National Curriculum Level-2 of Automobile Technology

National Vocational and Technical Training Commission (NAVTTC)
Government of Pakistan

Contents

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NAVTTC team under the leadership of Dr. Muqeem ul Islam initiated development of CBT & A based qualifications of diploma level-5 as a reform project of TVET sector in November 2018 and completed 27 NVQF diplomas of Level-5 in September, 2019. It seems worth highlighting that during this endeavor apart from developing competency standards/curricula in conventional trades new dimensions containing high-tech trades in TVET sector in the context of generation IR 4.0 trades have also been developed which inter alia includes Robotics, Mechatronics, artificial intelligence, industrial automation, instrumentation and process control. Moreover, trades like entrepreneurship, green/environmental skills and variety of soft/digital skill have also been developed to equip the Pakistani youth with skills set as per requirement of the global trends. These skills have been made integral part of all the 27 diplomas.

Nobody has been more important in the pursuit of this project than Dr. Nasir Khan, Executive Director, NAVTTC, whose patronage and support remain there throughout the development process and lastly to thanks specially to Syed Javed Hassan, Chairman NAVTTC and Raja Saad Khan, Deputy Team Lead TSSP-GIZ who made it happened in this challenging time.

1. Introduction

Automobile engineering is the one of the streams of mechanical engineering. It deals with the various types of automobiles, their mechanism of transmission systems and its applications. Automobiles are the different types of vehicles used for transportation of passengers, goods, etc. Basically, all the types of vehicles work on the principle of internal combustion processes or sometimes the engines are called as internal combustion engines. Different types of fuels are burnt inside the cylinder at higher temperature to get the transmission motion in the vehicles. Most of the automobiles are internal combustion engines vehicles only. Therefore, every mechanical and automobile engineer should have the knowledge of automobile engineering its mechanism and its various applications.

Automobile engineering is a branch of engineering which deals with everything about automobiles and practices to propel them.
Automobile is a vehicle driven by an internal combustion engine and it is used for transportation of passengers and goods on the ground. Automobile can also be defined as a vehicle which can move by itself, for example Car, jeep, bus, truck, scooter, etc. Therefore, industry expectations for skilled workforce are also dynamic which can only be managed through setting relevant competency standards in collaboration with the leading industries. Being cognizant of this fact, National Vocational & Technical Training Commission (NAVTTC) developed competency standards for Civil Technology under National Vocational Qualifications Framework (NVQF). These competency standards have been developed by a Qualifications Development Committee (QDC) and validated by the Qualifications Validation Committee (QVC) having representation from the Auto Mobile industry of the country.

2. Purpose of the Qualification.

Based upon the demand of industry these competency-based qualifications for Automobile Technology are developed under National Vocational Qualification Framework (Level 2). The qualification mainly covers competencies along with related knowledge and professional attitude which is essential for getting a job or self-employed.

The qualification is also in line with the vision of Pakistan's National Skills Strategy (NSS), National TVET Policy and National Vocational Qualification Framework (NVQF). This provides policy directions, support and an enabling environment to the public and private sectors to impart training for skills development to enhance social and economic profile. The National Vocational & Technical Training Commission (NAVTTC) has approved the Qualification Development Committee (QDC) for Automobile Technology. The QDC consists experts from the relevant industries from different geographical locations across Pakistan and academicians who were consulted during the development process to ensure input and ownership of all the stakeholders. The National Competency Standards could be used as a referral document for the development of curricula to be used by training institutions.

The purpose of the training is to provide skilled manpower to improve the quality of value-added products of Engineering sector. This training will provide the basic skills to the trainees in the field of Automobile and convert it into value added product which is acceptable by International market reducing the line losses and fit-in a skilled graduate into National Vocational Qualification Framework for his / her vertical career progression and qualification equivalencies at par with acceptable international standards.

3. Overall objectives of training program

The Automobile qualification of level 2 consists of both the theoretical and practical details and having the following Modules.

Code#	Modules
0716MS&A1	Specify Engine Types and its Component
0716MS&A2	Identify Engine Parts and Interpret Assembly Procedure
0716MS&A3	Maintain Engine Cooling System Components
0716MS&A4	Maintain Engine Lubrication System
0716MS&A5	Retain Fuel System of Petrol Engine
0716MS&A6	Retain Fuel System of Diesel Engine

0716MS&A7	Maintain Engine Exhaust System
0716MS&A8	Diagnosing Engine Faults
0716MS&A9	Perform Ignition System of Petrol Engine
0716MS&A10	Perform Overhauling of Four Stroke Single Cylinder Engine
0716MS&A11	Perform Bench Work on Metallic Surfaces
0716MS&A12	Perform Shaper Machine Operations
0716MS&A13	Perform Lathe Turning Operations
0716MS&A14	Read and Interpret Manufacturing Drawings
0716MS&A15	Preform Welding Procedure Specifications (WPS)
0716MS&A16	Prepare Materials for Welding
0716MS&A17	Perform Shielded Metal Arc Welding (SMAW) in Vertical (3F, 3G) and Overhead (4F, 4G) Positions
0716MS&A18	Perform Forging Operations
0716MS&A19	Participate in Workplace Communication
0716MS&A20	Perform Work in Team Environment
0716MS&A21	Read and Develop Career Professionalism
0716MS&A22	Practice Occupational Health and Safety Procedures

4. Date of Validation

The level 2 of National qualification on Automobile Technology has been validated by the Qualifications Development Committee (QDC) members on [redacted] and will remain valid for 10 years

5. Entry level of trainees

The entry for National Diploma level 2, in Automobile Technology are

1. A person having Matric certificate with Science subjects for entry into level 2.

6. Minimum qualification for teachers

- Degree holder in Automobile Technology/ Mechanical Technology
- D. A. E. in Automobile Technology with 3 Years teaching experience
- Must be able to communicate effectively

Medium of instruction

English, and Urdu.

7. Duration of the course:

The proposed curriculum is composed of **22 modules** that will be covered in **600 Learning hours**. Duration of the course is proposed to be 6 months. The total weightage for technical modules is 600 hours. A total of 200 hours has been reserved for allied subjects i.e. Islamic studies, English.

The details of technical modules are given as under:

Level - 2 = 6 months.

Level - 3 = 6 months.

Level - 4 = 1 Year.

Level - 5 = 1 Year.

The distribution of contact hours and credit hours in level-2 is given below:

Level - 2 = 6 months (16 weeks)

Total.	**600 hours. & 60 Credits**
Theory.	**120 hours (20 %)**
Practical.	**480 hours (80 %)**

8. Description and structure of the course

Following is the structure of the course:

National Certificate of Level-2 in Automobile Technology

1. Pro-Auto Mechanic

Code	Competency Standards	Category	Contact Hours			Credits
			Th	Pr	Total	
0716MS&A1	Specify Engine Types and its Component	Technical	4	24	28	2.8
0716MS&A2	Identify Engine Parts and Interpret Assembly Procedure	Technical	4	24	28	2.8
0716MS&A3	Maintain Engine Cooling System Components	Technical	4	24	28	2.8
0716MS&A4	Maintain Engine Lubrication System	Technical	4	24	28	2.8
0716MS&A5	Retain Fuel System of Petrol Engine	Technical	4	24	28	2.8
0716MS&A6	Retain Fuel System of Diesel Engine	Technical	4	24	28	2.8
0716MS&A7	Maintain Engine Exhaust System	Technical	4	24	28	2.8
0716MS&A8	Diagnosing Engine Faults	Technical	10	30	40	4
0716MS&A9	Perform Ignition System of Petrol Engine	Technical	4	24	28	2.8
0716MS&A10	Perform Overhauling of Four Stroke Single Cylinder Engine	Technical	5	25	30	3
		Total	**47**	**247**	**294**	**29.4**

2. Mill Wright Auto Mechanic/Automobile Machinist

Code	Competency Standards	Category	Contact Hours			Credits
			Th	Pr	Total	
0716MS&A11	Perform Bench Work on Metallic Surfaces	Technical	6	24	30	3
0716MS&A12	Perform Shaper Machine Operations	Technical	6	24	30	3
0716MS&A13	Perform Lathe Turning Operations	Technical	8	27	35	3.5
0716MS&A14	Read and Interpret Manufacturing Drawings	Technical	6	18	24	2.4
0716MS&A15	Preform Welding Procedure Specifications (WPS)	Technical	8	27	35	3.5
0716MS&A16	Prepare Materials for Welding	Technical	8	27	35	3.5
0716MS&A17	Perform Shielded Metal Arc Welding (SMAW) in Vertical (3F, 3G) and Overhead (4F, 4G) Positions	Technical	10	30	40	4
0716MS&A18	Perform Forging Operations	Technical	8	27	35	3.5
	Total		**60**	**204**	**264**	**26.4**

3. Generic-1

Code	Competency Standards	Category	Contact Hours			Credits
			Th	Pr	Total	
0716MS&A19	Participate in Workplace Communication	Generic	4	6	10	1
0716MS&A20	Perform Work in Team Environment	Generic	4	6	10	1
0716MS&A21	Read and Develop Career Professionalism	Generic	3	9	12	1.2
0716MS&A22	Practice Occupational Health and Safety Procedures	Generic	4	6	10	1
	Total		**15**	**27**	**42**	**4.2**

9. Overview of the Curriculum.

NVQF Level	Occupations	Numbers of Module	Theory	Practice	Duration	Credits
Level-2	1. Pro-Auto Mechanic, Automobile Machinist	10	47	247	294	29.4
	2. Mill Wright Auto Mechanic/Automobile Machinist	08	60	204	264	26.4
	3. Generic-1	04	15	27	42	4.2
Grand Total of Level-2		**22**	**120**	**480**	**600**	**60**

10. Scheme of Studies

National Certificate of Level-2 in "Automobile Technology"

S.#	Name of Occupations/Subjects	Category	Contact Hour			Credit	Periods per weak		
			Th	Pr	Total		Theory	Practice	Total
1	Pro-Auto Mechanic	Technical	47	247	294	29.4	3	15	18
2	Mill Wright Auto Mechanic/Automobile Machinist	Technical	60	204	264	26.4	4	13	16
3	Generic-1	Generic	15	27	42	4.2	1	2	3
		Allied							
Total			**120**	**480**	**600**	**60**	**8**	**30**	**38**

Maximum Periods per weak

7 periods in a day and 6 days in a week = 7 x 6 = 42 periods in a week

11. Detail of Modules

National Certificate of Level-2 in Automobile Technology

1. Pro Auto Mechanic

0716MS&A1. Specify Engine Types and its Component

Objective: This Module covers the knowledge and skills required to Identify different types of power producing units (engines) their understanding the working principles, construction, types, components and their relationship between different components, system of vehicle by Auto Mechanic, in accordance with the manufacturer's Manual.

Duration: 28 Hours **Theory: 04 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify Petrol Engine	**Trainee will be able to:** • Observe vehicle systems, identify the typical petrol engines and function of their main components. • Identify spark plugs and it functions	• Types of engines. • Define Petrol engine. • (Petrol four stroke, diesel four stroke, and rotary/Winkle). • Define cylinder layout (single, multi, and in-line-shape, horizontally opposed).	Theory-02Hrs. Practical-12Hrs. Total- 14Hrs.	• Measuring tools (Vernier caliper, micrometer, Cylinder bore gauge) • Hand tools trolley • Special tools	Class Room and workshop

	• Identify distributor and its function • Identify ignition coil and its functions • Identify plug leads and its functions • Identify carburetor and its function • Identify EFI engine and its main components	• Explain the carburetor and its function • **Practical Activity:** • Perform engine compression test (Dry test and wet test) and engine vacuum test • Identified different parts of petrol engine		(ring compressor, belt tensioner, torque wrench) • Engine Petrol	
LU2. Identify Diesel Engine	**Trainee will be able to:** • Observe vehicle systems, identify the typical diesel engines and function of their main components. • Identify fuel injectors and its function • Identify high pressure fuel pump and its functions • Identify heater plug and its function	• Explain type of diesel engine • Describe the function of injectors • Define the injector pump and its function • Describe heater plug and its function • **Practical Activity:** • Perform engine compression test (Dry test and wet test) and engine vacuum test • Identified different parts of diesel	Theory-02Hrs. Practical-12Hrs. Total- 14Hrs.	• Measuring tools (Vernier caliper, micrometer, Cylinder bore gauge) • Hand tools trolley • Special tools (ring compressor, belt tensioner, torque wrench) • Engine Petrol	Class Room and workshop

		engine			

0716MS&A2. Identify Engine Parts and Interpret Assembly Procedure

Objective: This module covers the knowledge and skills required to these competency standards designed to provide skills and knowledge for engines their understanding the working principles, construction, types, components and their relationship between different components, system of vehicle by Auto Mechanic, in accordance with the manufacturer's Manual.

Duration: 28 Hours **Theory: 4 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Understand Engine block assembly procedure.	**Trainee will be able to:** • Select appropriate tools and perform dismantling/assembly of the all-engine components as specified procedure in the manual. • Select appropriate tools and perform crankshaft assembly in the engine block with all related components. • Select appropriate tools and	• Describe and explain the engine block assembly as following: Top dead Centre (TDC), bottom dead Centre (BDC), bore, stroke, engine capacity, clearance volume, swept volume, compression ratio, single overhead cam, double overhead cam, overhead valve,	Theory-02 Hrs. Practical-12 Hrs. Total- 14 Hrs.	• Measuring tools (Vernier caliper, micrometer, Cylinder bore gauge) • Hand tools trolley • Special tools (ring compressor, belt tensioner, torque wrench) • Engine Petrol/	Class Room and workshop

	perform piston ring assembly in the block under the specified procedure.	**Practical Activity:** • Inspect and replace Crankshaft as per repair\shop manual. • Inspect and replace connecting rod and piston as per standard procedure. • Inspect engine block and cylinder bore as per standard procedure. • Set the engine timing according to the standards		diesel	
LU2. Understand Engine head assembly procedure.	**Trainee will be able to:** • Select appropriate tools and perform dismantling/ assembly of engine head valve train as specified procedure in the manual. • Select appropriate tools and	• Describe the main engine head components and functions **Practical Activity:** • Inspect and replace head valves, valve seat, and valve guide as per	Theory-02 Hrs Practical-12 Hrs Total- 14 Hrs	• Measuring tools (Vernier caliper, micrometer, Cylinder bore gauge) • Hand tools trolley • Special tools (ring compressor, belt tensioner, torque wrench)	Class Room and workshop

	perform dismantling/ assembly of rocker assembly on the engine head under the specified procedure in the manual. • Set the camshaft on the engine head and fit bearing caps under the specified procedure.	standard procedure. • Inspect and replace camshaft as per standard procedure. • Inspect and replace valve seals. • Adjust the engine valve clearance (tappet) under the specified procedure		• Engine Petrol/ diesel	

0716MS&A3. Maintain Engine Cooling System Components

Objective: This module covers the knowledge and skills required to this Learning module is designed to provide skills and knowledge for understanding the working principles, construction, types, components and their relationship between different components to service and repair air and water cooled engine cooling systems and to diagnose fault/s and other maintenance issues by Auto Mechanic, in accordance with the manufacturer's Manual.

Duration: 28 Hours **Theory: 4 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify Cooling system in the vehicle.	**Trainee will be able to:** • Identify main components of cooling system their functions. • Identifies the water pump and understand the function of its components. • Identify the thermostat and understand the function of its components. • Identify the radiator, its types and understand the function	• Describe the operating principles and terminologies of cooling system as following: Air cooled engine, liquid cooled engine, operating temperature, thermal efficiency, pressurized system, heat exchange method (conduction, radiation, and convection), corrosion, and	Theory-02Hrs Practical-12Hrs Total-14Hrs	Hand tools trolley Radiator leak tester Vehicle/ simulator with a cooling system Drive belt tensioner gauge	Class Room and workshop

	of the components. • Identify the radiator fan and understand its drive types	inhibitors/antifreeze) • Describe the functions and purpose of engine cooling system components as: • Electrical motor operated fan with thermo switch, belt operated fan, temperature controlled/viscous coupling fan, pressure cap, water body/pump, drive belt, thermostat, radiator, core plug, hoses/clamps, and gasket/ seals. • **<u>Practical Activity:</u>** • Identify faults in engine cooling system for repair or replace faulty parts or components • Adjust water pump belt tension • Replace radiator or its faulty			

		components			
LU2.Use Antifreeze /inhibitors	**Trainee will be able to:** • Identify the antifreeze its compositions and types. • Identify the rust corrosion in the engine and preventions.	• Describe the antifreeze its compositions and types. • Describe the rust corrosion in the engine and preventions • **Practical Activity:** • Servicing of radiator assembly • Inspect and replace of radiator coolant	Theory-02Hrs Practical-12Hrs Total- 14Hrs	Hand tools trolley Radiator leak tester Vehicle/ simulator with a cooling system Drive belt tensioner gauge	Class Room and workshop

0716MS&A4. Maintain Engine Lubrication System

Objective: This module covers the knowledge and skills required to this Learning module is designed to provide skills and knowledge for understanding the working principles, construction, types, components and their relationship between different components to repair different types of engine lubricating systems by Auto Mechanic, in accordance with the manufacturer's Manual.

Duration: 28 Hours **Theory: 4 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place

LU1. Identify the Lubrication system	**Trainee will be able to:** • Identify the main components of engine lubrication system and understand its functions. • Identify types of oil pumps and understand its function • Identify oil coolers for the high-performance engine (air cooled/Water cooled type)	• Describe the functions/operating principle and main components of engine lubrication system as following. Oil sump, Oil pumps and its types, pressure relief valves, oil filter, oil cooler, ventilation/PCV Valve, hoses, and oil level indicators. • Describe the Lubricant Classifications, (oils viscosity, viscosity index,) Reduction of frictional forces, cooling effect, cleaning effect, corrosion resistance, and noise reduction). • Describe and explain the Law of friction, static/dynamic. • **<u>Practical Activity:</u>** • Inspect Engine oil level and its condition. • Inspect Oil Pressure Warning Lamp and Oil Pressure Gauge.	Theory-02Hrs Practical-12Hrs Total- 14Hrs	• Hand tools trolley • Car Lift • Vehicle/ simulator with a cooling system • Sealant/gasket	Class Room and workshop

		• Inspect oil Sump condition. • Remove and Fit oil Cooler.			
LU2. Use different Lubricants in the vehicle	**Trainee will be able to:** • Identify the types of engine oil used in the engine with respect to viscosity. • Identify the function of oil filter and its components. • Identify the oil sump and its components	• Describe the types of engine oil viscosity. • Describe the function of oil filter and its component. • Describe the oil sump and its components. • **Practical Activity:** • Replace the engine oil and filter. • Check and identify the oil viscosity.	Theory-02Hrs Practical-12Hrs Total- 14Hrs	•Hand tools trolley •Car Lift •Vehicle/ simulator with a cooling system •Sealant/gasket	Class Room and workshop

0716MS&A5. Retain Fuel System of Petrol Engine

Objective: This module covers the knowledge and skills required to this Learning module is designed to provide skills and knowledge for understanding the working principles, construction, types, components and their relationship between different components to repair Carburator type fuel system and basic EFI petrol engine by Auto Mechanic, in accordance with the manufacturer's Manual.

Duration: 28 Hours **Theory: 4 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Fuel system (carburetor type engine)	**Trainee will be able to:** • Understand in the petrol engine function of Air Filter. • Understand in the petrol engine function of Fuel pump (Mechanical and Electrical). • Understand the petrol engine (Carburetor type) main components and function of Carburetor. • Understand the petrol engine (Carburetor type) main components and function of Fuel filter. • Understand the petrol engine's (Carburetor type) main components and function of fuel lines/clips.	• Describe the features of main components of engine fuel system as following: Fuel tanks, filler cap/ security, venting, fuel level sender, lines/ filters, carburetor, and fuel lift pumps (mechanical/ electrical), fuel (octane rating, Octane number, cetane Number, cetane rating, leaded, unleaded fuel). • **Practical activity:** • Replace fuel tank • Replace fuel filter • Replace fuel line	Theory-02Hrs Practical-12Hrs Total- 14Hrs	Toll trolley (Complete set) Test lamp/DMM (Digital MultiMate) Diesel injector pressure tester /Petrol Injector Tester Safety wears	Class Room and workshop

	• Understand the petrol engine's (Carburetor type) main components and function of fuel sending unit.				
LU2. Fuel system (EFI type engine)	**Trainee will be able to:** • Identifies the EFI main components and understand the working principle of main components. • Identify the sensors in the vehicle and understand the function of each. • Identify the actuators in the vehicle and understand the functions of each. • Identify the ECU and engine malfunctioning light and understand its functions.	• Define electronic fuel injection system • Enlist the main components of EFI system • Explain idle control valve • Enlist types of sensors use in EFI system • Describe the construction of fuel supply system **<u>Practical activity:</u>** Measure the fuel pressure with the help of gauge Measure the resistance of the sensors and check continuity of different sensors such as IAT Sensor, ECT sensor, TP sensor, CKP and CMP	Theory-02Hrs Practical-12Hrs Total- 14Hrs	•Socket set •Combination scanner •Open end spanner •Ring spanner •Screw driver •Multi-meter •Scanner •Vehicle Consumable •IAT Sensor •ECT sensor, TP sensor •CKP sensor •CMP sensor. •MAP sensor •Knock sensor • Idle air control valve •Fuel injectors •ECM •Petrol •Kerosene oil •Carb. cleaner	Class Room and workshop

		sensor. Measure the resistance of injectors. Trace of the fault by using engine diagnostic scanner			

0716MS&A6. Retain Fuel System of Diesel Engine

Objective: This module covers the knowledge and skills required to this Learning module is designed to provide skills and knowledge for diesel engine fuel system their understanding the working principles, construction, types, components and their relationship between different components, system of vehicle by Auto Mechanic, in accordance with the manufacturer's Manual.

Duration: 28 Hours **Theory:4 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Fuel system (diesel engine)	**Trainee will be able to:** • Inspect diesel engine main components and understand the performance of heater plug. • Inspect diesel engine main components and understand the performance of injectors. • Inspect diesel engine main components and understand the performance of injection pump. • Inspect diesel engine main	• Describe the Diesel injection systems main components as following. Single/multi-hole injectors, inline fuel injection pump, rotary fuel injection pump, fuel injection pressure, bleed points, fuel cutoff switch, governor operation, in Combustion chamber types, main features of pressure/volume diagrams/effects of	Theory-02Hrs Practical-12Hrs Total- 14Hrs	• Socket set • Combination scanner • Open end spanner • Ring spanner • Screw driver • Vehicle • Diesel injector • Diesel injector tester • Diesel pump test bench • Diesel fuel injection pump (inline, rotary) •	Class Room and workshop

	components and understand the performance of sediment /filter.	advanced/retarded/no fuel injection • Describe the as following statements. Diesel fuel composition, effects of low temperature, viscosity, volatility, calorific value, cetin rating. • **Practical Activity:** • Replace the diesel fuel filter • Service of Inline fuel injection pump • Service of distributer type fuel injection pump • service of diesel fuel injectors • Remove the airlock from diesel fuel			
LU2. Fuel system (EFI diesel engine)	**Trainee will be able to:** • Identifies the EFI main components and	• Describe the construction of electric fuel pump • Describe the construction	Theory-02Hrs Practical-12Hrs Total- 14Hrs	•Socket set •Combination scanner •Open end spanner	Class Room and workshop

	understands the working principle. • Identify the sensors in the diesel EFI engine and understand the functions of each. • Identify the actuators in the diesel engine and understand the functions of each. • Identify the ECU and engine malfunctioning light and understand the functions.	and operation of pressure regulator • Describe the construction and operation of fuel injector **Practical activity:** • Replace the fuel feed pump, fuel filter, pressure regulator • Check and service of fuel injectors • Replace faulty fuel injectors • Replace faulty sensors • Service throttle body • Replace idle speed control valve • Adjust TP sensors		•Injector cleaner •Fuel pressure gauge •Ring spanner •Screw driver •Multi-meter •Scanner •Vehicle	

0716MS&A7. Maintain Engine Exhaust System

Objective: This module covers the knowledge and skills required to this Learning module is designed to provide skills and knowledge for engine exhaust system their understanding the working principles, construction, types, components and their relationship between different components, system of vehicle by Auto Mechanic, in accordance with the manufacturer's Manual.

Duration: 28 Hours **Theory: 4 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Exhaust system components	**Trainee will be able to:** • Inspect the performance of main components of exhaust manifold • Remove and assemble exhaust manifold from engine • Replace the muffler, resonator and catalytic converter under the specified procedure. • Replace the gasket/packing of silencer under the specified procedure.	• Describe the purpose of exhaust system and its functions. • Describe the muffler assembly operation. • Describe the catalytic converter operation • Describe the positive crank case ventilation PCV system and its operation • Describe the exhaust gas recirculation and its	Theory-02Hrs Practical-12Hrs Total- 14Hrs	Vehicle Tool's trolley (Complete set of hand tools) Gas analyzer Vacuum pump	Class Room and workshop

		operation • **Practical Activity:** • Perform repair and replace the catalytic converter • Perform repair and replace the positive crank case ventilation (PCV)			
LU2. Emission control system	**Trainee will be able to:** • Identify catalytic converter and understand the function. • Identify the positive crankcase ventilation (PCV) and understand the function. • Identify and understand the functions of exhaust gas recirculation system (EGR) • Identify the main components of Evaporative control system of fuel system**.**	• Describe the main components of Evaporative control system of fuel system. • Describe the functions of exhaust gas recirculation system (EGR) • **<u>Practical Activity:</u>** • Repair and replace the EGR in Emission control system	Theory-02Hrs Practical-12Hrs Total- 14Hrs	Vehicle Tool's trolley (Complete set of hand tools) Gas analyzer Vacuum pump	Class Room and workshop

0716MS&A8. Diagnosing Engine Faults

Objective: This module covers the knowledge and skills required to this competency standard is developed to provide skills and knowledge to Overhaul Engine (Petrol and Diesel), in accordance with the Manufacturer Manual. You will be able to diagnose fault/s and other maintenance issues of automobile engines while ensuring safe use of tools equipment and materials

Duration: 40 Hours **Theory: 10 Hours** **Practice: 30 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Engine fault	**Trainee will be able to:** • Understand engine adjustment/setting faults of Engine Timing, Setting Distributor timing, tappet adjustment, drive belt/fan belt adjustment. • Understand the faults of engine head gasket, Crank main oil seal, Engine timing belt, manifold packing, and exhaust muffler. • Start the engine and identify	• Describe the following: Valve timing: lead, lag, overlap, timing diagrams, valve, clearances/adjustment/adjustment methods. Terms: Top Dead Centre (TDC), Bottom Dead Centre (BDC), Bore, Stroke, Capacity, Clearance Volume, Swept Volume, Compression Ratio, Crank Throw, Torque at	Theory-05Hrs Practical-15Hrs Total- 20Hrs	• Tool's trolley (complete set of tools) • Compression tester • Measuring tools (Complete set for engine overhauling) • Fuel pressure Tester • Special Service Tools	Class Room and workshop

	the condition of engine missing, stalling, and lack of power, back fire, knocking, black smoke/heavy fuel consumption, excessive oil consumption, and leakages.	REVS/min, Brake power at revs/min, Specific Fuel Consumption (SFC), Volumetric efficiency, OHV, and OHC. • Describe the possible causes of high fuel consumption as following: Overload the engine, excessive oil consumption, faulty air filter, carburetor poor setting, engine over cooled and hard/jam running of engine **Practical Activity:** • Perform the possible causes of high fuel consumption. • Check and repair the engine condition of			

		engine missing, stalling, and lack of power, back fire, knocking, black smoke/heavy fuel consumption, excessive oil consumption, and leakages.			
LU2. Engine assembly	**Trainee will be able to:** • Selects appropriate tools and perform dismantling/assembly of the all-engine components as specified procedure in the manual. • Assemble engine manifolds intake and exhaust.	• describe the dismantling/assembly of the all-engine components as specified procedure in the manual. • describe the assemble engine manifolds intake and exhaust **<u>Practical Activity:</u>** Perform dismantling/assembly of the all-engine components as specified procedure in the manual.	Theory-5Hrs Practical-15Hrs Total- 20Hrs	• Tool's trolley (complete set of tools) • Compression tester • Measuring tools (Complete set for engine overhauling) • Fuel pressure Tester • Special Service Tools	Class Room and workshop

0716MS&A9. Perform Ignition System of Petrol Engine

Objective: This module covers the knowledge and skills required to these competency standards designed to diagnose and troubleshoot conventional spark ignition system as well as conceptualize the ignition system mechanism in the engine of vehicle by Auto Mechanic, in accordance with the manufacturer's Manual.

Duration: 28 Hours **Theory: 4 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Repair Ignition System	**Trainee will be able to:** • Identify the vehicle Ignition system and understand procedure of testing ignition coil under the specified procedure. • Identify the vehicle Ignition system and understand procedure of testing fuse in fuse box under the specified procedure. • Identify the vehicle Ignition system and understand	• Describe the Purpose and function of ignition system's following parts. Spark ignition system contact breaker type, spark ignition system breaker less type. Ignition switch, Ignition coil, resister, plug cable, distributer cap, rotor arm, vacuum advancer, centrifugal advancer, contact breaker assembly, condenser, high tension leads/connectors,	Theory-02Hrs Practical-12Hrs Total- 14Hrs	• vehicle/ simulator • Digital Multimeter (DMM). • Tool's box • test lamp • Timing gun	Class Room and workshop

	procedure of testing the performance of plug cable and plugs under the specified procedure. • Identify the vehicle Ignition system and understand procedure of inspecting distributor cap/rotor for the performance under the specified procedure. • Identify the vehicle Ignition system and understand procedure of inspecting vacuum advancer, assess C.B Point condition/gap for the performance under the specified procedure. • Identify the vehicle Ignition system and understand procedure of correct ignition timing under the specified	suppression, spark plug (construction, heat range type, size), Magnetic Reflector, hall effect trigger/amplifier, differentiate the performance of contact breaker and contact breaker less type. • Describe primary circuit, secondary circuit of ignition system, identifies change in the spark timing in accordance to the load and speed of the engine. • Explain Faradays law of mutual induction and calculate the primary and secondary voltages and current. • **Practical Activity:** • Check ignition system circuit			

	procedure. • Identify the vehicle Ignition system and understand the performance of CDI of distributor under the specified procedure.	and wires continuity and diagnose faults. • Inspect ignition coil and resister. • Inspect CB point, condenser. • Check distributer unit and diagnose faults. • Inspect high tension leads. • Inspect spark plug gap.			
LU2. Adjust ignition timing	**Trainee will be able to:** • Installation of distributer assembly under specified procedure and start the engine, adjust ignition timing with the help of timing gun. • Inspect/ Replace ignition switch, inspect/replace ignition coil, and Repair/ replace electrical connectors under specified procedure	•Describe the distributer assembly. •Describe the ignition switch, ignition coil, and high-tension leads. **<u>Practical Activity:</u>** • Adjust ignition timing • Replace ignition switch, • Replace ignition coil, • Repair/ Replace electrical connectors under specified procedure	Theory-02Hrs Practical-12Hrs Total- 14Hrs	vehicle/ simulator Digital Multimeter (DMM). Tool's box test lamp Timing gun	Class Room and workshop

0716MS&A10. Perform Overhauling of Four Stroke Single Cylinder Engine

Objective: This module covers the knowledge and skills required to this competency standard is designed to provide skills and knowledge to Overhauling Motorcycle Engine of motorcycle by Motorcycle Mechanic, in accordance with the Manufacturer's Manual.

Duration: 30 Hours **Theory: 5 Hours** **Practice: 25 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Overhauling Four stroke motorcycle engines	**Trainee will be able to:** • Arrange proper tools and equipment's to service cylinder head. • Disconnect cables, wires, and muffler from cylinder head for dismantling cylinder head. • Remove cylinder head assembly and its components from the engine to identify damage parts. • Replace/clean cylinder	• Describe the Purpose and function of ignition system's following parts. Spark ignition system contact breaker type, spark ignition system breaker less type. Ignition switch, Ignition coil, resister, plug cable, distributer cap, rotor arm, vacuum advancer, centrifugal advancer, contact breaker assembly, condenser, high tension leads/connectors, suppression, spark plug (construction, heat	Theory-2.5Hrs Practical-12.5Hrs Total- 15Hrs	• vehicle/ simulator • Digital Multimeter (DMM). • Tool's box • test lamp • Timing gun	Class Room and workshop

	head and its components by using appropriate tools as per shop manual • Refit cylinder head and its components; connect all the cables/ wires and muffler as per shop manual. • Test engine performance to verify servicing of cylinder head.	range type, size), Magnetic Reflector, hall effect trigger/amplifier, differentiate the performance of contact breaker and contact breaker less type. • Describe primary circuit, secondary circuit of ignition system, identifies change in the spark timing in accordance to the load and speed of the engine. • Explain Faradays law of mutual induction and calculate the primary and secondary voltages and current. • **Practical Activity:** • Removal of the engine from the vehicle according to the workshop manual. • Dismantle the engine under the specified procedure. • Clean and inspect all			

		components of engine and identify faulty components			
LU2. Service cylinder, Piston and Piston Rings	**Trainee will be able to:** • Arrange proper tools and equipment to service cylinder and piston. • Remove cylinder head assembly from the cylinder block to service cylinder block piston and piston Rings as per shop manual. • Remove cylinder block, piston and inspect its components to identify the damage parts as per Shop manual. • Service/ clean cylinder block, piston and its	• Explain the cylinder bore. • Explain the cylinder head and cylinder block facing. • Describe the intake system and its components. • Describe the exhaust system and its components. • Explain the usage of torque wrench. • Explain the bolt tightening sequence. • Explain the valve clearance. • Explain the usage of engine scanner. • Describe the road test of vehicle **<u>Practical Activity:</u>** • Inspect and replace if required:	Theory2.5Hrs Practical-12.5Hrs Total- 15Hrs	• vehicle/ simulator • Digital Multimeter (DMM). • Tool's box • test lamp • Timing gun • Vehicle with workshop manual • Compression Gauge. • Vacuum Gauge • Radiator Pressure Tester • Tool Kit (Hand tools)	Class Room and workshop

	components to remove dust. • Refit Cylinder Block, piston, piston rings, and cylinder head and connect all the wires, cables to the engine as per shop manual. • Test engine performance to verify servicing of cylinder piston and piston rings as per shop	• Head valves, valve seat, and valve guide as per standard procedure. • Camshaft as per standard procedure. • Valve seals. • Crankshaft as per repair manual. • Connecting rod and piston as per standard procedure. • Engine block and cylinder bore as per standard procedure. • All house pipes for cracks or leakage. • Assembled the engine with specified torque as per repair manual. • Set the engine timing according to the standards • Adjust the engine Valve clearance (tappet) under the specified procedure			

2. Mill Wright Auto Mechanic/Automobile Machinist

0716MS&A11. Perform Bench Work on Metallic Surfaces

Objective: This module covers the knowledge and skills required to perform bench work operations using different tools and equipment, in accordance with approved procedures. You will be expected to perform sawing, filing, threading and reaming using hand tools. You will be required to operate the tools and equipment safely by comply the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration: 30 Hours **Theory: 06 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Carry-Out Sawing	**Trainee will be able to:** • Select appropriate blade and set in hacksaw frame according to the job requirement. • Select appropriate marking tool(s), mark the work piece and clamp it in the vice firmly as per standard practices • Adopt sawing methods and techniques that are safe and suitable to cut the work-piece as	• Define Mechanical Properties and strength of materials. • Define blades and their types. • Describe different type of measuring tools. • Describe different type of marking tools. • Describe sawing operations and techniques. • Describe feed and speed	Theory-02Hrs Practical-06Hrs Total- 08Hrs	Power Hacksaw Hand Hacksaw Raw Material (Round, Square and Rectangular bar) for practice. Work holding devices. Cutting Blade. Marking tools. Measuring tools. Work holding devices. Coolant	Class Room and workshop

	required • Follow marked line during sawing of work piece to ensure accuracy	settings according to the work-piece, tools& materials. • Describe Safety Precautions during sawing operation **Practical Activity:** Cut a round and square piece of material on power hacksaw according to given dimensions.			
LU2. File the Work-Piece	**Trainee will be able to:** • Select appropriate file and marking tool(s) according to the job requirement • Mark the work-piece and clamp it in the vice firmly as per standard practices • Adopt filing method and technique which is safe and suitable to produce the work-piece as per drawing • Follow drawing dimensions and surface finish of filed work-piece	• Describe different types of files. • Describe different types of bench vices and their types. • Describe the filing method. • Describe Safety Precautions during filing operation. **Practical Activity:** Flat a square piece using different types of files.	Theory-1Hrs Practical-6Hrs Total- 7Hrs	Set of Files. Marking Tools. Measuring Tools. Work holding devices.	Class Room and workshop

	to ensure accuracy and precision				
LU3. Carry out Drilling	**Trainee must be able to:** • Setup drill machine for producing hole in the work piece according to the job requirement • Select drill bit and marking tools according to the material and job requirement, respectively • Mark the work-piece according to the drawing and clamp it in the vice firmly as per standard practices • Set the suitable RPM. • Adopt proper drilling method (manual/auto-feed, applying coolants) which is safe and suitable to produce the hole in work-piece • Follow drawing dimensions of drilled hole to ensure accuracy	• Describe different types of drill machine. • Explain different type of drill bits. • Describe the feed and speed for drilling. • Describe Safety Precautions during filing operation. **Practical Activity:** Make different types of holes on a square and round bar.	Theory-1Hrs Practical-3Hrs Total- 4Hrs	Drill Machines. Drill Bits. Marking and measuring tools. Work holding devices. Coolant.	Class Room and workshop

	and precision				
LU4. Produce Threads on Work-Piece	**Trainee must be able to** • Select tap and die according to the type of thread to be produced on work-piece as per drawing • Clamp the work-piece in the clamping device firmly as per standard practices • Ensure the tap and die alignment as per prescribed standard • Make thread with die and follow appropriate sequence • Ensure the safety and dimensional accuracy of threads on work-piece as per drawing.	• Describe thread terminology. • Describe taps and dies types and working. • Describe Safety Precautions when you use tap and die for threading operation. **Practical Activity:** Make internal and external thread using Tap's and dies.	Theory-1Hrs Practical-6Hrs Total- 7Hrs	Set Of Taps. Set of Dies. Work holding devices. Lubrication oil.	Class Room and workshop
LU5. Perform Hand Reaming	**Trainee must be able to** • Select reamer according to the work-piece requirement • Clamp the work-piece in the	• Describe reaming and boring operations. • Describe function of reaming. • Describe Safety Precautions	Theory-1Hrs Practical-3Hrs Total- 4Hrs	Set of Reamer. Work holding devices.	Class Room

	clamping device firmly as per standard practices • Ensure the reamer alignment as per prescribed standard • Produce reamed hole by following safety and prescribed method • Ensure the accuracy and size of reamed hole of work-piece according to the drawing.	when you use reamer for reaming operation. •			

0716MS&A12. Perform Shaper Machine Operations

Objective: This module covers the knowledge and skills required to perform shaping operations on shaper machine in accordance with approved procedures. You will be expected to perform Facing, Step cutting, Squaring, Slotting, V-shape cutting with point cutting tool. You will be required to operate the shaper machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration: 30 Hours **Theory: 06 Hours** **Practice: 24 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare Materials for Shaping Operations	**Trainee must be able to** • Interpret drawing and arrange the material accordingly. • Prepare work-piece by required machining (sawing and filing etc.) and get ready to clamp. • Check and verify the dimensions of work-piece for shaping according to the drawing.	• Interpret basic drawings • Describe Different sawing operations. • Describe Filing Operations. • Describe Different measuring and marking technique.	Theory-1Hrs Practical-3Hrs Total- 4Hrs	Raw Material (Square and Rectangular bar). Measuring tool. Marking tool.	Class Room and workshop
LU2. Select Tools and Equipment	**Trainee must be able to** • Select the material and shape of tool(s) according to the job	• Describe different materials property. • Describe different measuring and	Theory-1Hrs Practical-3Hrs Total- 4Hrs	Tool Bits. Measuring Tool. Work holding	Class Room and workshop

	requirements • Arrange the measuring instruments and holding devices to attain accuracy of the work as per prescribed method.	holding tools. • Describe different type of cutting tool that can be used on shaper.		device.	
LU3. Set Shaper Machine for Operations	**Trainee must be able to** • Clamp the material of work-piece and tool into its holding devices as per standard practice • Maintain safe distance between surface of work-piece and tooltip as per prescribed method • Adjust the ram placement and stroke length according to the length of job • Adjust the parameters of shaping (speed and feed) from control unit as per prescribed method • Start shaping operation by locating the initial touching point and adjust the depth of cut	• Describe Shaper, planner and slotter. • Describe Safety Precautions during working on shaper. • Describe speed and feed for shaper machine. • Describe Working principle of shaper machine. • Describe different types of shaper machines. • Describe Ram and stroke settings. • •	Theory-1Hrs Practical-6Hrs Total- 7Hrs	Work holding devices. Shaper Machine. Tool kit.	Class Room and workshop

	according to the prescribed procedure				
LU4. Perform Shaping Operations (Square Job)	**Trainee must be able to** • Ensure the proper clamping of work-piece and the tool according to the standard practice • Start the shaping operation at top surface of work piece to get flatness as per initial requirements • Re-clamp the work-piece by rotating 90° for next surface as per prescribed method • Shape entire work-piece by following the above stated method for next surface to get square shaped work piece according to drawing	• Describe Different types of clamping devices used for shaping machine. • Describe Working of shaper machine. • Describe usage of tri-square. **Practical Activity:** Make a tool bit holder for the machine.	Theory-1Hrs Practical-6Hrs Total- 7Hrs	Work holding devices. Shaper Machine. Tool kit.	Class Room and workshop
LU5. Perform Shaping Operations (Angular Job)	**Trainee must be able to** • Ensure proper clamping of the work-piece and the tool according to standard practice	• Describe marking Technique. **Practical Activity:** Make slots using shaper machine.	Theory-2Hrs Practical-6Hrs Total- 8Hrs	Work holding devices. Shaper Machine. Tool kit.	Class Room

	• Mark work-piece according to the drawing • Set and align the sliding degree of head according to required angle • Start the angular shaping operation to get required angle as per marked line • Shape entire work-piece, by setting the required degree of head, to get angle of work-piece according to the drawing.				

0716MS&A13. Perform Lathe Turning Operations

Objective: This module covers the knowledge and skills required to perform lathe machine operations by a Machinist in accordance with the organization's approved guidelines and procedures. You will be expected to perform facing, turning drilling/boring, taper turning, knurling and threading operations using lathe machine. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration: 35 Hours **Theory: 08 Hours** **Practice: 27 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare Materials for Lathe Operations	**Trainee must be able to** • Interpret drawing and arrange the material accordingly • Prepare work-piece by required machining (sawing and filing etc.) and get it ready for clamping • Check and verify the dimensions of work-piece for lathe operations as per drawing	• Describe measuring Units. Describe sawing operation. **Practical Activity:** Cut the Material to perform lathe operation according to drawing.	Theory-2Hrs Practical-3Hrs Total- 5Hrs	Raw Material (Round, Rectangular). Sawing Machine. Measuring tool. Marking Tool.	Class Room and workshop
LU2. Select Tools and Equipment	**Trainee must be able to** • Select the tool(s) according to material of job and shape of the job requirements • Arrange the measuring	• Describe different tools that we can use on lathe machine. • Describe different measuring tools.	Theory-2Hrs Practical-3Hrs Total- 5Hrs	Measuring Tool. Work Holding Devices.	Class Room and workshop

	instruments and holding devices to attain accuracy of the work as per prescribed method				
LU3. Set Lathe Machine for Operations	**Trainee must be able to** • Clamp the material of work-piece and tool into its holding devices as per standard practice. • Maintain the safe distance between work-piece and tool tip as per prescribed method. • Adjust the revolution per minute (rpm) of chuck according to the specifications of work-piece. • Adjust the parameters of speed and feed from control unit as per prescribed method.	• Describe different Work holding devices that we use on lathe Machine. • Describe Safety precautions for Lathe machine. • Describe feed rate and speed of lathe machine.	Theory-2Hrs Practical-9Hrs Total- 11Hrs	Lathe Machine. Lathe Attachments. Work holding devices.	Class Room and workshop
LU4. Carry-Out Lathe Operations	**Trainee must be able to** • Ensure the proper clamping of work-piece and the tool into the holding devices according to the required operation	• Describe different types of lathe machine. • Describe different types of operations that we can perform on lathe machine.	Theory-02Hrs Practical-12Hrs Total- 14Hrs	Work Holding Devices. Cutting Tools. Measuring Tools.	Class Room and workshop

	• Maintain the alignment of work-piece and locate the tool tip at center position of the work-piece as per standard practice • Start the lathe operations as required according to the drawing and replacing the required tool • Check the work-piece by using appropriate measuring tools and instruments as per standard practice	• Describe Lathe attachments. • Importance and usage of coolants **Practical Activity:** • Perform Facing, Turning, Drilling, Boring, Tapper turning step turning and threading.			

0716MS&A14. Read and Interpret Manufacturing Drawings

Objective: This module covers the knowledge and skills required to read and interpret manufacturing drawings and welding symbols. The standard covers specific knowledge related to reading and understanding manufacturing drawings, interpreting welding symbols, recognizing materials and specifications, and bill of material/s and manufacturing parts according to manufacturing drawings.

Duration: 24 Hours **Theory: 6 Hours** **Practice: 18 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Read and Understand Manufacturing Drawings	**Trainee must be able to** • Recognize basics of lines used in engineering drawings • Describe uses of lines in engineering drawings • Recognize and explain orthographic and isometric views of a drawing • Identify manufacturing requirements according to drawings • Prepare job layout according to manufacturing requirements	• Describe Basic elements of engineering drawing. • Describe Drawing symbols • Describe types of fit and Tolerances. • Define First angle projections • Define Third angle projections • Define Hidden view technique	Theory-2Hrs Practical-3Hrs Total- 5Hrs	Drawing Tools.	Class Room and workshop
LU2. Interpret Welding Symbols	**Trainee must be able to** • Understand basic and supplementary welding symbols	• Describe Symbols for welding Joints. • Describe Basic welding Requirements.	Theory-1Hrs Practical-3Hrs Total- 4Hrs		Class Room and workshop

	used in manufacturing drawings • Understand and differentiate between types of welds and joints • Identify welding requirements according to welding symbols given in the manufacturing drawings				
LU3. Recognize Material Specifications and Bill of Material (BOM)	**Trainee must be able to** • Identify material specifications according to manufacturing drawing • Identify bill of material (BOM) according to manufacturing drawing	• Define BOM	Theory-2Hrs Practical-9Hrs Total- 11Hrs	Material Specification Chart. Tender Notice.	Class Room and workshop
LU4. Manufacture Parts	**Trainee must be able to** • Interpret dimensional tolerances according to manufacturing drawing • Assemble and tack weld parts according to manufacturing drawing	• Describe Welding joints. **<u>Practical Activity:</u>** Tack weld parts according to drawings.	Theory-1Hrs Practical-3Hrs Total- 4Hrs	Raw Material for Welding.	Class Room and workshop

0716MS&A15. Perform Welding Procedure Specifications (WPS)

Objective: This module covers the knowledge and skills required to prepare Welding Procedure Specifications (WPS). The standard covers specific knowledge related to recognizing, interpreting and explaining and preparing Welding Procedure Specifications (WPS).

Duration: 35 Hours **Theory: 08 Hours** **Practice: 27 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Recognize Welding Procedure Specifications (WPS)	**Trainee must be able to** • Describe and understand contents of Welding Procedure Specifications (WPS) • Recognize common acronyms used in Welding Procedure Specifications (WPS)	• Describe Common contents of WPS. • Describe Purpose of Welding Procedure Specifications •	Theory-1Hrs Practical-9Hrs Total- 10Hrs	Chart of common acronyms used in Welding.	Class Room and workshop
LU2. Interpret and Explain Welding Procedure Specifications (WPS	**Trainee must be able to** • Recognize materials specifications (base metals and fillers) according to Welding Procedure Specifications (WPS) • Recognize weld type and joint design according to Welding	• Describe Properties of materials. • Describe Welding Positions. • Define Types of welds •	Theory-4Hrs Practical-9Hrs Total- 13Hrs		Class Room and workshop

	Procedure Specifications (WPS) • Recognize welding positions and parameters according to Welding Procedure Specifications (WPS)				
LU3. Prepare a Welding Procedure Specifications (WPS	**Trainee must be able to** • Prepare sample Welding Procedure Specifications (WPS) following a simple welding procedure • Follow written Welding Procedure Specifications (WPS) to produce a production/sample weld	• Describe Welding processes • Describe Pre-Heating and post heating • Define Electrical characteristics - volts, current, polarity for WPS. • Define Welding consumables	Theory-3Hrs Practical-9Hrs Total- 12Hrs	Raw material. Welding Machine. Welding Both.	Class Room and workshop

0716MS&A16. Prepare Materials for Welding

Objective: This module covers the knowledge and skills required to prepare materials for a specific job. The standard covers specific knowledge of marking the material as per drawing/job requirement, setting up cutting equipment, cutting and preparing edges of base materials, cleaning surfaces and edges, preparing welding consumables and fitting up base materials.

Duration: 35 Hours **Theory: 08 Hours** **Practice: 27 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Select and Mark Material/s as per Drawing/Job Requirement	**Trainee must be able to** • Select and obtain required material/s as per job requirements • Select appropriate marking tools as per job requirements • Mark the area to be cut as per drawing/ job requirements	• Describe Interpretation of drawings and sketches • Define Measuring and marking tool. **Practical Activity:** Mark the job according to drawing with the help of marking and measuring tools.	Theory-2Hrs Practical-6Hrs Total- 8Hrs	Measuring Tools. Marking Tool. Sawing Machine.	Class Room and workshop
LU2. Cut and Prepare Edge/s of Base Materials	**Trainee must be able to** • Select appropriate cutting equipment as per job requirements • Set-up cutting equipment as per	• Define different type of cutting machines. • Describe Sawing operations. • Describe materials property and cutting tools properties.	Theory-2Hrs Practical-6Hrs Total- 8Hrs	Measuring Tool. Marking Tool. Work holding Devices. Raw Material. Grinding	Class Room and workshop

	manufacturer's instructions/job requirements • Cut the base material as per job specifications and dimensions provided in the drawing • Prepare edges of the base materials as per drawing/ WPS • Check dimensions of the prepared edges as per drawing/ WPS • Select proper tools and chemicals for cleaning • Clean the edges of the base materials as per job requirements	• Describe cleaning agent for welding. **Practical Activity:** Cut the base material according to Marking lines.		Machine. Cleaning Agent.	
LU3. Prepare Welding Consumables	**Trainee must be able to** • Select relevant welding consumables as per job requirements/ WPS • Prepare consumables in accordance with required specifications	• Describe Welding Consumable Materials. • Describe Consumable Materials according to base metal properties.	Theory-2Hrs Practical-6Hrs Total- 8Hrs	Consumable Material for welding.	Class Room and workshop

LU4. Fit-up Base Materials	**Trainee must be able to** • Select proper tools and equipment to fit-up base materials • Tack weld joint/s as per drawing/ welding procedure specifications (WPS) • Check root gap as per drawing/welding procedure specifications (WPS) • Check alignment as per applicable code/standard	• Describe Selection of appropriate method of edge preparation • Describe Selection of appropriate equipment, accessories and supplies. • Describe Safety procedures for cutting, grinding and Welding. **<u>Practical Activity:</u>** Adjust the parts at right position as they are going to be weld.	Theory-02Hrs Practical-09Hrs Total- 11Hrs	Filling Material. Measuring tool.	Class Room and workshop

0716MS&A17. Perform Shielded Metal Arc Welding (SMAW) in Vertical (3F, 3G) and Overhead (4F, 4G) Positions

Objective: This module covers the knowledge and skills required to to perform Shielded Metal Arc Welding (SMAW) operations in Flat (1F, 1G) and Horizontal (2F, 2G) positions at workplace. The standard covers specific knowledge of performing Shielded Metal Arc Welding (SMAW) by selecting and setting up welding equipment, installing consumables, adjusting welding parameters and making fillet and groove welds in Flat (1F, 1G) and Horizontal (2F, 2G) positions of plate. The standard also covers post welding operations comprising cleaning, measuring, inspecting and repairing welds at workplace.

Duration: 40 Hours **Theory: 10 Hours** **Practice: 30 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Prepare Welding Machine and Accessories for SMAW	**Trainee must be able to** • Identify welding requirements from the job, welding procedure specifications and/or technical drawings • Prepare SMAW welding machine in accordance with welding procedure specifications/ manufacturer instructions • Set up welding machine accessories and consumables as	• Describe types of welding and welding machines. • Describe Polarity setting according to standard specifications • Define Specifications/ classification of electrode/s required for the job. • Describe voltages according to welding machines.	Theory-2.5Hrs Practical-6Hrs Total- 8.5Hrs	Measuring Tool. SMAW Machine. Measuring Tool. Welding Rod	Class Room and workshop

	per job requirements, welding procedure specifications and/or manufacturer's instructions • Connect welding machine to an independent power supply • Set polarity indicated in the welding procedure specifications				
LU2. Make Fillet Welds on Carbon Steel Plate	**Trainee must be able to** • Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job requirements to produce acceptable weld • Maintain gap between electrode and base metal as per standard practices • Carry out welding in Flat (1F) and Horizontal (2F) positions following standard procedures • Follow applicable manufacturing codes and standards for acceptance	• Describe Electrical supply AC and DC. • Describe Electrical parameters like (voltage, current etc.) and their effects on weld • Describe Flat and Horizontal Positioning of welding. • Define acceptance criteria of visual welding defects. **<u>Practical Activity:</u>** Make Butt Joint and lap joint.	Theory-2.5Hrs Practical-6Hrs Total- 8.5Hrs	Measuring Tool. SMAW Machine. Measuring Tool. Welding Rod	Class Room and workshop

	criteria of visual welding defects				
LU3. Make Groove Welds on Carbon Steel Plate	**Trainee must be able to** • Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job requirements to produce acceptable weld • Maintain gap between electrode and base metal as per standard practices • Carry out welding in Flat (1G) and Horizontal (2G) positions following standard procedures • Deposit root pass as per welding procedure specifications/ job requirements • Deposit filling passes as per welding procedure specifications/job requirements • Deposit capping pass as per welding procedure specifications/job	• Define distance between base metal and consumable material for welding. • Explain Flat 1G and 2G Horizontal Positioning for welding. • Describe applicable manufacturing codes and standards for acceptance criteria of visual welding defects. • Describe Welding codes and standards **<u>Practical Activity:</u>** Make T Joint and Corner joint.	Theory-2.5Hrs Practical-9Hrs Total- 11.5Hrs	Measuring Tool. SMAW Machine. Measuring Tool. Welding Rod	Class Room and workshop

	requirements • Check root, filling and capping passes for any visual discontinuities as per acceptance standards • Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects				
LU4. Perform Post Welding Operations	**Trainee must be able to** • Carry out finishing work of welds following standard procedures • Inspect weld visually and mark any visual defects, as required • Carry out repair work in accordance with approved procedures, as required • Clean work area in accordance with workplace safety practices • Maintain and store tools/ equipment/ consumable materials in accordance with organization guidelines	• Describe different types of grinding for finishing process. • Describe safety precautions after welding process. • Describe the purpose of finishing.	Theory-2.5Hrs Practical-9Hrs Total- 11.5Hrs		Class Room and workshop

0716MS&A18. Perform Forging Operations

Objective: This module covers the knowledge and skills required to perform main operation of forging (Drawing down and Swaging).

Duration: 35 Hours **Theory: 08 Hours** **Practice: 27 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Drawing down	**Trainee must be able to** • Make fire in available forge furnace. • Put the stock in forge furnace. • Heat the stock upto bright red condition (Plastic State) • Grip the heated stock by tong and put on anvil. • Apply firm blows of sledge hammer on both sides of stock. • Put the stock again in forge furnace and repeat process • Always wear safety dress before start the performance.	• Describe Forging Process. • Describe Furnaces that used for forging process. • Define annealing. • Describe techniques of drawing down. •	Theory-5Hrs Practical-12Hrs Total- 17Hrs	Furnace. Raw Material. Hammer. Anvil. Work Holding Devices.	Class Room and workshop
LU2. Swaging	**Trainee must be able to** • Make fire in forge furnace	• Explain material properties and their melting	Theory-03Hrs Practical-15Hrs Total- 18Hrs	Furnace. Raw Material. Hammer.	Class Room and workshop

	• Put the round stock in forge furnace. • Heat the stock up to bright red condition. • Fix the bottom swage in hardy hole. • Put the red-hot round bar in the bottom swage. • Put the top swage over round bar with the help of handle. • Apply firm blows of sledge hammer and move round bar longitudinally and circumferentially. • Always wear safety dress before start the performance	temperatures. • Define the detection fault method after forging process. • Describe Safety process during Swaging.		Anvil. Work Holding Devices.	

3. Generic-I

0716MS&A19. Participate in Workplace Communication

Objective: This module is designed to enable the learner to the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements

Duration: 10 Hours **Theory:04 Hours** **Practice: 06 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Obtain and convey Workplace information	**Trainee will be able to:** • Assess the Specific and relevant information from the appropriate sources • Convey and gather the information of Effective questioning, active listening and speaking skills. • Transfer the information using the appropriate medium and ideas. • Use appropriate non- verbal communication. • Identify and follow appropriate	Describe the following: Appropriate sources: Team members, Suppliers, Trade personnel, Local government, Industry bodies Medium: Memorandum, Circular, Notice, Information discussion, Follow-up or verbal, instructions, Face to face communication. **Practical Activity** Perform a Play for conveying bay work activity in auto	Theory-1.5Hrs Practical-1.5Hrs Total- 03Hrs	Shop bay equipped with general and special tools	Class Room and workshop

	lines of communication with supervisors and colleagues. • Use the defined workplace procedures for the location and storage of information. • Carry out Personal interaction clearly and concisely.	workshop			
LU2. Participate in workplace meetings and discussions	**Trainee must be able to** • Attend the team meetings on time • Clearly express your own opinions and listen other's point of view without interruption. • Established the protocols in the courteous manner of meeting inputs with the meeting purpose and Workplace interactions. • Questions about simple routine workplace procedures and maters concerning working conditions of employment are asked and responded to Meeting's outcomes	Describe the following: **Storage:** Manual filing system, Computer-based filing system. **Forms:** Personnel forms, telephone message forms, safety reports. **Practical Activity** Prepare a safety report of a standard automobile work shop.	Theory-1.5Hrs Practical-1.5Hrs Total- 03Hrs	Auto mobile work shop Stationary. Report specimen	Class Room and workshop

	are interpreted and implemented				
LU3. Complete relevant work-related documents	**Trainee must be able to** • Range of forms relating to conditions of employment are completed accurately and legibly • Workplace data is recorded on standard workplace forms and documents • Perform the basic mathematical processes that are used for routine calculations • Identify the errors in recording information on forms/ documents and properly acted upon • Reporting requirements to supervisor are completed according to organizational guidelines	Describe the following: **Workplace interactions:** Face to face, Telephone, Electronic and two-way radio, Written including electronic, memos, instruction, and forms, non-verbal including gestures, signals, signs and diagrams **Protocols:** Observing meeting, Compliance with meeting decisions, Obeying meeting instructions **<u>Practical Activity</u>** Prepare minutes of meeting for auto work shop team.	Theory-01Hrs Practical-03Hrs Total- 04Hrs	stationary	Class Room and workshop

0716MS&A20. Perform Work in Team Environment

Objective: This module is designed to enable the learner to Perform Work In Team Environment of effects of auto mobile workshop.

Duration: 10 Hours **Theory:04 Hours** **Practice: 06 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Describe team role and scope	**Trainee will be able to:** • Identify the role and objective of the team from available sources of information. • Identify team parameters, reporting relationships and responsibilities from team discussions and appropriate external sources.	**Role and objective of team:** Work activities in a team environment with enterprise or specific sector, Limited discretion, initiative and judgment maybe demonstrated on the job, either individually or in a team environment. **Practical Activity** • Identify the role and objective of the team from available sources of information.	Theory-1.5Hrs Practical-1.5Hrs Total- 03Hrs	Stationary	Class Room and workshop
LU2. Identify own role and responsibility within team	**Trainee must be able to** • Identify the individual role and responsibilities within the team environment. • Identify and recognize the roles	• Standard operating and/or other workplace procedures, Job procedures, Machine/equipment manufacturer's specifications and instructions, Organizational or	Theory-1.5Hrs Practical-1.5Hrs Total- 03Hrs	Stationary	Class Room and workshop

	and responsibility of other team members. • Reporting relationships within team and external to team are identified	external personnel, Client/supplier instructions, Quality standards, OHS and environmental standards. **Practical Activity** • Identify and recognize the roles and responsibility of other team members.			
LU3. Work as a team member	**Trainee must be able to** • Effective and appropriate forms of communications used and interactions undertaken with team members who contribute to known team activities and objectives • Effective and appropriate contributions made to complement team activities and objectives, based on individual skills and competencies and workplace context • Observed protocols in reporting	• Work procedures and practices, Conditions of work environments, Legislation and industrial agreements, Standard work practice including the storage, safe handling and disposal of chemicals, Safety, environmental, housekeeping and quality guidelines. **Practical Activity** • Perform a play with Effective and appropriate contributions made to complement team activities and objectives, based on individual skills and competencies and	Theory-01Hrs Practical-03Hrs Total- 04Hrs	Stationary	Class Room and workshop

	using standard operating procedures ○ Contribute to the development of team work plans based on an understanding of team's role and objectives	workplace context			

0716MS&A21. Read and Develop Career Professionalism

Objective: This module is designed to enable the learner to Read and Develop Career Professionalism as well under the specified procedure in the manual.

Duration: 12 Hours **Theory: 3 Hours** **Practice: 9 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Integrate personal objectives with organizational goals	**Trainee will be able to:** • Personal growth and work plans are pursued towards improving the qualifications set for the profession • Maintain the Intra- and interpersonal relationships in the course of managing oneself based on performance evaluation. • Demonstrate the commitment to the organization and its goal in the performance of duties.	**Describe the following** Performance Appraisal, Psychological Profile, Aptitude Tests **Practical Activity** **Evaluate the following:** Prepare a performance appraisal method flow chart of a standard auto work shop.	Theory-1Hrs Practical-3Hrs Total- 4Hrs	Stationary, standard Performa's /charts	Class Room and workshop

LU2. Set and meet work priorities	**Trainee must be able to** • Competing demands are prioritized to achieve personal, team and organizational goals and objectives. • Manage work priorities and commitments in order to utilize the resources efficiently and effectively. • Practices along economic use and maintenance of equipment and facilities are followed as per established procedures	Describe the following: • **Resources:** Human, Financial, Technology, Hardware, Software • Trainings and career opportunities: Participation in training programs, Technical, Supervisory, Managerial, Continuing Education, Serving as Resource Persons in conferences and workshops. **Practical Activity** Enlist the available resources in auto workshop	Theory-1Hrs Practical-3Hrs Total- 4Hrs	Stationary, standard Performa's/charts	Class Room and workshop
LU3. Maintain professional growth and development	**Trainee must be able to** • Identify the trainings and career opportunities and avail on the bases of job requirements. • Recognitions are sought/received and demonstrated as proof of career advancement	Describe the following: • Recommendations, Citations, Certificate of Appreciations, Commendations, Awards, Tangible and Intangible Rewards. • **Licenses and/or**	Theory-1Hrs Practical-3Hrs Total- 4Hrs	Stationary, standard Perform as /charts vehicle	Class Room and workshop

	• Obtained and renewed the licenses and/or certifications relevant to job and career.	**certifications:** National Certificates, Certificate of Competency, Support Level Licenses, Professional Licenses **Practical Activity** Prepare a certificate of a given vehicle as per auto work shop standards.			

0716MS&A22. Practice Occupational Health and Safety Procedures

Objective: This module is designed to enable the learner to the outcomes required to comply with regulatory and organizational requirements for occupational health and safety under the specified procedure in the manual.

Duration: 10 Hours **Theory:04 Hours** **Practice: 06 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Identify hazards and risks	**Trainee will be able to:** • Identify the safety regulations and workplace safety and hazard control practices and procedures are clarified and explained based on organization procedures • Identify the hazards/risks in the workplace and their corresponding indicators to minimize or eliminate risk to co-workers, workplace and environment in accordance with organization procedures.	Describe the following: **Safety regulations:** May include but are not limited to: Clean Air Act, Building code, National Electrical and Fire Safety Codes, Waste management statutes and rules, Philippine Occupational Safety and Health Standards, DOLE regulations on safety legal requirements, ECC regulations. **Practical Activity** • Prepare a report to identify hazards in auto work shop	Theory-1.5Hrs Practical-1.5Hrs Total- 03Hrs		Class Room and workshop

	• Contingency measures during workplace accidents, fire and other emergencies are recognized and established in accordance with organization procedures				
LU2. Evaluate hazards and risks	**Trainee must be able to** • Identify the terms of maximum tolerable limits which when exceeded will result in harm or damage are identified based on threshold limit values (TLV) • Identify the effects of the hazards. • Identify the OHS issues and/or concerns and safety hazards are reported to designated personnel in accordance with workplace requirements and relevant workplace OHS	**Describe the following:** **Hazards/Risks:** May include but are not limited to: Physical hazards – impact, illumination, pressure, noise, vibration, temperature, radiation, Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects, Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors Ergonomics, Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles Physiological	Theory-1.5Hrs Practical-1.5Hrs Total- 03Hrs	stationary	Class Room and workshop

	legislation.	factors – monotony, personal, relationship, work out cycle. **Practical Activity** Identify the OHS issues and/or concerns and safety hazards in auto work shop			
LU3. Control hazards and risks	**Trainee must be able to** • Identify the occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace are consistently followed • Procedures for dealing with workplace accidents, fire and emergencies are followed in accordance with organization OHS policies • Use of Personal protective equipment (PPE) in accordance with organization OHS procedures and	**Describe the following:** **Contingency measures:** May include but are not limited to: Evacuation, Isolation, Decontamination, (Calling designed) emergency personnel. **PPE:** May include but are not limited to: Mask, Gloves, Goggles, Hair Net/cap/bonnet, Face mask/shield, Ear muffs, Apron/Gown/coverall/jump suit, Anti-static suits. **Practical Activity** •Enlist the PPEs used in auto	Theory-0.5Hrs Practical-1.5Hrs Total- 02Hrs	PPEs stationary	Class Room and workshop

	practices. • Provide the appropriate assistance in the event of a workplace emergency in accordance with established organization protocol.	workshop			
LU4. Maintain OHS awareness	**Trainee must be able to** • Practice the emergency-related drills and trainings as per established organization guidelines and procedures. • Update and complete the OHS personal records in accordance with workplace requirements.	**Describe the following:** **Emergency-related drills and training:** Fire drill, Earthquake drill, Basic life support/CPR, First aid, Spillage control, Decontamination of chemical and toxic, Disaster, preparedness/management. **OHS personal records:** Medical/Health records, Incident reports, Accident reports, OHS-related training completed. **Practical Activity** Perform a Fire extinguisher drill on liquid type of fire	Theory-0.5Hrs Practical-1.5Hrs Total- 02Hrs	Fire extinguisher Liquids (used oil, Diesel etc.	Class Room and workshop

12. Members of Curriculum Development Committee

The following members participated in the qualification's development workshop 22 January 2020 to 26 January 2020 at Four Point by Sheraton, Lahore.

S.No.	Name	Designation	Organization
1.	Ijaz Hamid,	Chief Instructor / DACUM Facilitator	GCT, Railway Road, Lahore PTEVTA
2.	Shakeel Ahmad	Jr. Instructor	GCT, Faisalabad, PTEVTA
3.	Abdul Ateeq,	CEO	Rehman Motors Workshop, Model Town, Lahore
4.	Abdul Waheed,	CEO	Honda Pitspot, Johar Town Motors, Lahore
5.	Aamir Rehman,	Sr. Technician (Body Parts)	Honda Center, Rawalpindi.
6.	Muhammad Arslan,	Cluster Manager	PSIC, Lahore
7.	Saba Sadiq,	Lecturer	UOL, Islamabad
8.	Umer Farooq,	Instructor	GSPTC, Gujrat, PTEVTA
9.	Shahbaz Ali,	Instructor	GSPTC, Gujrat, PTEVTA
10.	Muhammad Rizwan,	Instructor	GTTI, Sheikhupura, PTEVTA
11.	Muhammad Sohaib,	Assistant Manager (Tech)	Lucky Cement, Karachi
12.	Arslan Khan	Lecturer	UOL, Islamabad
13.	Muhammad Ishaq,	Deputy Director (Coordinator/ Quality Assurance)	NAVTTC, HQ, Islamabad