-II Scanner Multi meter Repair Manual Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel Spanner Service creeper Tool Trolley Appropriate PPEs

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	• Importance of housekeeping Display a flip chart showing the following key question: *'How to verify Electric Parking System?'* Give each learner a sheet of paper and asked them to write their name at the top. Explain to learners that they will be sharing their work with other learners. Ask learners to write silently for 3-5 minutes answering the question displayed on the flip chart. When learners have completed writing, instruct them to pass their paper to the learner on their left. Each learner will read what their partner has passed to them and write a response. This will also be done silently. After another 2-3 minutes, instruct the learners to pass the paper to their left a second time. Repeat the same procedure, also done in silence. At the end of the activity, ask the learners to return the paper to the original writer. Allow learners a few moments to read over the responses to their writing. Ask learners to work in pairs to reflect on and discuss the responses to the question on the flip chart. When this activity is concluded, collect the papers and make copies for each learner. After activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to verification of Electric Parking System in a practical environment.		

Module 13: 071400965 Maintain Hybrid System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU 1: Maintain Series Hybrid	Lead a discussion about how to maintain series Hybrid. Use real examples to support the discussion and ensure the discussion considers: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Recognizing and use proper PPEs for the activity • Explaining Hybrid System and its types (series, parallel and combined) • Describing series hybrid system (electric hybrid) and its functioning procedure. • Describing the procedure of series hybrid system maintenance. • Describing the functions of high tension cables in hybrid system • Describing the function of Inverters in hybrid system • Describing the function of Power Split Unit	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Fender cover WD-40 Cotton Rag OBD-II Scanner Multi meter Repair Manual Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel Spanner Service creeper

Module 13: 071400965 Maintain Hybrid System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	• Describing various sensors used in Hybrid vehicles • Performing inspection of various sensors used in Hybrid vehicles • Describing types of batteries in Hybrid vehicle (Lead acid battery, Nickel-metal-Hydride battery, Lithium-ion battery) • Describing the function AC-DC Convertor in hybrid system • Describing the function of PCM in hybrid system • Performing work area cleans during and after the activity • Importance of housekeeping Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for maintaining series hybrid Learners need to work in small groups discussing the key topics. Each group should make notes from their discussions that identify **three main points** that related to **each key topic**. After the discussion, begin the feedback session. Ask one group to share the main points they have recorded for the first key topic for maintaining series		Tool Trolley Appropriate PPEs

Module 13: 071400965 Maintain Hybrid System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	hybrid Discuss these main points briefly with the whole group. Learners should make additional notes to record additional points their group had not identified. Then ask the next group to share the main points they have recorded for the second key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. After activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to practice and develop their knowledge and skills relating to maintaining series hybrid in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding. Ask questions to confirm their understanding. Learners must be able to demonstrate their knowledge and skills relating to installation of gas appliances in a practical environment. Ensure that learners have the opportunity to ask questions to support their understanding.		
LU 2: Maintain Parallel Hybrid	Lead a discussion about how to maintain parallel Hybrid. Use real examples to support the discussion and ensure the discussion considers: • Understanding of appropriate tools and equipment	Class room with multimedia aid and flip charts Or	Fender cover WD-40 Cotton Rag OBD-II Scanner

Module 13: 071400965 Maintain Hybrid System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	• Explaining the safety precautions regarding personal health and workplace • Recognizing and use proper PPEs for the activity • Explaining parallel hybrid system (mild extended hybrid) components and their functions • Describing the maintenance in parallel hybrid system using OBD-II Scanner. • Performing work area cleaning during and after the activity • Importance of housekeeping Learners need to devise 5 quiz questions with answers based on maintaining parallel hybrid. They must make sure their questions cover key topics for maintaining parallel hybrid. Issue each learner with 5 blank cards. Each learner should number the cards and write their name on one side with a question about maintaining parallel hybrid. On the reverse of the card, they should write an appropriate answer to their question. For the quiz, arrange learners in two equal teams. Ask one learner to keep score using a suitable score-card. Player 1 for Team A asks one of their questions to Player 1 of Team B, who needs to answer the question. Discuss the answer with the group and ask the group to determine if the answer is correct. Player 1 of Team A then confirms the answer they had	Access to an Automobile Workshop with required tools and equipment	Multi meter Repair Manual Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel Spanner Service creeper Tool Trolley Appropriate PPEs

Module 13: 071400965 Maintain Hybrid System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	devised. (You need to correct answers if the learner's answer was not wholly correct.) The scorekeeper records 1 mark for a correct answer under the appropriate team's score column. Play then passes to Player 1 of Team B, who asks their question to Player 1 of Team A, and so on. Total the scores at the end of the quiz to see which team won. After the quiz, collect learners' question/answer cards and check that answers provided were correct. Return any incorrect answers to learners and ask them to change their answer to the correct one. After activity, demonstrate the above stated competence for better understanding of the trainees. Learners must be able to demonstrate their knowledge and skills relating to maintenance of parallel hybrid in a practical environment. Ensure that learners have the opportunity to ask questions to support their understanding.		
LU 3: Maintain Combined Hybrid System	Deliver a presentation on how to maintain combined Hybrid system. Ensure your presentation addresses the following important points: • Understanding of appropriate tools and equipment • Explaining the safety precautions regarding personal health and workplace • Recognizing and use proper PPEs for the activity	Class room with multimedia aid and flip charts Or Access to an Automobile Workshop with required tools and equipment	Fender cover WD-40 Cotton Rag OBD-II Scanner Multi meter Repair Manual

Module 13: 071400965 Maintain Hybrid System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	• Describing the components and their components of Series- Parallel or Combined Hybrid (Active Hybrid) system. • Explaining the fault diagnosing procedure using OBD-II Scanner. • Performing work area cleans during and after the activity • Importance of housekeeping Display a slide or flip chart with a key question relating to how to maintain combined hybrid system. **Step 1 – Think** Working on their own, each learner **thinks** about the question and makes notes of their responses or key points which they believe to be important. **Step 2 – Pair** For the next step, each learner **pairs** up with a partner. The two learners exchange their ideas and make further notes to add clarity to their own ideas. **Step 3 – Share** The final step is for you to invite different pairs to share the ideas they have discussed in response to the key question relating to how to maintain combined hybrid system. After activity, demonstrate the above stated competence for better understanding of the trainees.		Wire cutter Combination Plier Combination spanner set Small socket set Screw driver set Needle nose pliers Car lifting equipment Car Jack Wheel Spanner Service creeper Tool Trolley Appropriate PPEs

Module 13: 071400965 Maintain Hybrid System

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	Learners must be able to practice and develop their knowledge and skills relating to maintaining combined hybrid system in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding. Use appropriate resources (see Media column) to reinforce various points. To prepare for the practical sessions, divide trainees in group of 3 and ask each group to maintain combined hybrid system. Check that each trainee understands his task		

Short Questions/Answers

What is gasoline direct injection (GDI) system?	The Gasoline is highly pressurized, and injected directly into the combustion chamber of each cylinder via common rail fuel line as oppose to conventional multipoint fuel injection that injects fuel into the intake cylinder port.
What is CRDI stands for?	CRDI stands for common rail direct injection.
How common rail direct injection (CRDI) works?	CRDI directly inject fuel into the cylinders of a diesel engine through a single common line known as the common rail.
What is the difference between CRDI and TDI engine?	TDI is the turbo diesel engine while the CRDI is common rail direct injection engine.
What is echo-idle system?	An echo-idle system is starts stop system in automobiles.
What is the working of pressure control valve?	Pressure control valve is a relieve valve or safety valve used to control or limit the pressure in the system.
What is a diesel particulate filter? https://www.rac.co.uk/drive/advice/emissions/diesel-particulate-filters/	A diesel particulate filter (DPF) is a filter that captures and stores exhaust soot (some refer to them as soot traps) in order to reduce emissions from diesel cars.
What is emission control system?	Emission control system is a system in automobile which employed to limit the discharged of anxious gasses from the internal combustion engine and other components.
What are the main components of emission control system?	The main components of emission control system are: 1. Catalytic converter 2. Exhaust gases recirculation valve (EGR) 3. Positive crankcase ventilation (PCV)
What is the function of catalytic converter?	Catalytic converter is an exhaust emission controlled device that reduce toxic gases and pollutants in an exhaust gases from an internal combustion engine.
What is the function of Exhaust gases recirculation (EGR) valve?	Exhaust gases recirculation (EGR) valve is an emission control technology allowing significant NOx emission reduction from most

	type of diesel and petrol engine.
What is AD Blue?	Ad blue is a liquid solution of urea when it meets hot exhaust system it release ammonia which is a catalyst to a chemical reaction that converts dangerous nitrogen oxide into two harmless products water vapor and nitrogen.
What is diesel particulate filter (DPF)?	Diesel particulate filter (DPF) is a device designed to remove diesel particulate matter from the exhaust gas of a diesel engine.
How do I maintain a diesel particulate filter? https://www.rac.co.uk/drive/advice/emissions/diesel-particulate-filters/	The best way to maintain a DPF is to make sure it's fully able to regenerate itself when it's full of soot (when the warning light appears).
What causes a diesel particulate filter blockage? https://www.rac.co.uk/drive/advice/emissions/diesel-particulate-filters/	Short journeys at low speeds are the prime cause of blocked diesel particulate filters. This is why car makers often go as far as recommending city-bound short-hop drivers choose a patrol car instead of diesel (and it's why diesels are something of a rarity in the city car sector). Other things that are bad for DPFs include poor servicing. A diesel particulate filter on a poorly serviced car may fail sooner than a well maintained one, generally, they should last for at least 100,000 miles. It's important you use the right type of oil as well – some oils contain additives that can actually block filters.
Which direction does the steel belt turn when driving in forward and reverse?	In reverse the steel belt turns in the opposite direction as in forward.
Explain continuous variable transmission (CVT)?	Continuous variable transmission is an automatic transmission that can change seamlessly through a continuous range of effective gear ratios.
Write down the components name of continuous variable transmission (CVT)?	The components of continuous variable transmission (CVT) are as follows: Steel belt, planetary gear assembly, forward clutch, reverse brake,

	start clutch, fly wheel, parking mechanism, ATF pump, hydraulic valve unit and Power control unit (PCU).
What is the purpose of the air bag installed in the motor vehicle/	The purpose of the airbag is to provide the occupants a soft cushioning and restraint during a crash event.
Write down the component of supplementary restraint system (SRS) system?	It consist of an air bag cushion, a flexible fabric bag, inflation module and impact sensor.
What is cruise control system?	Cruise control system is a system that automatically controls the speed of a motor vehicle.
Explain the mechanism of cruise control system?	Cruise control takes its speed signals from a rotating drive shaft, speedometer, cable, wheel speed sensor, from the engine RPM by the vehicle.
What is the mean of supplementary restraint system (SRS) system?	SRS system is the proper name for the Air bag system.
What is the function of wiper in a vehicle?	Wiper is used to remove rain water, snow and debris from wind screen of a vehicle.
What is windscreen washer system?	It is a system which provide water for wind screen cleaning.
Define rain sensor?	Rain sensor is a sensor which operate the wipers after sensing the rain drop on the screen.
Explain combination switch?	Combination switch is a switch which provide us different positions to operate wiper arms and washer system for screen.
Explain electric power steering (EPS)?	The steering system which is powered by the electric motor is called electric power steering (EPS) system.
What is the function of oxygen sensor?	Oxygen sensor is mounted in the exhaust manifold to monitor how much unburnt oxygen is in the exhaust as the exhaust exists in the engine.
What is the position of crank position sensors?	An electronic device used in an internal combustion engines to monitor the position or rotational speed of the crankshaft.
Explain the function of cam sensor?	Cam shaft sensor is a sensor which determine which cylinder is in

	power stroke while the car computer monitors the rotating position of the cam shaft which is related to the crank shaft.
What is function of throttle position sensors?	Throttle position sensor is a sensor which is used to monitor the air intake of an engine.
Define navigation system?	Navigation system is a system that aids in navigation.
Types of navigation system?	1. Automotive navigation system 2. Marine navigation system 3. Satellite navigation system 4. Surgical navigation system 5. Inertial guidance system 6. Robotic mapping
What is GPS and how does it work? http://www.trackingworld.com.pk/FAQsnavi.html	GPS is an acronym for Global Positioning System and it works in coordination with GPS satellites which send out coordinates of longitude and latitude to your GPS tracking device. The device communicates with devices that have the GPS chip installed in them. Through this way you can get the location of your vehicle and this information is transmitted to you over cellular networks of GSM/GPRS through wireless provider.
What is the best navigation system?	Global positioning system (GPS) is the best navigation system.
Explain control area network (CAN)?	Control area network (CAN) is a robust vehicle bus standard design to allow microcontroller and devices to communicate with each other in application without a host computer.
Explain the application of control area network (CAN)?	1. Passenger vehicles 2. Trucks 3. Buses 4. Gasoline vehicle 5. Electrical vehicles 6. Elevators 7. Escalators 8. Medical instruments & equipment
What is hill assist system?	Hill assist system control the car when you have stopped on an

	incline and want to start moving again.
What is ABS modulator?	ABS modulator is a device which electronically control ABS brakes from brake locking up status.
What is hybrid system?	Hybrid system uses more than one propulsion that means combining a petrol or diesel engine with electric motor.
Name types of hybrid system system?	1. Series hybrid system 2. Parallel hybrid system 3. Combined hybrid system
What are the types of hybrid car batteries?	1. Lead acid batteries 2. Lithium ion batteries 3. Nickel meta-hydride NiMH
What is the high tension cable?	High tension cable is a cable which is used for electric power transmission at high voltage for long distance.
Describe the function of inverters?	Inverter is an electric device which change direct current to alternate current.
Describe the function of DC – DC converter?	DC – DC converter is a device which converts high voltage direct current into low voltage.

Test Yourself (Multiple Choice Questions)

MODULE 7				
Question 1	Where the piston reaches, when fuel injection system injects fuel into the combustion chamber of a diesel engine?	Xx	A	Top dead Centre
			B	Bottom dead Centre
			C	In between top dead Centre and bottom dead Centre
			D	Any of the above
Question 2	In which condition, the fuel consumption is least?		A	Idling range
			B	No load running
		Xx	C	Cruising range
			D	High power range
Question 3	Is the below statement True or false? Diesel engines are more fuel efficient than gasoline engines.	Xx	A	True

		B	False
Question 4	Which of the following is (are) the part(s) of Electronic Control Unit (ECU)?	A	Injector control
		B	Spark advance control
		C	Idling control
		Xx D	All of the above
Question 5	Which of the following is not the function of the fuel injection system?	A	Time the fuel injection
		Xx B	Control the engine speed
		C	Atomize the fuel to fine particles
		D	Filter the fuel

Question 6	Which of the following are important parameters that can be controlled, in a gasoline engine?		A	air-fuel ratio
			B	mixture distribution between cylinders
			C	ignition timing
		Xx	D	all of the mentioned
Question 7	Why Catalytic converters use lambda sensors? to keep		A	to keep exhaust temperature constant
			B	to keep exhaust pressure constant
		Xx	C	to keep excess air ratio within a range
			D	to keep Flow rate of air constant
Question 8	A resistor that changes its resistance with changes of temperature is called a:	Xx	A	Thermistor
			B	Transistor
			C	Potentiometer

				D	Rheostat
Question	**9**	Which of the following must be mixed in the right amount, with gasoline to burn properly?		A	Carbon
			Xx	B	Air
				C	Hydrogen
				D	Lead
MODULE	**8**				
Question	**10**	A technician suspects the EGR (Exhaust Gas Recirculation) valve is closed. Which of the following would indicate a closed EGR valve?		A	Rough idle
				B	Stalling
			Xx	C	Spark knock
				D	Engine surge

Question 11 The plastic sensors on an electronically controlled EGR valve have melted. Technician A says excessive back pressure caused by a partially clogged exhaust system could be the cause. Technician B says to always check for a restricted exhaust whenever replacing a failed EGR valve sensor. Who is right?

	A	A only
	B	B only
Xx	C	Both A & B
	D	Neither A nor B

Question 12 What is the main function of an exhaust muffler?

	A	Optimization of exhaust efficiency
Xx	B	Reduction of exhaust noise
	C	Reduction of nitrogen oxide in the exhaust gases
	D	Reduction of the exhaust gas volume

Question 13 On which of the following, the level of gasoline depends during operation of an engine?

	A	Tank
	B	ignition chamber
Xx	C	float chamber
	D	none of the mentioned

Question	**14**	Inside which of the following, gasoline vapours are removed from the charcoal particles, during purging process?	Xx	A	Canister
				B	float chamber
				C	tank
				D	All of above
Question	**15**	What charcoal canister is also called?		A	Vapour
				B	Fuel
				C	Water
			Xx	D	Carbon
Question	**16**	How exhaust valve of an engine is compared to inlet valve, In petrol engine?		A	Same
			Xx	B	Smaller

	C	Bigger
	D	varies from design to design

Question 17 Which instrument is used to measure CO and CO_2 emission in the exhaust gases of an engine?

	A	FID analyzer
Xx	B	NDIR analyzer
	C	Chemiluminescent analyzer
	D	lemda sensor

Question 18 Which is/are a by-product of combustion and is/are emitted from the exhaust system, in automotive applications?

	A	Fuel
	B	Air
Xx	C	Emission
	D	Catalysts

Module	**9**				
Question	**19**	What is the major purpose of an electronically controlled automatic transmission?		A	Eliminates gear clutches
				B	Eliminates the gear shaft lever
				C	Reduces the number of automatic transmission components
			Xx	D	Reduces shift shock and achieves more efficient transmission of engine torque
Question	**20**	What is the other name of continuous variable transmission (CVT)?	Xx	A	Shiftless transmission
				B	Shift gear transmission
Question	**21**	By which material the belt is made, in continuous variable transmission (CVT?		A	Rubber
			Xx	B	Steel

				C	Leather
				D	None of these
Question	**22**	What component in continuous variable transmission (CVT) is used to switch the rotation direction?		A	Dry pulley
				B	Driven pulley
			Xx	C	Planetary gear assembly
				D	Secondary driven gear
Question	**23**	Is the statement True or False? Start clutch is located in a place which allow the pulleys and the steel belt to be isolated from the wheels when the start clutch is not engaged.		A	False
			Xx	B	True
Question	**24**	By which the ATF pump in continuous variable transmission (CVT) is driven?	Xx	A	Input shaft

			B	Output shaft
			C	None of these
			D	All of above
Question	**25**	With which the forward clutch engaged and disengaged?	A	Ring gear
		Xx	B	Sun gear
			C	Pinion gear
			D	None of these
Question	**26**	How many parallel shafts, a continuous variable transmission (CVT) contains?	A	1
			B	2
			C	3
		Xx	D	4

Question	**27**	What do conventional automatic transmissions have, that CVTs don't?		A	A reverse gear
				B	A stick shaft
				C	A clutch
			Xx	D	A gear box
Question	**28**	Which of the following is not one of the key elements that enable CVT technology to work?	Xx	A	the clutch
				B	A high power belt
				C	an output "driven" pulley
				D	A shaft

Question	**29**	Which pulley transfers energy to the driveshaft, in a CVT?		A	Driving pulley
			Xx	B	Driven pulley
				C	Variable pulley
Question	**30**	Which of the following is not one of the benefits of CVTs?		A	Improved fuel efficiency
				B	A smoother ride
			Xx	C	greater horsepower
				D	Reduce emission
Module	**10**				
Question	**31**	Which is the most commonly used supplementary restraint system (SRS) component?		A	Seat belt
				B	Brake
			Xx	C	Air bag
				D	Steering

Question 32 Due to which of the following, all cruise control system being turned off?

	A	When the driver depress the accelerator pedal
Xx	B	When the driver depress the brake pedal
	C	When the driver depress the accelerator and brake pedal at same time
	D	None of these

Question 33 Which was the first car made with cruise control system?

	A	Rolls Royce
Xx	B	Chrysler Imperial
	C	Henry Ford Folks wagon
	D	None of the above

Question 34 Where the seat belt tensioners are built?

	A	In front seats
	B	In shoulder anchors
Xx	C	In seat belt retractors
	D	In seat belt buckles

Module	**11**				
Question	**35**	Which component is responsible for converting the rotation of the steering wheel into lateral motion is the		A	Steering wheel
				B	Steering shaft
			Xx	C	Steering gearbox
				D	Tie rod
Question	**36**	Which of the following is not a part of the chassis?		A	Wheels
				B	Front axle
				C	Steering system
			Xx	D	Seats

Question	**37**	What is the effect of having excess camber?		A	Excessive steering alignment torque
				B	Hard steering
				C	Too much traction
			Xx	D	Uneven tyre wear
Question	**38**	How the power steering pump is driven? In a hydraulic power steering system?	Xx	A	By belt driven by crankshaft
				B	By belt driven by camshaft
				C	By chain driven by crankshaft
				D	By belt driven by driveshaft
Question	**39**	What incorrect steering axis inclination (S.A.I.) causes?		A	Tendency to assume toe-out orientation
				B	Generation of a braking effect at tight corners
			Xx	C	Poor recovery of the steering wheel after making a turn
				D	The vehicle to pull to the side of lesser inclination

Module	**12**				
Question	**40**	What is GPS stands for?		A	General process system
			Xx	B	Global Positioning System
				C	Global Project system
				D	General Post System
Question	**41**	What is the process called when the state vector is calculated on board the vehicle?	Xx	A	Navigation
				B	Guidance
				C	Surveillance
				D	Position location

Question	**42**	How can control area network protocol describe?		A	As input or output
			Xx	B	As high or low speed
				C	As reliable or limited
				D	As modern or old
Module	**13**				
Question	**43**	What purpose does a generator serve in a hybrid vehicle?		A	It converts nuclear energy into more nuclear energy.
			Xx	B	It converts mechanical energy into electrical energy.
				C	It converts chemical energy into electrical energy.
				D	It converts electrical energy into mechanical energy.
Question	**44**	Which vehicle use a high-voltage battery?		A	Electric
				B	Hybrid
			Xx	C	Both electric & hybrid
				D	None of above

Question 45 What are the two main types of hybrid vehicle?

	A	The series hybrid vehicle and the mild hybrid vehicle.
	B	The parallel hybrid vehicle and the full hybrid vehicle.
Xx	C	The series hybrid vehicle and the parallel hybrid vehicle.
	D	The full hybrid vehicle and the empty hybrid vehicle.

Question 46 Which sentence best describes a parallel hybrid vehicle?

	A	The engine is directly connected to the transmission.
	B	The electric motor is directly connected to the transmission.
Xx	C	Both of the above
	D	None of the above.

Question 47 Which of these is a purpose of the power-split device?

	A	To split electrical energy into mechanical energy.
Xx	B	To allow both the engine and electric motor to propel the vehicle.

				C	To recharge the battery while braking.
				D	To recharge the brakes while driving.
Question	**48**	What voltage is likely to be available from the battery of an electric vehicle or hybrid?		A	12 V
				B	24 V
			Xx	C	300 V
				D	400 v
Question	**49**	Which of the following vehicle produce zero emission?		A	Hybrid
			Xx	B	Electric

ANSWERS

MODULE	**7**			
Question	**1**	Where the piston reaches, when fuel injection system injects fuel into the combustion chamber of a diesel engine?	A	Top dead Centre
Question	**2**	In which condition, the fuel consumption is least?	C	Cruising range
Question	**3**	Is the below statement True or false? Diesel engines are more fuel efficient than gasoline engines.	A	True
Question	**4**	Which of the following is (are) the part(s) of Electronic Control Unit (ECU)?	D	All of the above
Question	**5**	Which of the following is not the function of the fuel injection system?	B	Control the engine speed
Question	**6**	Which of the following are important parameters that can be controlled, in a gasoline engine?	D	all of the mentioned
Question	**7**	Why Catalytic converters use lambda sensors? to keep	C	to keep excess air ratio within a range
Question	**8**	A resistor that changes its resistance with changes of temperature is called a:	A	Thermistor
Question	**9**	Which of the following must be mixed in the right amount, with gasoline to burn properly?	B	Air
MODULE	**8**			
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Question	**11**	The plastic sensors on an electronically controlled EGR valve have melted. Technician A says excessive back pressure caused by a partially clogged exhaust system could be the cause. Technician B says to always check for a restricted exhaust whenever replacing a failed EGR valve sensor. Who is right?	C	Both A & B
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Question	**33**	Which was the first car made with cruise control system?	B	Chrysler Imperial
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Module	**13**			
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Question	**44**	Which vehicle use a high-voltage battery?	C	Both electric & hybrid
Question	**45**	What are the two main types of hybrid vehicle?	C	The series hybrid vehicle and the parallel hybrid vehicle.
Question	**46**	Which sentence best describes a parallel hybrid vehicle?	C	Both of the above
Question	**47**	Which of these is a purpose of the power-split device?	B	To allow both the engine and electric motor to propel the vehicle.
Question	**48**	What voltage is likely to be available from the battery of an electric vehicle or hybrid?	C	300 V
Question	**49**	Which of the following vehicle produce zero emission?	B	Electric

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