



COMPETENCY BASED CURRICULUM

AUTOMOTIVE TECHNOLOGY

BQF CERTIFICATE III



Technical Trainers Training and Resources Centre
Department of Workforce Planning and Skills Development
Ministry of Education and Skills Development

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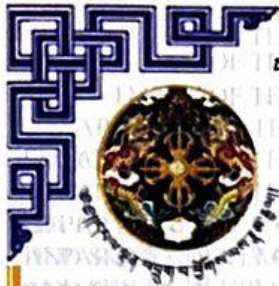
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Royal Government of Bhutan
Ministry of Education and Skills Development
Department of Workforce Planning and Skills
Development



Certificate No: DWPSD/CEC-AMT/2025-26/013

Curriculum Endorsement Certificate

This is to certify that the curriculum for the following course(s) developed by

Technical Trainers Training and Resource Center

has been endorsed by the department.

Course	Level
Automotive Technology	BQF Certificate 3

Date of Endorsement: 13/01/2026



This certificate is valid till 12/01/2031 from the date of endorsement

Director General
Department of Workforce Planning and Skills Development

FOREWORD

Bhutan has seen a gradual increase in the requirement of skilled workers in recent years due to growth of industries. However, supply of skilled workforce that are responsive to the needs of the industry has not been able to keep in pace with the industry demand. Since the skilled workers are crucial ingredient for socio-economic development of the country, it is important to have adequate number of trained and certified workers. With growing industries, the “Automotive Technician” is not only the most significant occupation but also have high demand in the labor market. In an effort to meet the skilled human resources requirement in the area of agriculture sector, it is imperative to deliver training based on Competency Based Training system in Automotive Technology BQF Certificate-III to ensure quality and adequate number of work force in this sector.

To this end, the Department of Workforce Planning and Skills Development (DWPSD) is pleased to present Competency Based Curriculum for Automotive Technology BQF Certificate-III course developed based on national competency standard. Since it is an outcome of a more participatory process of curriculum development, it is expected to provide training delivery with reformed approaches having its content being directly related to labor market needs, focusing on imparting of skills and assessment based on industry work standards. We believe that the Competency Based Curriculum will help in bridging the skill gap between industry’s needs and training institutes thereby enhancing the employability of the technical graduates.

The Department acknowledges the valuable contributions made by institutes, officials, and experts from relevant industries who were involved in the design and development of this curriculum. As it is a dynamic document which may require revision based on the needs of the changing labor market, the Department look forward to receiving valuable feedbacks from the institutes and the industries to further improve and refine the curriculum. The Department hope that this document will help advance Competency Based Learning in most of the TVET Institutions.



(Phub Rinzin)
Director General

Department of Workforce Planning and Skills Development

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The Technical Trainers Training and Resources Centre, Department of Workforce Planning and Skills Development would like to express our appreciation and with particular thanks to the following subject experts and facilitators who have participated in the revision and validation of Automotive Technology BQF Certificate-III curriculum.

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Competency Profile
Trade: Automotive Technology BQF Certificate 3

Competency Area	Sub- Competency Area	Competencies/Tasks 			
A. Perform engine tune-up	A1 Carry out Spark Ignition (SI) engine tune-up	A1.01 Test high tension cable	A1.02 Service Contact Breaker (CB) point	A1.03 Test ignition coil	A1.04 Service spark plug
		A1.05 Set spark ignition timing	A1.06 Set electronic ignition timing	A1.07 Replace timing belt	
	A2 Service air intake and exhaust system	A2.01 Service air filter	A2.02 Service throttle body	A2.03 Adjust idle speed	A2.04 Service turbocharger
		A2.05 Replace catalytic convertor	A2.06 Replace silencer	A2.07 Service EGR	
	A3 Carry out diesel engine/Compression Ignition (CI) tune-up	A3.01 Adjust tappet clearance	A3.02 Replace high pressure pump	A3.03 Service Common Rail Injection system	
B. Overhaul engine	B1 Overhaul cylinder head	B1.01 Replace timing chain	B1.02 Service rocker arm assembly	B1.03 Service camshaft	B1.04 Service VVT oil control valve
		B1.05 Remove cylinder head assembly	B1.06 Inspect cylinder head for warpage	B1.07 Service engine valve	B1.08 Perform valve lapping
		B1.09 Replace glow plug	B1.10 Change pre-combustion chamber	B1.11 Install cylinder head assembly	

Competency Area	Sub- Competency Area	Competencies/Tasks			
					
	B2 Overhaul engine block	B2.01 Dismount engine	B2.02 Inspect engine block	B2.03 Service connecting rod	B2.04 Inspect cylinder bore
		B2.05 Service piston	B2.06 Service crank shaft	B2.07 Service oil pump	B2.08 Service engine oil cooler
		B2.08 Install timing gear	B2.10 Mount engine		
	B3 Troubleshoot engine problem	B3.01 Conduct visual inspection	B3.02 Check engine abnormal sound	B3.03 Diagnose engine overheating	B3.04 Check engine oil pressure
		B3.05 Check engine compression	B3.06 Check fuel pressure	B3.07 Perform on-board diagnosis	

COURSE INFORMATION

COURSE TITLE	Automotive Technology
LEVEL	BQF Certificate 3
COURSE OBJECTIVE	Upon completion of Automotive Technology BQF Certificate 3, the trainee will be able to: • Perform engine tune-up • Overhaul engine
COURSE DESCRIPTION	This course is designed to provide learners with the knowledge, skills and attitude required of an individual to become competent Automotive Technician. This course will prepare the trainees to exhibit professionalism, teamwork, adaptability and safety practices as per the requirement of workplace. To obtain the qualification of Automotive Technology BQF C 3, all learning outcomes prescribed for this qualification must be achieved.
TOTAL DURATION	1072 Hours
TRAINING PROPORTION	1:12 (Practical) 1:20 (Theory)
ENTRY REQUIREMENT	Completed Automotive Technology BQF Certificate 2
TRAINER QUALIFICATION	• Must have undergone Training of Trainers-Technical Instruction and Andragogy • Must have a minimum qualification of diploma in Automobile Mechanic/Mechanical Engineering or with National Certificate 3 in Automotive Technician with Five years of relevant working experience • Should have good moral character • Must¹ have at least 5 years job/industry experience

¹ Applicable only if institutes hire instructor or guest lecturer from industry

COURSE OUTLINE

Sl. No	Subject /Module	Duration (Hours)	Content Competencies (Mapped)
1.	Core modules	388	CC
2.	OJT	420	CC
3.	Applied Dzongkha	42	SS
4.	ICT	48	SS
5.	Applied Mathematics	53	SS
6.	Technical English	51	SS
7.	Assessment for NC 3	70	
	Total Course Duration	1072	

Note: (*) This curriculum contains core modules which cover main competencies of Automotive Technology BQF Certificate 3 and OJT component. There are separate curricula for subjects/modules for delivery of soft skills, professional development & values and environmental concern & safety. In order to achieve the qualification of Automotive Technology BQF Certificate 3, the subjects and modules listed must be accomplished as per the credit hours provided.

Content Competencies:

CC-Core Competencies

SS-Soft Skills

PD-Professional Development and Values

ES-Environmental concern and Safety

COURSE STRUCTURE FOR CORE COMPETENCIES

Training Modality	Module Title	Learning outcomes	Nominal Duration
1. Institute Training	A. Performing engine tune-up	A1. Carry out Spark Ignition (SI) engine tune-up A2. Service air intake and exhaust system A3. Carry out diesel engine/Compression Ignition (CI) tune-up	131 Hours
	B. Overhauling engine	B1. Overhaul cylinder head B2. Overhaul engine block B3. Troubleshoot engine problem	257 Hours
2. On the Job Training	A. Performing engine tune-up	A1. Carry out Spark Ignition (SI) engine tune-up A2. Service air intake and exhaust system A3. Carry out diesel engine/Compression Ignition (CI) tune-up	420 hours (3 months)
	B. Overhauling engine	B1. Overhaul cylinder head B2. Overhaul engine block B3. Troubleshoot engine problem	
Total CC Duration:			808 hours

ASSESSMENT

Formative assessment for every module and learning outcome will be conducted through assignments, project works, continuous assessment, demonstration of practical skills/observations, oral questioning and written test.

Summative assessment after completion of each national certificate level will be conducted by TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD as per the National Competency Standards and Guidelines for National Assessment and Certification System, provided the course is accredited with TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD.

CERTIFICATION

On successful completion of every module, the institute will award a certificate of achievement to the trainees. The TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD will award a National Certificate to the trainees upon the successful completion of NC level assessment.

COURSE DELIVERY

1. Modular
2. Demonstration
3. Lecture
4. Discussion
5. Industrial visit/attachment
6. Project based learning
7. Problem based learning

RESOURCES**Materials**

- High tension cable set, CB point, water paper, ignition coil, ballast resistor, spark plugs, distributor assembly, battery, rotor, air filter element, throttle body, cleaning solvent, lock nut, rocker arm gasket, adjusting screws & nuts, catalytic converter, mounting nuts & bolts, silencer assembly, turbocharger, anti-rust spray, gaskets, HP pump, HP pipes, fuel filter, fuel injector, diesel, banjo washer, wires, crocodile clips, markin cloth, tappet cover gasket, shim, timing belt, timing idler, timing chain, timing sprockets, tensioner spring, engine coolant, chain vibration damper, chain tensioner slipper, chain guide, cylinder head, petrol, kerosene, engine oil, rocker arm screws & nuts, rocker arm mounting bolts & brackets, rocker arm shaft, push rod, camshaft bearing, camshaft oil seal, camshaft, valve, valve spring, valve keepers, spring retainers, engine head, grinding paste/abrasive compound, wooden block, mechanical valve lifter, valve seat, valve guide, water, glow plug, jumper wire, seal packing, head gasket, sealant, U-bolt clamp, steel rope, dry penetrant, soft brush, connecting rod, connecting bearing, connecting bush, oil jet/nozzle, bore measurement chart, piston assembly, piston ring set, cylinder liner, thrust washer, crankshaft, crankshaft bearing, crankshaft bearing cap, crankshaft oil seal, oil pump, oil pump gasket, relieve valve, liner O-ring, engine oil cooler, engine oil filter, oil strainer, oil strainer gasket, oil sump gasket, oil sump, timing gear, service bolt, engine mounting, grinding stone, thread-locking compound, fuel, oil pressure switch, oil pressure sensor, solenoid and hose clamps

Tools

- Screwdriver set, spanner set, jumper probe, spark plug socket, torque wrench, socket set, SST/Allen key set, tray, filter wrench/clamp, valve shim remover (SST), flare nut spanner, fuel injector puller, flat screwdriver, timing gear puller, flange holding (SST), puller (SST), oil can, V-block, valve spring compressor (SST), magnetic stick, carbon brush, try square, hammer, sliding hammer, valve lapping tool, pot, brass bar, test lamp, soft brush, gasket scraper, plastic hammer, plier, snap ring plier, pry bar, flat screw driver, scraper, feeler gauge, chisel, oil seal puller (SST), variable pin wrench (SST) and lever

Equipment

- Test lamp, timing light, air compressor, air filter cleaning machine, scan tool, lift, CRDI diesel engine, engine head assembly, surface plate, CI/SI Engine, heat gun, engine hoist, hydraulic crane, connecting rod aligner, impact wrench, engine stand, engine block, work bench, piston ring expander, piston ring compressor, gudgeon pin remover, chain hoist, oil pressure gauge, training vehicle, automotive sound scope, diesel/petrol engine and compression gauge set

Instrument

- Feeler gauge, spark plug gauge, multimeter, micrometer, plastigauge, vernier calliper, spring tension tester, straight edge, dial gauge, steel ruler, tachometer, cylinder bore gauge, straight edge and fuel pressure gauge

PPE

- Workshop dress, safety boots, hand gloves, face mask, safety goggles, safety helmet and fender cover

Learning materials

- Reference books
- Hand-outs
- Audio visuals
- Competency Based Learning materials (CBLM)

Infrastructure and Training facilities

- **Theory classroom size:** Minimum of 1.5 square meter per person
- **Practical workshop size:** Minimum of 3 square meter per student. Variables must be considered depending upon type of skill being taught and the number of students being participated at one time

MODULE INFORMATION
AUTOMOTIVE TECHNOLOGY BQF C III

**MODULE 1
ON
PERFORMING ENGINE TUNE-UP**

MODULE INFORMATION

Occupation	Automotive Technician
Competency Area	Perform engine tune-up
Module Title	Performing engine tune-up
Module Code	7231-L3-M1
Module Description	This module is structure to provide learners with the knowledge, skills and right attitude required to carry out Spark Ignition (SI) engine tune-up, service air intake & exhaust system and carry out diesel engine/Compression Ignition (CI) tune-up
Nominal Duration	131 Hours
Certificate Level	Certificate 3
Pre-requisite	Completed Automotive Technology BQF Certificate II
Learning Outcomes	1. Carry out Spark Ignition (SI) engine tune-up 2. Service air intake and exhaust system 3. Carry out diesel engine/Compression Ignition (CI) tune-up

CBC Automotive Technology BQF III

Module Title	Performing engine tune-up		
Module Code	7231- L3- M1		
Learning Outcome 1	Carry out Spark Ignition (SI) engine tune-up		
Duration	Theory: 08 hours	Practical: 47 hours	Total: 57 hours
Assessment Criteria	• High tension cable is tested as per the job requirement following standard procedure • Contact breaker point is serviced as per the job requirement following standard procedure • Ignition coil is tested as per the job requirement following standard procedure • Spark plugs are serviced as per the job requirement following standard procedure • Spark ignition timing is set as per the job requirement following standard procedure • Electronic ignition timing is set as per the job requirement following standard procedure • Timing belt is replaced as per the job requirement following standard procedure		
Contents	A1.00 Introductory Knowledge • History of engine • Definition of engine • Classification of engine • Definition of engine tune-up A1.01 Testing high tension cable Knowledge • Definition of ignition system • Construction and working principle of spark ignition system • Types of ignition system • Function of high-tension cable Skills • Using multimeter • Using ignition spark tester • Using scan tools • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS Rules and Regulations • Ensuring to communicate prior to cranking the engine A1.02 Servicing Contact Breaker (CB) point		

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	Knowledge • Definition of distributor • Function of distributor • Types of distributor • Operation of distributor • Definition of Contact Breaker (CB) point • Function of Contact Breaker point • Operation of Contact Breaker point • Importance of maintaining CB point gap • Causes, effects and remedy of defective contact breaker point Skills • Using feeler gauge • Using multimeter • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to adjust CB point gap as per the specification A1.03 Testing ignition coil Knowledge • Definition of ignition coil • Function of ignition coil • Types of ignition coil • Construction of ignition coil • Operation of ignition coil • Functions of ballast resistor Skills • Using multimeter • Using ignition coil tester • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS Rules and Regulations • Ensuring to connect ignition coil terminals securely
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	A1.04 Servicing spark plugs Knowledge • Definition of spark plugs • Function of spark plugs • Construction of spark plugs • Type of spark plugs • Servicing interval of spark plugs • Purpose of maintaining spark plug gap • Purpose of inspecting spark plug • Specification of spark plug Skills • Using spark plug gauge • Using feeler gauge • Using torque wrench • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to tighten spark plugs to specified torque A1.05 Setting spark ignition timing Knowledge • Types of ignition timing • Purpose of setting spark ignition timing Skills • Using timing light • Using test lamp • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations A1.06 Setting electronic ignition timing Knowledge • Definition of electronic ignition system
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	• Types of electronic ignition system and their operation • Working principle of signal generator • Effects of advance and retard timing Skills • Using scan tools • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to clear tools or objects nearby moving engine parts prior to starting engine A1.07 Replacing timing belt Knowledge • Definition of timing belt • Functions of timing belt • Construction of timing belt • Causes and effects of defective timing belt • Interval of changing timing belt Skills • Using timing gear puller (SST) • Using flange holding (SST) • Using timing belt tension gauge • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to align timing marks accurately • Ensuring to erase timing belt warning signal
Learning Conditions	Learning materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books

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	• Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • High tension cable set, CB point, timing belt, Markin cloth, water paper, ignition coil, ballast resistor, spark plugs, conventional distributor assembly, electronic distributor assembly, battery, coil on plug and distributor rotor Tools • Screwdriver set, combination spanner set, jumper probe, scan tools, spark plug socket, torque wrench and socket set Equipment • Petrol engine with conventional ignition system and electronic fuel injection system Instrument • Feeler gauge, timing belt tension gauge, ignition spark tester, timing light, test lamp, spark plug gauge and multimeter PPE • Workshop dress, safety boots, hand gloves, face mask, safety goggles, safety helmet and fender cover
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

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Module Title	Performing engine tune-up		
Module Code	7231- L3- M1		
Learning Outcome 2	Service air intake and exhaust system		
Duration	Theory: 11 hours	Practical: 33 hours	Total: 44 hours
Assessment Criteria	• Air filter is serviced as per the job requirement following standard procedure • Throttle body is serviced as per the job requirement following standard procedure • Idle speed is adjusted as per the job requirement following standard procedure • Turbocharger is serviced as per the job requirement following standard procedure • Catalytic converter is serviced as per the job requirement following standard procedure • Silencer is serviced as per the job requirement following standard procedure		
Contents	A2.01 Servicing air filter Knowledge • Definition of air induction system • Construction and operation of air induction system • Function of intake system sensors • Definition of air filter • Function of air filter • Types of air filter • Purpose of intake and exhaust manifold • Changing interval of air filter Skills • Using air compressor • Sensor removal skills • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations A2.02 Servicing throttle body Knowledge • Definition of throttle body • Function of throttle body • Function of throttle position sensors • Types of throttle body • Construction of throttle body • Operation of throttle body		

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- Causes, effects and remedies of dust and carbon deposits on throttle body
- Function of accelerator pedal position sensor (APP)
- Causes and effects of defective APP

Skills

- Using air compressor
- Using scan tools
- Communication skills
- Analytical skills
- Observation skills

Attitude, safety and environmental concern

- Being time conscious
- Being a team player
- Having work ethics and integrity
- Proper handling of tools and materials
- Ensuring appropriate use of PPE
- Ensuring proper disposal of waste
- Ensuring to follow OHS rules and regulations
- Ensuring to be cautious while handling throttle body
- Ensuring to assemble Idle Air Control (IAC) valve and gasket properly

A2.03 Adjusting idle speed

Knowledge

- Definition of idle speed
- Purpose of adjusting engine idle speed
- RPM range for idle speed
- Definition of Idle Air Control (IAC) Valve
- Function of IAC Valve
- Construction and operation of IAC Valve
- Causes and effects of defective IAC valve

Skills

- Using tachometer
- Using scan tool
- Communication skills
- Analytical skills
- Observations skills

Attitude, safety and environmental concern

- Being time conscious
- Being a team player
- Having work ethics and integrity
- Proper handling of tools and materials
- Ensuring appropriate use of PPE
- Ensuring proper disposal of waste
- Ensuring to follow OHS rules and regulations
- Ensuring to adjust idle speed as per the specification

A2.04 Servicing turbocharger

Knowledge

- Definition of turbocharger
- Function of turbocharger

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- Types of turbochargers
- Construction and operation of turbocharger
- Causes and effects of defective turbocharger
- Purpose of replacing engine oil and air filter while replacing turbocharger

Skills

- Using scan tools
- Communication skills
- Analytical skills
- Observation skills

Attitude, safety and environment concern

- Being time conscious
- Being a team player
- Having work ethics and integrity
- Proper handling of tools and materials
- Ensuring appropriate use of PPE
- Ensuring proper disposal of waste
- Ensuring to follow OHS Rules and Regulations
- Ensuring to apply engine oil to oil inlet of turbocharger prior to installation

A2.05 Replacing catalytic convertor

Knowledge

- Introduction to air pollution control
- Definition of catalytic converter
- Function of catalytic converter
- Types of catalytic converter
- Construction of catalytic converter
- Operation of catalytic converter
- Causes and effects of defective catalytic convertor
- Function of oxygen sensor
- Purpose of exhaust after treatment system (EATS)
- Components of exhaust after treatment system (EATS)
- Operation of exhaust after treatment system (EATS)
- Types of regeneration system

Skills

- Using two/four post car lift
- Using exhaust gas analyzer
- Using scan tools
- Communication skills
- Analytical skills
- Observation skills

Attitude, safety and environmental concern

- Being time conscious
- Being a team player
- Having work ethics and integrity
- Proper handling of tools and materials
- Ensuring appropriate use of PPE
- Ensuring proper disposal of waste
- Ensuring to follow OHS rules and regulations

	A2.06 Replacing silencer Knowledge • Definition of silencer pipe • Function of silencer pipe • Function of muffler • Construction of muffler • Types of muffler box • Purpose of resonator • Noise reduction process (muffler) • Causes, effects and remedies of defective muffler box Skills • Communication skills • Analytical skills • Observations skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to remove oxygen sensor using SST A2.07 Servicing Exhaust Gas Recirculation Knowledge • Definition of EGR • Function of EGR • Operation of EGR • Construction of EGR • Types of EGR • Causes and effects of defective EGR Skills • Using scan tools • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations A2.08 Replacing EGR cooler Knowledge • Definition of EGR cooler
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	• Function of EGR cooler • Operation of EGR cooler • Construction of EGR cooler • Types of EGR cooler • Causes and effects of defective EGR cooler Skills • Using scan tools • Communication skills • Analytical skills • Observations skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Air filter element, throttle body, Markin cloth, cleaning solvent, lock nut, adjusting screws & nuts, gasket, resonator, catalytic converter, oxygen sensor, mounting nuts & bolts, silencer assembly, turbocharger, APP sensor, anti-rust spray, EGR, EGR valve, EGR gasket, EGR cooler, EGR hoses, EGR cooler gasket, coolant and sealant Tools • Combination spanner set, screwdriver set, socket set, scan tools, SST/Allen key set, tray, wire brush and ring spanner set Equipment • Air compressor, diesel engine, petrol engine, tachometer and two/four post car lift Instrument

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	• Multimeter PPE • Workshop dress, safety boots, hand gloves, face mask, safety goggles, safety helmet and fender cover
Instructional Methodologies	The trainer shall use <i>inter alia</i> , the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i> , the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

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Module Title	Performing engine tune-up		
Module Code	7231- L3- M1		
Learning Outcome 3	Carry out diesel engine/Compression Ignition (CI) tune-up		
Duration	Theory: 3 hours	Practical: 27 hours	Total: 30 hours
Assessment Criteria	• Tappet clearance is adjusted as per the manufacturer's specification following standard procedure • High pressure pump is replaced as per the job requirement following standard procedure • Common Rail Direct Injection (CRDI) injector is serviced as per the job requirement following standard procedure		
Content	A3.01 Adjusting tappet clearance Knowledge • Definition of valve clearance • Purpose of adjusting valve clearance • Causes and effects of incorrect valve clearance • Types of valve adjustment • Purpose of setting different valve clearance for intake and exhaust valve Skills • Using feeler gauge • Using micrometer • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations A3.02 Replacing High-Pressure (HP) pump Knowledge • Introduction to common rail system • Definition of common rail injection system • Definition of HP pump • Function of HP pump • Construction and operation of HP pump • Causes and effects of defective HP pump Skills • Using scan tools • Communication skills • Analytical skills • Observation skills		

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	<i>Attitude, safety and environment concern</i> • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to align HP pump, pipes and flare nut properly while installing A3.03 Servicing Common Rail Injection system <i>Knowledge</i> • Function of fuel injector • Types of fuel injector • Construction and operation of fuel injector • 3 phases of injection <i>Skills</i> • Using multimeter • Using scan tool • Communication skills • Analytical skills • Observation skills <i>Attitude, safety and environment concern</i> • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to remove HP pipe and injector safely • Ensuring to neutralise pressure before the removal of injector
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pump gaskets, marking pen, nuts & bolts, HP pump, HP pipes, fuel filter, fuel injector, diesel, banjo bolt & washer, wires, injector O-ring, injector

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	overflow pipe, injector pipe, cello tape, plastic, crocodile clips, battery, Markin cloth, tappet cover gasket, sealant, shim and cleaning solvent Tools • Socket set, tray, sprocket tool, combination spanner set, mini socket set, torque wrench, filter wrench/clamp, valve spring compressor, allen key set, Phillips/flat screwdriver set, pliers, scan tool, valve shim remover (SST), flare nut spanner and fuel injector puller Equipment • Diesel engine, single point and multi point fuel injection diesel engine, bench vice, injector tester and two/four post car lift Instruments • Multimeter and feeler gauge PPE • Workshop dress, safety boots, hand gloves, face mask, safety goggles, protective seat cover and fender cover
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

MODULE 2
ON
OVERHAULING ENGINE

MODULE INFORMATION

Occupation	Automotive Technician
Competency Area	Overhaul engine
Module Title	Overhauling engine
Module Code	7231- L3- M2
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to overhaul cylinder head & engine block and troubleshoot engine problem.
Nominal Duration	257 Hours
Certificate Level	Certificate 3
Pre-requisite	Completed 7231- L3- M1
Learning Outcome	1. Overhaul cylinder head 2. Overhaul engine block 3. Troubleshoot engine problem

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Module Title	Overhauling engine		
Module Code	7231- L3- M2		
Learning Outcome 1	Overhaul cylinder head		
Duration	Theory: 12 hours	Practical: 79 hours	Total: 91hours
Assessment Criteria	- Timing chain is replaced as per the job requirement following standard procedure - Cylinder head assembly is removed as per the job requirement following standard procedure - Rocker arm assembly is serviced as per the job requirement following standard procedure - Camshaft is serviced as per the s job requirement following standard procedure - Engine valves are serviced as per the job requirement following standard procedure - Valve lapping is performed as per the job requirement following standard procedure - Glow plug is replaced as per the job requirement following standard procedure - Cylinder head is inspected as per the job requirement following standard procedure - Pre-combustion chamber is serviced as per the job requirement following standard procedure - Cylinder head assembly is installed as per the job requirement following standard procedure		
Content	B1.01 Replacing timing chain Knowledge - Definition of timing chain - Functions of timing chain - Types of timing chain - Operation of timing chain mechanism - Changing interval of timing chain Skills - Using scan tools - Communication skills - Analytical skills - Observation skills Attitude, safety and environmental concern - Being time conscious - Being a team player - Having work ethics and integrity - Proper handling of tools and materials - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulations - Ensuring to align timing marks accurately B1.02 Servicing rocker arm assembly Knowledge - Definition of rocker arm		

	• Types of rocker arm • Functions of rocker arm • Construction of rocker arm assembly • Causes and effects of damaged rocker arm shaft Skills • Valve adjustment skills • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to apply specific torque while tightening rocker arm bolts B1.03 Servicing camshaft Knowledge • Definition of camshaft • Types of camshafts • Functions of camshaft • Functions of camshaft bearing and oil seal • Purpose of oil clearance • Construction and operation of camshaft and bearing • Configuration of camshaft mechanism • Causes and effects of damaged camshaft and camshaft bearing Skills • Using camshaft oil seal puller SST • Using torque wrench • Using Plastigauge • Using dial gauge • Using micrometer • Using V-block • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to install bearing cap in correct position and in sequence • Ensuring proper alignment of key grooves and key • Ensuring to install correct sized bearing and proper alignment of camshaft
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	• Ensuring to maintain appropriate oil clearance • Ensuring to apply torque B1.04 Servicing VVT oil control valve Knowledge • Introduction to Variable Valve Timing (VVT), Variable Timing Valve Train (VTVT) and Variable Valve Timing-intelligence (VVT-i) • Operation of VVT mechanism • Operation of VVT-i mechanism • Advantages of VVT • Function of oil control valve • Types of oil control valve • Operation of oil control valve • Causes and effects of clogged oil control valve Skills • Using multimeter • Using scan tools • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations B1.05 Removing cylinder head assembly Knowledge • Definition of cylinder head • Functions of cylinder head • Construction of cylinder head • Types of cylinder head • Loosening and tightening sequence of cylinder head • Causes and effects of damaged cylinder head Skills • Using camshaft and crankshaft locking tools (SST) • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations B1.06 Inspecting cylinder head
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	Knowledge • Definition of warpage • Purpose of checking warpage • Composition of cylinder head • Causes and effects of cylinder head warpage Skills • Using feeler gauge • Using straight edge • Using scrapper • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Having patience • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of tools while removing gasket deposits from cylinder head surface B1.07 Servicing engine valve Knowledge • Definition of valve • Functions of valve • Construction of valve • Types of valves • Valve timing diagram • Operation of valve mechanism • Causes and effects of damaged valve • Functions of push rod • Causes and effects of damaged push rod • Function of valve spring • Definition of free length, deviation and tension of spring • Construction of valve spring • Function of valve lifter • Construction and operation of hydraulic valve lifter • Construction and operation of mechanical valve lifter • Advantage of hydraulic valve lifter • Function of valve seat • Types of valve seat • Purpose of changing valve seat • Causes and effects of defective valve seat • Functions of valve guide • Purpose of maintaining close clearance between valve stem and guide bore • Causes and effects of defective valve guide • Function of valve oil seal Skills
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	• Using valve spring compressor (SST) • Using spring tension tester • Using Vernier calliper • Using try square • Valve guide removal skills • Valve oil seal removal and installing skills • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to align rocker arm and push rod correctly while installing B1.08 Performing valve lapping Knowledge • Definition of valve lapping • Purpose of valve lapping • Definition of grinding paste • Purpose of fine and coarse grinding paste • Effects of improper valve seating • Importance of maintaining interference angle between valve and valve seat Skills • Using lapping tool • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having patience • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to check valve seat and face frequently while lapping B1.09 Replacing glow plug Knowledge • Definition of pre-heating system • Purpose of pre-heating system • Circuit diagram of pre-heating system • Definition of glow plug • Function of glow plug
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	• Types of glow plug • Construction and operation of glow plug • Purpose of glow plug relay • Methods of testing glow plug • Causes and effects of faulty glow plug Skills • Using multimeter • Using glow plug wrench • Using test lamp • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being vigilant • Having work ethics and integrity • Proper handling of tools and materials • Having patience while replacing glow plug • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensuring to apply rust spray before removing glow plug B1.10 Changing pre-combustion chamber Knowledge • Definition of combustion chamber • Definition of pre-combustion chamber • Function of pre-combustion chamber • Types of pre-combustion chamber • Purpose of servicing pre-combustion chamber • Causes and effects of defective pre-combustion chamber Skills • Using insertion tool • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Having patience • Having work ethics and integrity • Proper handling of tools and materials • Being vigilant • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation B1.11 Installing cylinder head assembly Knowledge • Definition of cylinder head gasket • Function of cylinder head gasket • Types of head gasket
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	• Construction of head gasket • Causes and effects of gasket failure Skills • Using torque wrench • Using gasket scrapper • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being vigilant • Having patient • Having work ethics and integrity • Proper handling of tools and materials • Being time conscious • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensuring to install head gasket in correct position • Ensuring to apply specific torque to cylinder head bolts in sequence
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Timing belt, timing idler, timing chain, timing sprockets, tensioner spring, engine coolant, chain vibration damper, chain tensioner slipper, chain guide, cylinder head, Markin cloth, petrol, kerosene, engine oil, rocker arm screws & nuts, rocker arm mounting bolts & brackets, rocker arm shaft, push rod, cleaning solvent, camshaft bearing, camshaft oil seal, camshaft, valve, valve spring, valve keepers, spring retainers, water paper, grinding paste/abrasive compound, wooden block, mechanical valve lifter, hydraulic valve lifter, shims, valve seat, valve guide, water, glow plug, battery, dry penetrant, seal packing, head gasket, CI/SI engine, engine head assembly, gasket, sealant, VVT oil control valve, O-ring, pre combustion chamber and wire Tools • Combination spanner set, socket set, Phillips/flat screwdriver set, timing gear puller, flange holding (SST), puller (SST), star/Allen key set, oil can, V-block, valve spring compressor (SST), magnetic stick, carbon brush, try square, hammer, sliding hammer, camshaft and crankshaft locking tools, valve lapping tool, insertion tool, jumper wire, brass bar, test lamp,

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	pliers, scrapper, tray, soft brush, tensioner locking tool, drive belt remover and installer (SST), scan tool and gasket scraper Equipment • Engine, two/four post car lift, air compressor, surface plate, work bench vice and heat gun Instrument • Micrometer, torque wrench, feeler gauge, Plastigauge, vernier calliper, spring tension tester, multimeter, straight edge and magnetic dial gauge PPE • Workshop dress, safety boots, hand gloves, face mask, safety goggles, protective seat cover and fender cover
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

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Module Title	Overhauling engine		
Module Code	7231- L3- M2		
Learning Outcome 2	Overhaul engine block		
Duration	Theory: 14 hours	Practical: 80 hours	Total: 94 hours
Assessment Criteria	- Engine is dismantled as per the job requirement following standard procedure - Engine block is inspected as per the job requirement following standard procedure - Connecting rod is serviced as per the job requirement following standard procedure - Cylinder bore is inspected as per the job requirement following standard procedure - Piston is serviced as per the job requirement following standard procedure - Crankshaft is serviced as per the s job requirement following standard procedure - Engine oil cooler is serviced as per the job requirement following standard procedure - Timing gear is installed as per the job requirement following standard procedure - Engine is mounted as per the job requirement following standard procedure - Test run of engine is performed as per the job requirement following standard procedure		
Content	B2.01 Dismounting engine Knowledge - Introduction to Otto cycle and Diesel cycle - Working principle of SI engine - Working principle of CI engine Skills - Using engine hoist/hydraulic crane - Communication skills - Analytical skills - Observation skills Attitude, safety and environmental concern - Being time conscious - Being a team player - Having work ethics and integrity - Proper handling of tools and materials - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulations - Ensuring to anchor in correct position B2.02 Inspecting engine block Knowledge - Function of engine block - Types of engine block - Construction of engine block - Purpose of checking warp and cracks		

	• Causes and effects of damaged engine block Skills • Using feeler gauge • Using scraper • Using straight edge • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations B2.03 Servicing connecting rod Knowledge • Definition of connecting rod • Function of connecting rod • Construction of connecting rod • Causes and effects of worn out and bent connecting rod • Function of connecting rod bearing • Causes and effects of defective connecting rod bearing Skills • Using micrometer • Using dial gauge • Using Vernier calliper • Using Plastigauge • Using torque wrench • Using connecting rod aligner • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations B2.04 Inspecting cylinder bore Knowledge • Definition of ovality and tapperness • Definition of thrust and axial direction • Definition of cylinder bore • Function of cylinder • Causes and effects of defective cylinder bore
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	• Difference between boring and honing • Effects of piston slapping • Definition of cylinder liner • Function of cylinder liner • Types of cylinder liner • Difference between undersize and oversize Skills • Using cylinder bore gauge • Using Vernier calliper • Using micrometer • Interpreting bore measurement chart • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations B2.05 Servicing piston Knowledge • Definition of piston • Function of piston • Sizes of piston • Types of piston • Purpose of T-slot • Construction of piston • Causes and effects of worn-out piston and piston ring • Definition of piston ring • Function of piston ring • Types of piston ring and their construction • Piston ring end gap and its position • Purpose of ring end gap and groove clearance Skills • Using piston ring expander • Using piston ring compressor • Using feeler gauge • Using micrometer • Using piston pin remover • Using Vernier calliper • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity
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	• Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to use ring expander while installing and removing piston rings B2.06 Servicing crankshaft Knowledge • Definition of crankshaft • Function of crankshaft • Construction of crankshaft • Tightening sequence of crankshaft bearing cap bolts • Causes and effects of defective crankshaft • Definition of crankshaft bearing • Function of crankshaft bearing • Construction of crankshaft bearing • Causes and effects of deformed crankshaft bearing • Function of oil jet/nozzle • Causes and effects of blocked oil jet/nozzle • Definition of crankshaft thrust play • Purpose of maintaining thrust play • Function of thrust washer • Causes and effects of abnormal crankshaft thrust play • Function of oil seal • Causes and effects of oil seal failure Skills • Using torque wrench • Using micrometer • Using dial gauge • Using Plastigauge • Using oil seal puller (SST) • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to apply torque to crankshaft journal bearing cap bolts as per the service manual B2.07 Servicing oil pump Knowledge • Definition of oil pump • Function of oil pump • Types of oil pump • Construction and operation of oil pump
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	• Function of relieve valve • Construction and operation of relieve valve • Causes and effects of defective oil pump • Functions of oil strainer and oil sump Skills • Using feeler gauge • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to service oil strainer B2.08 Servicing engine oil cooler Knowledge • Definition of engine oil cooler • Types of engine oil cooler • Functions of engine oil cooler • Construction of oil cooler • Operation of engine oil cooler • Causes and effects of defective oil cooler Skills • Using air compressor • Communication skills • Analytical skills • Observation skills Attitude, safety and environment concern • Being time conscious • Being vigilant • Having work ethics and integrity • Proper handling of tools and equipment • Having patience • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensuring to apply sealant or gasket while installing oil cooler B2.09 Installing timing gear Knowledge • Definition of timing gear • Functions of timing gear • Construction of timing gear • Importance of aligning timing gear Skills • Using variable pin wrench (SST) • Communication skills
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	- Analytical skills - Observation skills Attitude, safety and environment concern - Being time conscious - Being a team player - Having work ethics and integrity - Proper handling of tools and materials - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulations - Ensuring to align timing marks accurately while installing B2.10 Mounting engine Knowledge - Function of engine mounting - Types of engine mounting - Causes and effects of engine mounting failure Skills - Using engine hoist/hydraulic crane - Using screw/hydraulic jack - Communication skills - Analytical skills - Observation skills Attitude, safety and environment concern - Being time conscious - Being vigilant - Having work ethics and integrity - Proper handling of tools and equipment - Having patience - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensuring to fasten engine with rope/chain & hook securely on the hydraulic crane
Learning Conditions	Learning materials - CBLM - Hand-outs - Audio Visuals - Reference books - Manuals Learning facilities and infrastructure - Classroom with adequate facilities - Information Technology (IT) lab - Library - Workshop Materials - Markin cloth, U-bolt clamp, steel rope, cleaning solvent, dry penetrant, soft brush, connecting rod, connecting rod bearing, oil jet/nozzle, bore measurement chart, piston assembly, piston ring set, engine oil, thrust

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	washer, crankshaft, crankshaft bearing, crankshaft bearing cap, crankshaft oil seal, oil pump, oil pump gasket, relieve valve, sealant, engine oil cooler, engine oil filter, coolant, oil strainer, oil strainer gasket, oil sump gasket, oil sump, timing gear, engine gasket set, engine mounting, nuts, water paper, engine block, rust spray, thread-locking compound and fuel Tools • Hammer, plastic hammer, combination plier, circlip plier, socket set, pry bar, combination spanner set, Phillips/flat screw driver set, scrapper, brass bar, oil can, chisel, V-block, tray, oil seal puller (SST), filter wrench, variable pin wrench (SST), gudgeon pin remover, torque wrench, liner installer, piston ring compressor and piston ring extender Equipment • Engine hoist/hydraulic crane, connecting rod aligner, impact wrench, engine, engine stand, work bench, air compressor, surface plate, chain hoist and two/four post car lift Instruments • Steel ruler, dial gauge, feeler gauge, micrometer, Plastigauge, tachometer/scan tool, Vernier calliper, cylinder bore gauge and straight edge PPE • Workshop dress, safety boots, hand gloves, face mask, safety goggles, protective seat cover and fender cover
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

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Module Title	Overhauling engine		
Module Code	7231- L3- M2		
Learning Outcome 3	Troubleshoot engine problems		
Duration	Theory: 10 hours	Practical: 62 hours	Total: 72 hours
Assessment Criteria	- Visual inspection is conducted as per the job requirement following standard procedure - Engine abnormal sound is checked as per the job requirement following standard procedure - Engine overheating is diagnosed as per the job requirement following standard procedure - Engine oil pressure is checked as per the job requirement following standard procedure - Engine compression is checked as per the job requirement following standard procedure - Fuel pressure is checked as per the job requirement following standard procedure - On-board diagnosis is performed as per the job requirement following standard procedure		
Content	B3.01 Conducting visual inspection Knowledge - Importance of visual inspection - Different symbols on instrument panel board - Causes of different colour of exhaust gas - Importance of checking fuel, lubricant and water leakages - Importance of checking coolant condition in the radiator Skills - Using scan tools - Using exhaust gas analyser - Communication skills - Analytical skills - Observation skills Attitude, safety and environmental concern - Being time conscious - Being vigilant - Having work ethics and integrity - Proper handling of tools and equipment - Being a team player - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulations B3.02 Checking engine abnormal sound Knowledge - Types of abnormal engine sound - Symptoms, causes and remedies of abnormal engine sound Skills - Using automotive stethoscope - Using scan tools - Communication skills		

	• Analytical skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being a team player • Having work ethics and integrity • Proper handling of tools and materials • Being vigilant • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations B3.03 Diagnosing engine overheating <i>Knowledge</i> • Process of diagnosing engine overheating • Causes, effects and remedies of engine overheating <i>Skills</i> • Using radiator pressure tester • Using scan tools • Communication skills • Analytical skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being a team player • Being vigilant • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations B3.04 Checking engine oil pressure <i>Knowledge</i> • Function of engine oil pressure sensor • Operation of engine oil pressure indicator switch • Symptoms, causes and remedies of low engine oil pressure <i>Skills</i> • Using oil pressure gauge • Using scan tool • Using multimeter • Communication skills • Analytical skills • Observation skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being vigilant • Having patience • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	- Ensuring to follow OHS rules and regulation B3.05 Checking engine compression Knowledge - Definition of Swept volume/piston displacement - Calculation of Swept volume - Definition of engine compression - Definition of compression ratio - Calculation of compression ratio - Compression ratio of CI and SI engine - Interpretation of compression gauge reading - Purpose of compression test - Types of compression test and its purpose - Symptoms, causes and remedies of low engine compression Skills - Using compression gauge - Using scan tools - Using bore gauge - Communication skills - Analytical skills - Observation skills Attitude, safety and environment concern - Being time conscious - Being a team player - Being vigilant - Having work ethics and integrity - Proper handling of tools and materials - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulations - Ensuring to fit compression gauge to adapter and engine properly B3.06 Checking fuel pressure Knowledge - Definition of fuel pressure - Purpose of checking fuel pressure - Function of pressure regulator - Operation of pressure regulator - Symptoms, causes and remedies of abnormal fuel pressure Skills - Using fuel pressure gauge - Using multimeter - Using scan tools - Communication skills - Analytical skills - Observation skills Attitude, safety and environment concern - Being time conscious - Being a team player - Being vigilant - Having work ethics and integrity
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	• Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to clamp hoses securely • Ensuring to cool the engine prior to testing fuel pressure B3.07 Performing on-board diagnosis Knowledge • Definition of Engine Management System (EMS) • Function of EMS • Advantages of EMS • Types and operation of EMS • Description of two sub-system of EMS • Types of OBD scan tools • Interpretation of Diagnostic Trouble Code Skills • Using Data Link Connector • Using scan tool • Communication skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being time conscious • Being a team player • Being vigilant • Having work ethics and integrity • Proper handling of tools and materials • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations • Ensuring to select correct DLC cable for scan tool
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Markin cloth, oil pressure switch, fuse, oil pressure sensor, fuel, coolant, engine oil, radiator pressure cap, thermostat valve, head gasket set, oil pump, oil cooler, O-ring, oil seal, radiator hose, radiator, water pump, oil pressure regulator, fuel pressure regulator, fuel filter, manifold gasket, sealant, solenoid, wires & connectors, insulation tape and hose clamps

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	Tools - Combination spanner set, socket set, crimping tool, allen key set, tray, crocodile clip, combination plier, scan tool and Phillips/flat screw driver set Equipment - Training vehicle, diesel/petrol engine and work bench Instrument - Fuel pressure gauge, oil pressure gauge, bore gauge, compression gauge set, automotive stethoscope and digital multimeter PPE - Workshop dress, safety boots, hand gloves, face mask, safety goggles, protective seat cover and fender cover
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial training/attachment - Guided practice - Group activity with project-based learning - Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: - Practical demonstration/observation - Case study - Oral/viva-voce - Written test - Assignment - Project work - Rubrics

ANNEXES

Annex I: Time Duration

CBC Time Distribution					
Automotive Technology BQF 3					
Module Title	Learning outcomes	Tasks	Theory (hours)	Practical (hours)	Total (hours)
A: Perform engine tune-up	A1: Carry out Spark Ignition (SI) engine tune up	A1.00 Introductory knowledge	1	0	1
		A1.01 Test high tension cable	1	2	3
		A1.02 Service Contact Breaker point	1	4	5
		A1.03 Test ignition coil	1	2	3
		A1.04 Service spark plug	1	2	3
		A1.05 Set spark ignition timing	1	17	18
		A1.06 Set electronic ignition timing	1	11	12
		A1.07 Replace timing belt	1	11	12
	Sub Total Duration		8	49	57
	A2: Service air intake exhaust system	A2.01 Service air filter	1	1	2
		A2.02 Service throttle body	2	4	6
		A2.03 Adjust idle speed	1	2	3
		A2.04 Service turbo charger	2	10	12
		A2.05 Replace catalytic convertor	2	4	6
		A2.06 Service silencer	1	2	3
		A2.07 Service EGR	2	10	12
	Sub Total Duration		11	33	44
	A3: Carry out diesel engine (CI) tune up	A3.01 Adjust tappet clearance	1	11	12
		A3.02 Replace High Pressure pump	1	5	6
		A3.03 Service Common rail injection system	1	11	12
	Sub Total Duration		3	27	30
	Total Duration (A)		22	109	131
B: Overhaul engine	B1: Overhaul cylinder head	B1.01 Replace timing chain	1	11	12
		B1.02 Service rocker arm assembly	1	5	6
		B1.03 Service camshaft	1	5	6
		B1.04 Service VVT oil control valve	1	5	6

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		B1.05 Remove cylinder head assembly	1	12	13
		B1.06 Inspect cylinder head	1	5	6
		B1.07 Service engine valve	2	10	12
		B1.08 Perform valve lapping	1	5	6
		B1.09 Replace glow plug	1	5	6
		B1.10 Change pre-combustion chamber	1	5	6
		B1.11 Install cylinder head assembly	1	11	12
	Sub Total Duration		12	79	91
	B2: Overhaul engine block	B2.01 Dismount engine	2	4	6
		B2.02 Inspect engine block	1	3	4
		B2.03 Service connecting rod	1	5	6
		B2.04 Inspect cylinder bore	2	16	18
		B2.05 Service piston	2	16	18
		B2.06 Service crankshaft	2	10	12
		B2.07 Service oil pump	1	5	6
		B2.08 Service engine oil cooler	1	5	6
		B2.09 Install timing gear	1	11	12
		B2.10 Mount engine	1	5	6
	Sub Total Duration		14	80	94
	B3: Troubleshoot engine problem	B3.01 Conduct visual inspection	1	5	6
		B3.02 Check engine abnormal sound	1	5	6
		B3.03 Diagnose engine overheating	1	11	12
		B3.04 Check engine oil pressure	1	5	6
		B3.05 Check engine compression	3	15	18
		B3.06 Check fuel pressure	1	5	6
		B3.07 Perform on-board diagnosis	2	16	18
	Sub Total Duration		10	62	72
	Total Duration (B)		36	221	257
Grand Total Duration(hours)			58	330	388

Annex II: Assessment Sample

Unit of competency	Drive Light Vehicle
Unit Code	8322-U4-L2
Module Title	Driving Light Vehicle
Module Code	8322-U4-L2-M1
Time Duration	45 min *
Problem or Project: Drive Light Vehicle	
Introduction: Perform pre-operating procedures before starting the vehicle. Drive light vehicle under different environment conditions following standard traffic rules and defensive driving techniques. Perform post operating procedures after parking the vehicle.	
Observation: (How will you be assessed as Competent?) Your performance will be assessed based on the following criteria: • Performance of pre and post operating procedures as per standard practice; • Application of standard procedures while starting the LMV; • Demonstrating the driving skills in different road condition using the system of vehicle control (SOVC); • Demonstrating your adherence to RSTA Rules, Defensive Driving; • The final outcome of your driving skills	
Note: For Assessor/Institute for preparation for assessment. Materials and Equipment for 1 candidate • LMV in good running condition with all necessary vehicle documents 2. Roles and responsibilities of assessors (before/during and after assessment) • Identify in advance the different road environment (rough road, town, simulated night and poor light condition, highway) • During assessment let the candidate demonstrate moving off, reversing, overtaking, and parking.	

Assessor/ Observation Check List

Unit of competency	Drive Light Vehicle
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Unit Code	8322-U4-L2		
Module Title	Driving Light Vehicle		
Module Code	8322-U4-L2-M1		
Problem/Project: Drive Light Vehicle	Psychomotor (Practical) domain level: P2		
Candidate's Name:			
Place of Assessment:		Date of Assessment:	
A. During the demonstration of skills did the candidate do following:	Marks allocated	Marks received	Remarks
1. Check mirror settings, fluid level, tire pressure and required documents.	4		
2. Start LMV according to the procedure of standard starting procedure (Cockpit Drill)	2		
3. Move off and steer LMV wearing seat belts and without stalling the engine*	3		
4. Reverse LMV safely without stalling the engine*	3		
5. Park LMV safely in the centre of given parking area following standard parking procedure	2		
6. Drive LMV on the highway according to the road conditions following the road safety signs.	2		
7. Drive LMV in towns according to the traffic signs and signals.	2		
8. Drive LMV on 4WD safely (if necessary and available)	1		
9. Giving pass and overtake the vehicle safely according to the road and weather condition *	3		
10. Stop LMV safely in a given area according to standard stopping procedure	1		
B. Is the job outcome correct in the following areas?			
Caused no accidents and damages to the vehicle.*	5		
Total marks obtained	28		
The Candidate's performance was:	Satisfactory:		
	Not Satisfactory:		

Note: The questions marked with * are the critical questions which the trainees must be able to answer. Otherwise, they will be rated unsuccessful even if they perform well in the practical exam. The mark **P** is for the psychomotor domain level (P1- Simple Routine Assignment; P2- Questions related to Simple Routine Assignment and P3- Questions not related to Simple Routine Assignment)

Oral Questions checklist:

Unit of competency	Drive Light Vehicle
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Unit Code	8322-U4-L2			
Module Title	Driving Light Vehicle			
Module Code	8322-U4-L2-M1			
Problem/Project: Drive Light Vehicle				
Candidate's Name:				
Place of Assessment:		Date of Assessment:		
Questions (and its domain level) to be answered by the trainee / candidate:	Key Answer	Marks allocated	Marks obtained	Remarks
Why do you keep the vehicle in start mode for a few minutes before moving? (Verifying observations) (C1)				
In case of accidents who will you contact first? (contingency questions) (C2)				
While entering intersection, before how many seconds do you have to give signal? (verifying observations) (C3)				
Total Marks Obtained				
The candidate's performance was:		Satisfactory:		
		Not Satisfactory:		
Assessor's Name:		Signature:		

Note: The questions marked with C describes the cognitive level of the questions. C1- Remembering; C2- Functional Understanding and C3- Problem Solving.

Written questions checklist:

Unit of competency	Drive Light Vehicle		
Unit Code	8322-U4-L2		
Module Title	Driving Light Vehicle		
Module Code	8322-U4-L2-M1		
Problem/Project: Drive Light Vehicle			
Candidate's Name:			
Place of Assessment:		Date of Assessment:	
Questions (and its domain level) to be answered by the trainee/ candidate:	Key Answer	Marks Allocated	Marks Obtained
1. List down three types of parking. (Short Answer Question) (C1)	Angle, Straight and Parallel Parking	1	
2. All of the following are honking prohibited places EXCEPT : (C2) a. pedestrian crossing c. traffic jam	d	2	

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b. public procession d. curves and bends (Multiple Choice Question)				
3. According to RSTA Regulations how much is the penalty for drunk driving?(C1)		Nu. 1750	1	
4. Match the following signs in column A with the indications in column B. (Matching Type) (C2) Column A 1.  2.  3.  Column B a. Give way b. Restriction End c. Compulsory Ahead d. Pedestrian Prohibited		1-c, 2-a, 3-d	3	
Total marks obtained				
The Candidate's performance was:		Satisfactory:		
		Not Satisfactory:		
Assessor's Name:		Signature:		
The Candidate's overall result:		Competent:		
		Not Yet Competent:		
Feedback to Candidate: (Provide feedback to the candidate on how they could improve – especially if they are not competent)				

I am satisfied with the way assessment was conducted: (Please include reasons if not satisfied) Candidate Name: Signature: Date:	YES	NO
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Assessor Name:
Signature:
Training Provider:
Date:

This is to verify that

Mr/Ms.....

has completed module on

.....

Covering following learning outcomes:

1.
2.
3.

Instructor:

Head of the Department:

.....

.....

Signature:

Signature:

Date: / / (dd/mm/yyyy)
.....(dd/mm/yyyy)

Date: / /

Head of the Institute:

Trained Assessor (Institute)/Exam OC:

.....

.....

Signature:

Signature:

Date: / ... / (dd/mm/yyyy)

Date: / /(dd/mm/yyyy)

Annex IV: Lesson Plan
Lesson Plan

Course Title:		NC Level:
Module Code:		Duration:
Module Title:		
Learning Outcome:		
Skill/Task/Topic:		
Terminal Performance Objective:		
<i>(Note: Write narrative statement extracted from TPO of Task Sheet)</i>		
Enabling Objectives (Related knowledge):		
<i>By the end of the lesson learners will be able to:</i>		
i) ii) iii)		
What (Content/Activity)	Who (T/L)	How (Methods/ Media)
Duration (Min.)	Questions	
Introduction:		
Main body		
Conclusion		
Projects/Problems:		

Instructional Resources Plan				
Skills/Task/Topic:				
No. of Trainees:				
Sl. No.:	Instructional materials/resources	Specifications	Qty.	Remarks
Prepared by :		Signature	Date:	
Revised by:		Signature	Date:	
Approved by:		Signature	Date:	

Task sheet

TS-1/4: Practical Plan

Course Title:		N C Level:
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Module code:		Duration:	
Module Title			
Learning outcome			
Skills/Task Title:		Task no:	
Terminal Performance Objective: <i>Given:</i> <i>Cue:</i> <i>Who:</i> <i>What:</i> <i>Within:</i> <i>How well:</i> - - -			
Enabling Objectives (Related Skills): <i>By the end of a lesson, the learners will be able to:</i> i) ii) iii) iv)			
Activities	Who (T/L)	How (methods/ media)	Duration
Project/Assignment: 			

TS-2/4: Tool and Equipment required:				
Sl no.	Particulars	Specifications	Qty.	Remarks

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Training Materials required:							
Sl no.	Particulars	Specifications	Qty.	Rate	Amount	Remarks	
TS-3/4: Performance Guide							
Skill/Task:					Date:		
Directions: Use the following performances criteria to rate the learner. Check YES/NO to indicate whether the learner performed each step as indicated or not?							
Sl. No:	Steps					Yes	No
Note: Critical steps: All * marked steps should be carried out very carefully. For a quality performance guide, all items should be checked "YES"							

TS-4/4: Instruction and Drawing	
General Instructions for Trainees i) ii) iii) iv)	
Drawing (if any)	

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Safety Precaution i) ii) iii)		
Prepared by :	Signature	Date:
Revised By:	Signature	Date:
Approved by :	Signature	Date:

Annex V: Course Plan
Institutes letter head and Logo

(Trade)YEAR PLAN- _____ Semester_____ (Year)

Trade: NC Level:			Schedule																																																Total Hours
Module Code	Module Title	Learning Outcome	Feb.				March				April				May				June				July				Aug.				Sept				Oct.				Nov.												
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4													
OJT																																																			
Assessment and Certification																																																			

Prepared by:

Verified & Approved by:

Date:

Monthly/Weekly Plan

Month:

Trade:

Trainer:

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 01							
Week 02							
Week 03							
Week 04							
Week 05							

Developed by:

Approved by:

Date:



For more information please contact:

Technical Trainers Training and Resource Center (TTTRC), DWPSD

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