



COMPETENCY BASED CURRICULUM AUTOMOTIVE TECHNOLOGY DIPLOMA

**Technical Trainers Training and Resource Center
Department of Workforce Planning and Skills Development
Ministry of Education and Skills Development
Thimphu**



Course Curriculum

AUTOMOTIVE TECHNOLOGY DIPLOMA

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Foreword

Bhutan has seen a gradual increase in the requirement of skilled workers over the recent years due to rapid growth of industries. However, an acute shortage of skilled workers has affected the growth of industries. Since the skilled workers are crucial for socio-economic development of the country, it is important to have adequately trained and certified workers.

The Department of Workforce Planning and Skills Development with support from Institute of Technical Education (ITEs) Singapore, hereby presents the first edition of curriculum for Automotive Technology as per the need of industries following the standard curriculum development process. It is expected to provide training delivery with reformed approaches having its content being directly related to labour market needs, focusing on imparting of skills and assessment based on industry work standards. Thus, the curriculum will help in bridging the skill gap between industry's needs and training institutes and, ultimately contribute to enhancing the employability of the technical graduates.

The Department acknowledges the valuable contributions made by institutes, officials, and experts from relevant industries and organization who were involved in the design and development. As it is a dynamic document which may require revision based on the needs of the changing labour market, the Department look forward to receiving valuable feedbacks from the institutes and the industries to further improve and refine the curriculum. Further, we look forward for successful implementation of this curriculum to meet the skilled workforce requirement by the labor market.

The Department hope that this document will help facilitate in addressing the issue of mismatch between skills supply and demand.



(Norbu Wangchuk)

Director

Department of Workforce Planning and Skills Development

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Course Outline for Automotive Technology Diploma

Sl. No	Subject /Module	Duration (Hours)	Content Competencies (Mapped)
1.	Core modules	1440	CC
2.	OJT	420	CC
3.	Project work	324	
4.	Self-study	216	
5.	Summative and formative assessment	180	
Total		2580	
Generic Modules			
6.	Applied Dzongkha	42	
7.	Applied ICT	90	
8.	Applied Mathematics	126	
9.	Professional English Language	136	
10.	Ethics and integrity	68	PD
11.	GNH and Human Values module	30	PD
Total		492	
Total Course Duration		2532	

Note: (*) This curriculum contains core modules which cover main competencies of Automotive Technology Diploma 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 Diploma, 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 (2 Years Program)

1. Semester 1

SL. No		Duration (Hours)
1.	Module 1	230
2.	Module 2 L01	105
3.	Module 2 L02	83
4.	Module 2 L03	72
5.	Applied Dzongkha	42
6.	Ethics and integrity	68
7.	Institute Assessment	30
Total Duration:		630

2. Semester 2:

SL. No	Subject/Module	Duration (Hours)
1.	Module 2 L04	52
2.	Module 2 L05	73
3.	Module 3	293
4.	Module 4 L01	153
5.	GNH and Human Values	30
6.	Institute Assessment	30
Total Duration		631

3. Semester 3:

SL. No	Subject/Module	Duration (Hours)
1.	Module 4 LO2	82
2.	Module 4 LO3	50
3.	Module 4 LO4	54
4.	OJT	420
5.	Institute Assessment	30
Total Duration:		636

4. Semester 4:

SL. No	Subject/Module	Duration (Hours)
1.	Module 4 LO5	193
2.	Applied Mathematics	126
3.	Professional English Language	136
4.	Applied ICT	90
5.	Institute Assessment	30
6.	Annual Assessment	60
Total Duration:		635

COMPETENCY PROFILE
Occupation: Automotive Technologist
Level: Diploma

Competency Area	Sub-Competency Area	Competencies/Tasks			
A. Carryout diagnosis and servicing of Chassis and Undercarriage components	A1. Perform troubleshooting of brake system	A1.01 Troubleshoot excessive pedal travel	A1.02 Troubleshoot spongy brake pedal	A1.03 Troubleshoot hard brake pedal	A1.04 Troubleshoot brake grab
		A1.05 Troubleshoot vehicle pull to one side	A1.06 Troubleshoot brake lock	A1.07 Troubleshoot brake noise	A1.08 Troubleshoot ABS malfunctions
		A1.09 Troubleshoot brake pedal pulsation/vibration	A1.10 Troubleshoot parking brake malfunctions	A1.11 Troubleshoot faulty electronically controlled brake system	
	A2. Perform troubleshooting of suspension system	A2.01 Troubleshoot suspension noise	A2.02 Troubleshoot excessive suspension vibration	A2.03 Troubleshoot uneven tire wear	A2.04 Troubleshoot faulty electronic suspension control system
	A3. Perform troubleshooting of steering system	A3.01 Troubleshoot uneven tire wear	A3.02 Troubleshoot steering noise	A3.03 Troubleshoot steering wheel vibration	A3.04 Troubleshoot hard steering
		A3.05 Troubleshoot steering wheel play	A3.06 Troubleshoot steering wheel off-center	A3.07 Troubleshoot malfunction of EPS	
B. Carryout diagnosis and servicing of engine systems	B1 Perform troubleshooting of engine system faults	B1.01 Troubleshoot abnormal engine noise	B1.02 Troubleshoot engine knocking	B1.03 Troubleshoot consumption of engine oil	B1.04 Troubleshoot engine overheating
		B1.05 Troubleshoot rough engine idling	B1.06 Troubleshoot engine starting faults	B1.07 Troubleshoot low engine power	B1.08 Troubleshoot abnormal exhaust gas

	B2 Perform troubleshooting of fuel system	B2.01 Troubleshoot low fuel pressure	B2.02 Troubleshoot poor engine idling	B2.03 Troubleshoot poor acceleration/hesitation	B2.04 Troubleshoot faulty EFI system
		B2.05 Troubleshoot black exhaust gas (CI engine)	B2.06 Troubleshoot fuel injection pump timing faults (inline or VE pump)	B2.07 Troubleshoot CRDI/DDIS system faults	
	B3 Perform troubleshooting of lubrication and cooling system	B3.01 Troubleshoot engine overheating	B3.02 Troubleshoot coolant consumption	B3.03 Troubleshoot engine overcooling	B3.04 Troubleshoot low lubricant pressure
		B3.05 Troubleshoot corrosion of engine gallery			
	B4 Perform troubleshooting of air intake and induction system	B4.01 Troubleshoot rough idling	B4.02 Troubleshoot engine misfire	B4.03 Troubleshoot black exhaust gas	B4.04 Troubleshoot abnormal noise
	B5 Perform troubleshooting of emission control system	B5.01 Troubleshoot excessive exhaust emission	B5.02 Troubleshoot diesel particulate matter emission	B5.03 Troubleshoot rough, slow idle or stalling	B5.04 Troubleshoot overheating of catalytic convertor
		B5.05 Troubleshoot vehicle reeking of fuel			
	C1. Perform troubleshooting of automatic transmission system	C1.01 Troubleshoot abnormal shift shock	C1.02 Troubleshoot ATF contamination	C1.03 Troubleshoot low ATF pressure	C1.04 Troubleshoot clutch slippage
		C1.05 Troubleshoot abnormal noise	C1.06 Troubleshoot engine stalling	C1.07 Troubleshoot overheating of automatic transmission	
	C. Carryout diagnosis and servicing of Power Train System				

	C2. Perform troubleshooting of Manual Transmission/ transaxle system	C2.01 Troubleshoot abnormal noise/vibration	C2.02 Troubleshoot hard shifting	C2.03 Troubleshoot slipping out of gear	C2.04 Troubleshoot gear clash in shifting
		C2.05 Troubleshoot no power through transmission	C2.06 Troubleshoot gear sticking		
	C3. Perform troubleshooting of driveline system	C3.01 Troubleshoot abnormal noise/vibration of clutch	C3.02 Troubleshoot clutch slippage	C3.03 Troubleshoot spongy clutch pedal	C3.04 Troubleshoot hard clutch pedal
		C3.05 Troubleshoot clutch grab	C3.06 Troubleshoot noise/vibration of propeller shaft	C3.07 Troubleshoot noise/vibration of wheel hubs	C3.08 Troubleshoot noise/vibration of constant velocity joint
		C3.09 Troubleshoot noise/vibration of differential			
	D. Carryout diagnosis and servicing of electrical and electronic systems	D1.01 Troubleshoot faulty lighting system	D1.02 Troubleshoot faulty central locking system	D1.03 Troubleshoot faulty power window system	D1.04 Troubleshoot faulty sun roof system
		D1.05 Troubleshoot faulty wiper and washer system	D1.06 Troubleshoot faulty infotainment system	D1.07 Troubleshoot faulty SRS	D1.08 Troubleshoot faulty alarm and immobilizer system
		D1.09 Troubleshoot faulty power mirror system	D1.10 Troubleshoot faulty power seat system	D1.11 Troubleshoot faulty Instrument Panel	

	D2. Perform troubleshooting of ignition and starting system	D2.01 Troubleshoot ignition system faults	D2.02 Troubleshoot ignition timing faults	D2.03 Troubleshoot pre-heating system faults	D2.04 Troubleshoot starting system faults
		D2.05 Troubleshoot faulty idling stop system			
	D3. Perform troubleshooting of battery and charging system	D3.01 Troubleshoot faulty battery	D3.02 Troubleshoot faulty charging system	D3.03 Troubleshoot noise from alternator	
	D4. Perform troubleshooting of Heating Ventilation and Air Conditioning system	D4.01 Troubleshoot heating system faults	D4.02 Troubleshoot faulty air conditioning system	D4.03 Troubleshoot abnormal noise and foul odor	
	D5. Perform troubleshooting of Electric Vehicle	D5.01 Perform safe shut down of high voltage system	D5.02 Check high voltage harness system	D5.03 Perform EV charging	D5.04 Replace traction/drive battery
		D5.05 Troubleshoot battery management system fault	D5.06 Troubleshoot faulty inverter	D5.07 Troubleshoot faulty electric motor	D5.08 Troubleshoot faulty electronic control unit
		D5.09 Troubleshoot faulty regenerative braking system	D5.10 Troubleshoot faulty DC to DC convertor	D5.11 Troubleshoot air conditioning system fault	D5.12 Troubleshoot faulty EV cooling system
		D5.13 Troubleshoot faulty EV reduction gear box			

Course Information

COURSE TITLE	Automotive Technology
LEVEL	Diploma
COURSE OBJECTIVE	Upon completion of Automotive Technology Diploma, the trainee will be able to: • Carryout diagnosis and servicing of chassis and undercarriage components • Carryout diagnosis and servicing of engine systems • Carryout diagnosis and servicing of Power Train system • Carryout diagnosis and servicing of electrical and electronic systems
COURSE DESCRIPTION	This course is designed to provide learners the knowledge, skills and attitude to become competent automotive technologist in accordance with industry standards. Upon completion of this course, the graduates will be able to work in industries where they can perform duties like carrying out diagnosis and servicing of chassis components, undercarriage components, engine systems, power train system and electrical & electronic system. To obtain the qualification of Automotive Technologist, all learning outcomes prescribed for this qualification must be achieved.
TOTAL DURATION	3132 Hours
TRAINING PROPORTION	1:12 (Practical) 1:20 (Theory)
ENTRY REQUIREMENT	• Automobile Technician Certificate-3 and Auto-Electrician Certificate-3
TRAINER QUALIFICATION	• Must have a minimum qualification of degree in relevant field. Preference will be given to the candidates with minimum of three years of field experience; • Must have undergone Training of Trainers-Technical Instruction and Pedagogy; • Must have at least 5 years job/industry experience in relevant field if institute hire instructors or guest lecturer from industry.

Assessment and Certification System

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 Bhutan Qualification and Professional Certificate Authority (BQPCA), MoESD as per the National Competency Standards and Guidelines for National Assessment and Certification System, provided the course is accredited with BQPCA, MoESD.

CERTIFICATION

On successful completion of course, the institute will award a certificate of achievement to the trainees. The Bhutan Qualification and Professional Certificate Authority (BQPCA), MoESD will award a National Diploma Certificate to the trainees upon the successful completion of each ND level assessment.

COURSE DELIVERY

1. Modular
2. Demonstration
3. Lecture
4. Discussion with problem-based learning
5. Industrial training/attachment
6. Project work

RESOURCES

Materials

Pen, pencil, note book, brake fluid, brake pad, brake shoe, wheel cylinder, master cylinder, brake pipes, markin cloth, water paper, brake disc, brake booster, parking brake cable, parking brake shoe, brake drum, brake caliper, brake adjuster, piston, drag reduction spring, anti-rattling clips, wheel speed sensor, ABS solenoids, valves, pump, skid control module, ABS rotor, fuses, relays, vacuum pump, parking lever, pressure sensor, pedal stroke sensor, brake power backup unit, electronic brake control unit, brake booster with master cylinder, pressure accumulator, caliper, suspension arms, shock absorber, coil spring, leaf spring, bushes, U-bolts, shackle, ball joint, stabilizer bar & link, grease, water paper, tire, wheel rim, suspension arm, chassis, shock absorber, coil spring strut, ball joint, balancing rod, stabilizer bar, steering wheel angle sensor, shock absorber control module, engine control module, shock absorber control actuator, G-sensor, height sensor, wire harness, wheel counter weight and electronically controlled shock absorber, ball joint, link rod, tire, tie-rod end, steering gear box, counter weight, wheel rim, steering column, steering cross bearing, power steering pump, steering knuckle arms, steering rack end, steering rack end boot, power steering fluid, power steering motor, power steering belt, gasket kits, O-ring, silicon sealant, wheel, wheel hub, wheel hub bearing, rack and pinion, pitman arm, gear box mount bush, shim, lower arm, upper arm, coil spring, leaf spring, torsion bar spring, shock absorber, Power steering control module, Torque sensor, drive belt, power steering

pressure switch, power steering pressure regulator, power steering vane pump, WB grease, hub oil seal, lock nut, lock washer, spacer, steering wheel nut, spiral cable, EPS motor, EPS control module, CV joint, steering angle sensor, wire harness, vehicle speed sensor, fuse, relay, insulation tape/heat shrink insulator, cable tie, soldering lead and soldering flux, oil pressure switch, fuel, contact breaker, spark plug, air filter, air induction pipe, cam shaft, rocker arm, drive belt, alternator, A/C compressor, Water pump, Cooling fan, Oil Pump, Injector, Connecting rod, Connecting rod bearing, Piston, Piston ring, Piston Pin, Cylinder block, VVT actuator oil control valve, Timing chain, Timing belt, Timing belt tensioner, Timing chain Tensioner, Timing chain guide, engine gasket set, Coolant, Engine oil, Oil filter, oil pressure gauge, knock sensor, throttle body, detergent, coolant temperature, oxygen sensor, oil level gauge, PCV valve, Purge valve, turbocharger, cylinder block, valve stem oil seal, water pump, hoses, radiator, thermostat, water pump, coolant temperature sensor, radiator flush solution, hose clamp, radiator pressure cap, reservoir tank, radiator fan, engine valve, lash adjuster, cylinder block, valve grinding paste, oil control valve and cylinder liner, fuel hoses, fuel pump, fuel filter, fuel rail, fuel tank, fuel pressure regulator, fuel hose clamp, fuel delivery pipe, fuel pulsation damper, fuel injector, Mass Air Flow (MAF) sensor, Oxygen(O₂) sensor, Throttle Position (TP) sensor, spark plugs, vacuum hose, intake hose, ignition coils, distributor, high-tension cables, fuel, throttle body assembly, battery, MAP sensor, CRK position sensor, CMP sensor, APS sensor, IAT sensor, IAC valve, ECU, wire harness, FIP pump, injection nozzle and nozzle holder, crank angle sensor, boost pressure sensor, air filter, regulator switch, FI pump service kit, Engine sensors, common rail injector nozzles, fuel pipes, regulator switch, fuel pump, hand pumps, high pressure pipe, fuses, relays, pipe clamps, railing, high pressure pump, injector nozzle seal, rail pressure sensor, fuel temperature sensor, pressure regulator valve, intake modulating valve, injector driver, coolant, coolant reservoir, engine oil, radiator hose, hose clamps, radiator, oil pan, water pump, oil filters, radiator cap, oil seals, piston, piston ring, timing belt/ chain, engine valve, freeze plug, radiator fan, drive belt, thermostat, heater hose, heater core, heater valve, relay, fuse, distributor, oil strainer, intake air pipe, intake manifold, exhaust pipe, coolant temperature tester, fuel injector, silicon sealant, wire harness, oil pressure switch, pressure relief valve, gasket kit, high-temperature paint or coating, replacement Bolts & nuts and detergent, MAF sensor, oxygen sensor, vacuum hoses, throttle body, throttle position sensor, accelerator position sensor, rust removing spray, IAC valve, intake manifold, hose clamp, intake manifold gasket, air filter element, high tension cable, catalytic converter, ignition coil, spark plug, fuel filter, fuel injector, fuel pressure regulator, engine control unit, MAF sensor cleaning agent, EGR unit, hoses, throttle body cleaning agent, intake manifold, PCV and turbocharger, EGR valve, oxygen sensor, NOx sensor, LNT catalyst, fuel injectors, fuel filter, catalytic converter, spark plug, piston ring, piston, EGR cooler, EGR pipe/tube, EGR control solenoid, EGR filter, water pump, catalytic system cleaner, Markin cloth, DPF, DPF pressure sensor, DPF cleaning kit, gasket, MAP sensor, MAF sensor, APPS, throttle body, turbo Charger, hoses, muffler, valves, relays, FIP

pump, Silencer pipe, silencer gasket, exhaust manifold, ignition coil, charcoal canister, charcoal canister filter, check valve, purge control valve, fuel tank and alligator clip, throttle position sensor, VE pump, pressure accumulator, AT wet type clutch, AT brake, torque convertor, ATF, ATF tester, ATF strainer, chamber gasket, solenoid, pressure relief valve, pump, regulating valve, gear cable, gear knob, gear lever, gearbox mounting, bearings, gears, clutch gear, input & output shaft, valve body, water paper, vehicle speed sensor, transmission shifting solenoid, ATF dip stick, Automatic transmission, solenoid valve, control valve, Planetary gear set, tie, band brake, AT fluid, cooling system components, coolant, actuator lock shift, AT controller and Transmission Cooler Cleaner, synchronizer unit, bearings, input shaft, output shaft, gear shift fork, gasket, drain plug, silicon sealant, manual transmission oil, manual transmission lever linkage, oil seal, transmission gear, detent ball & spring, clutch plate, pressure plate, release bearing, gear shift lever, pilot bearing, gear box, gear cable, clutch cable, slave cylinder, counter gear, gear selector and circlip lock, clutch fluid, transmission mounting, clutch disc, pressure plate, release bearing, clutch master cylinder, slave cylinder, fork, clutch cable, clutch pedal, clutch fluid line, bleeding nipple, grease, rust removing spray, fly wheel, pilot bearing, gasket, universal joint, propeller shaft, propeller shaft mounting bolts, yoke, center bearing, Wheel bearing, hubs, hubs oils seal, claw washer, lock nut, cotter pin, CV joint shaft, CV joint boot, boot clamp, Ring gear, gear oil, bevel gear shaft, side gear, pinion gear, drive pinion, silicon sealant, oil seals, spacers, washer, shim, side bearing, pinion cover oil seal, drive pinion oil seal, differential case, differential side bearing adjuster and companion flange, electric wire, BCM, water paper, insulation tape/heat shrink insulator tube, lead acid battery, single & double filament bulbs, headlight bulbs, flasher, instrument panel, male & female connector, eye terminal, soldering lead & flux, cable tie, key fob, blade key, center locking module, actuator, rust removal spray, wire harness, 3V lithium battery, test lamp, wire connectors, power window switch, power window motor, window regulator, sunroof screen, sunroof motors, sunroof tracks & rail, seals, sunroof position sensor, windshield washer fluid tank, windshield washer motor, wiper blade, wiper switch, speaker, infotainment unit, radio antenna, air bag & inflator, seat belt tensioner, collision sensor, spiral cable, SRS control module, shock sensor, power mirror assembly, crocodile clip, power mirror control module, power mirror control switch, seat switch, motors, seat ECU, rain sensor and plugin bulb, water paper, fuse, insulation tape, spark plug, ignition coil, distributor assembly, sensors, igniter, heat shrink tube, soldering lead & flux, lead acid battery, wires, wire connectors, CRK sensor, CMP sensor, wire harness, ECU, cable ties, glow plug, ECT sensor, glow plug timer, test lamp, start/stop switch, transponder chips, ignition switch, 3V lithium battery, lithium battery, rust removal spray, transmission neutral position sensor, wheel speed sensor, skid control computer, intelligent battery sensor, bonnet switch, body control module, safety clutch switch, starter motor and seat belt buckle switch, lead acid battery, distilled water, battery terminal cleaner spray, battery terminal end, petroleum jelly, battery cable, heat shrink tube, battery terminal cover, alternator, drive-belt, wire, fuse, soldering flux and

lead, rust removing spray, baking soda, jumper cable, idler pulley & tensioner, battery temperature sensor, carbon brush, IC regulator, slip ring, diode, relay, rotor, stator and alternator bearings, heater core & hoses, thermostat, blower motor, cabin air filter, blend door actuator, fuses, relay, soldering flux & lead, coolant, heater control panel, HP/LP hose, jumper wires, insulation tape, heat shrink tube, lead acid battery, compressor O-ring, A/C refrigerant, magnetic clutch, A/C compressor oil, A/C pressure sensor, temperature sensor, service valve, A.C filter, evaporator, blower, compressor and drive belt, drive battery cable, PTC heater cable, motor cable, inverter, relays, fuses, heat shrink tube, high voltage cable, lithium-ion cell, battery module, BMS, seal packing, circuit breaker, inverter assembly, electric motor, ECU, wire harness, cable tie, thermal pad, thermal grease, potting compounds, epoxy resins, electronic component cleaner, anti-static mats & wrist strap, soldering lead & flux, wire terminals, connectors, rotors, insulation tape, DC-DC convertor, compressor, condenser, air conditioning wire, pressure sensor, air conditioning control panel, room temperature sensor, blower with fan motor, pollen filter, cooler expansion valve, pressure hose, blend actuators, ECT sensor, refrigerant pressure sensor, A/C auto amplifier, EV cooling system pump, drive motor inverter, on-board charger, cooling fan control module, cooling fan, radiator, reservoir tank, coolant, gears, bearings, gear oil, gearbox mountings, fasteners, park lock actuators, gaskets, oil seal, silicon sealant, differential and drain plug

Tools

Wheel wrench, torque wrench, flare nut wrench, ruler, drum brake service tool, drum brake adjustment tool, safety stand, wheel wedge, flashlight, manual brake bleeding kit, wire brush, hydraulic pressure gauge, brake pad spreader, auto mechanic hand tool set, Jack, jack stands, ball joint remover, coil spring compressor, wheel wedge, bush extractor, tire lever, inflating nozzle and valve key, steering wheel holder, adjustable wrench, pry bar, gasket scrapper, stethoscope, check nut wrench, bearing puller, hub puller, steering wheel puller, Trox set, soldering iron, sound Scope, valve spring compressor, piston ring compressor, piston ring expander, oil filter wrench, try square, straight edge, V-block, surface plate, Allen key, valve lapping tool, valve spring compressor, air gun, timing gear locking tool set, universal fuel pump removal tool, air gun, injector nozzle puller, filter clamp, wire brushes & scrapers, tap & die set turbocharger, hand-held vacuum pump, filler plug adapter, SST for AT, gear puller, AT brake spring compressor set, snap ring expander, flexible magnetic pickup tool, feeler gauge, manual brake bleeding kits, oil seal puller, mini-socket set, trim remover, panel popper tools, seat belt buckle switch, spark plug gauge, flash light, vent plug opener, wire stripper, wire crimper, post terminal battery brush, A/C clutch hub puller, refrigerant leak detector, expandable safety barrier, lockout tagout, insulated torque wrench, rotor puller, wire stripper, crimping tools, copper wire brush, terminal release tool, panel remover tools, battery terminal cleaning tools, safety lock out kit, expandable safety barrier, refrigerant leak detector, recovery cylinder, measuring tape and oil analysis kit

Instruments

Vernier caliper, multimeter, dial gauge, tire pressure gauge, camber gauge, hydraulic pressure gauge, camber caster kingpin gauge, turn table, spring gauge, clamp meter, belt tension gauge, feeler gauge, belt tension gauge, oil pressure gauge, timing light, head bolt angle gauge, telescopic gauge, hydrometer/refractometer, combustion leak tester, cooling system pressure tester, thermometer, compression gauge, engine compressor tester, radiator pressure tester, cooling system pressure tester, infrared thermometer, tachometer, smoke meter, flow meter, back pressure gauge, ATF pressure gauge, overflow level gauge, micrometer, preload gauge, belt tension gauge, refractometer, battery load tester, manifold pressure gauge, micron gauge, circuit tester, HV two pole tester, megaohm meter, HV multimeter, HV clamp on meter, infrared thermometer, manifold pressure gauge and radiator pressure tester

Equipment

Hydraulic jack/car lift, brake fluid tester, oscilloscope, diagnostic scan tools, impact wrench, hydraulic press, tire changer, air compressor, wheel balancing machine, computerized wheel alignment machine, bench vice, heat gun, engine hoist, air compressor, valve spring tension tester, injector tester, PCV valve tester, ultrasound flow detector, drill machine, fuel pressure gauge, exhaust gas analyzer, ATF changer, ATF tester, transmission jack, cooling system pressure tester, gear oil dispenser, clutch fluid tester, hydraulic press, safety stand, key programming device, heat gun, charging system analyzer, battery charger, vacuum pump, recovery cylinder, recovery machine, electromechanical crimping tool, charging station, two post car lift, battery lifter & pallet, computer with internet connection, module charger balancer, EV battery charger, bearing press, refrigerant recovery machine, vacuum pump, transmission jack, air compressor and oil dispenser

PPE

Safety goggles, safety shoes, safety helmet, working dress, safety gloves, dust mask and hand sanitizer

Learning Materials

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

Infrastructure and training facilities

- **Theory classroom size:** Minimum of 1.5 m² per trainee;
- **Practical Workshop size:** Minimum of 3 m² per trainee. Variables must be considered depending upon type of skills being taught and the number of trainees participating at a time.

Module Information:
Automotive Technology Diploma

Module 1
on
Carrying out diagnosis and servicing of chassis and undercarriage
components

MODULE INFORMATION

Occupation	Automotive Technologist
Competency Area	Carryout diagnosis and servicing of chassis and undercarriage components
Module Title	Carrying out diagnosis and servicing of chassis and undercarriage components
Module Code	3115-Diploma-M1
Module Description	This module is structured to provide learners the knowledge, skills and right attitude required to troubleshoot brake system, suspension system and steering system
Nominal Duration	230 Hours
Qualification	Diploma
Pre-requisite	Completed Automobile Technician C3
Learning Outcome	1. Perform troubleshooting of brake system 2. Perform troubleshooting of suspension system 3. Perform troubleshooting of steering system

Module Title	Carrying out diagnosis and servicing of chassis and undercarriage components		
Module Code	3115- Diploma-M1		
Learning Outcome 1	Perform troubleshooting of brake system		
Duration	Theory:33 hours	Practical:90 hours	Total: 123 hours
Assessment Criteria	- Excessive pedal travel is troubleshot as per job requirement following the standard procedure - Spongy brake pedal is troubleshot as per job requirement following the standard procedure - Hard brake pedal is troubleshot as per job requirement following the standard procedure - Brake grab is troubleshot as per job requirement following the standard procedure - Vehicle pull to one side is troubleshot as per job requirement following the standard procedure - Rare brake lock is troubleshot as per job requirement following the standard procedure - Brake noise is troubleshot as per job requirement following the standard procedure - ABS malfunction is troubleshot as per job requirement following the standard procedure - Brake pedal pulsation or vibration is troubleshot as per job requirement following the standard procedure - Parking brake malfunction is troubleshot as per job requirement following the standard procedure - Faulty electronically controlled brake system is troubleshot as per job requirement following the standard procedure		
Content	A1.00 Introductory knowledge - Introduction to Automotive Technology - Trends and scope of Automotive Technologist A1.01 Troubleshooting excessive pedal travel Knowledge - Function of diagnostic scan tool - Operation of Diagnostic scan tool - Pascal law and its application - Working of hydraulic brake system - Causes and remedies of excessive pedal travel - Importance of using correct brake fluid - Importance of referring manufacturer's specification Skills - Using vernier caliper - Interpreting service manual - Observation skills - Numeracy skills		

	<i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.02 Troubleshooting spongy pedal <i>Knowledge</i> • Causes and remedies of spongy brake pedal • Difference between excessive pedal travel and spongy brake pedal <i>Skills</i> • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation • Ensure to use bleeding kit to avoid body paint damage by brake fluid A1.03 Troubleshooting hard brake pedal <i>Knowledge</i> • Causes and remedies of hard brake pedal • Working of brake booster <i>Skills</i> • Using vacuum gauge • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	• Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.04 Troubleshooting brake grab <i>Knowledge</i> • Definition of brake grab • Law of friction • Causes and remedies of brake grab <i>Skills</i> • Using vernier caliper • Using dial gauge • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.05 Troubleshooting vehicle pull to one side <i>Knowledge</i> • Causes and remedies of vehicle pulling to one side <i>Skills</i> • Observation skills • Numeracy skills • Interpreting service manual <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.06 Troubleshooting brake lock <i>Knowledge</i> • Definition of brake lock • Types of brake lock • Importance of brake adjustment
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	• Causes and remedies of brake lock Skills • Observation skills • Numeracy skills • Interpreting service manual Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.07 Troubleshooting brake noise Knowledge • Types of noises produced by brakes • Causes and remedies for individual brake noise • Importance of using genuine components Skills • Observation skills • Numeracy skills • Interpreting service manual Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.08 Troubleshooting ABS malfunction Knowledge • Working of ABS system • Causes and remedies of ABS malfunction • Introduction to automatic traction control and automatic stability control Skills • Using diagnostic scan tools • Using Multimeter • Using oscilloscope • Interpreting service manual • Observation skills • Numeracy skills
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	<i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.09 Troubleshooting brake pedal pulsation/vibration <i>Knowledge</i> • Causes and remedies of brake pedal pulsation/vibration <i>Skills</i> • Using vernier caliper • Using dial gauge • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.10 Troubleshooting parking brake malfunctions <i>Knowledge</i> • Principles of lever • Working of parking brake system • Types of parking brake • Causes and remedies of parking brake system malfunction <i>Skills</i> • Using vernier caliper • Using dial gauge • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment
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	• Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A1.11 Troubleshooting faulty electronically controlled brake system Knowledge • Construction and working of electronically controlled brake system • Causes and remedies of faulty electronically controlled brake system. • Importance of referring manufacturer's service manual Skills • Using diagnostic scan tool • Using multimeter • Using motor • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, note book, brake fluid, brake pad, brake shoe, wheel cylinder, master cylinder, brake pipes, markin cloth, water paper, brake disc, brake booster, parking brake cable, parking brake shoe, brake drum, brake caliper, brake adjuster, piston, drag reduction spring, anti-rattling clips, wheel speed sensor, ABS solenoids, valves, pump, skid control module, ABS rotor, fuses, relays, vacuum pump, parking lever, pressure sensor, pedal stroke sensor,

	brake power backup unit, electronic brake control unit, brake booster with master cylinder, pressure accumulator and caliper Tools • Wheel wrench, torque wrench, flare nut wrench, ruler, drum brake service tool, drum brake adjustment tool, safety stand, wheel wedge, flashlight, manual brake bleeding kit, wire brush, hydraulic pressure gauge, brake pad spreader and auto mechanic hand tool set Instrument • Vernier caliper, multimeter and dial gauge Equipment • Hydraulic jack/car lift, brake fluid tester, oscilloscope, diagnostic scan tools and impact wrench PPE • Safety goggles, safety shoes, safety helmet, working dress, safety gloves, dust mask and hand sanitizer
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of chassis and undercarriage components		
Module Code	3115- Diploma-M1		
Learning Outcome 2	Perform troubleshooting of suspension system		
Duration	Theory: 9 hours	Practical:24 hours	Total: 33 hours
Assessment Criteria	• Suspension noise is troubleshot as per job requirement following the standard procedure • Suspension vibration is troubleshot as per job requirement following the standard procedure • Uneven tire wear is troubleshot as per job requirement following the standard procedure • Faulty electronic suspension control system is troubleshot as per job requirement following the standard procedure		
Content	A2.01 Troubleshooting suspension noise Knowledge • Types of suspension movement • Causes and remedies of suspension noise Skills • Observation skills • Numeracy skills • Interpreting service manual Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A2.02 Troubleshooting excessive suspension vibration Knowledge • Causes and remedies of excessive suspension vibration Skills • Using vernier caliper • Using dial gauge • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment		

	• Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A2.03 Troubleshooting uneven tire wear <i>Knowledge</i> • Types of tires and its specifications • Tire construction and tread patterns • Causes and remedies of uneven tire wear <i>Skills</i> • Using camber gauge • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A2.04 Troubleshooting faulty electronic suspension control system <i>Knowledge</i> • Types of active suspension system • Functions of active suspension system • Construction and working of active suspension system • Causes and remedies of faulty electronic suspension control system <i>Skills</i> • Using diagnostic scan tools • Using multimeter • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations
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	Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials - Competency Based 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 - Pen, pencil, note book, Markin cloth, suspension arms, shock absorber, coil spring, leaf spring, bushes, U-bolts, shackle, ball joint, stabilizer bar & link, grease, water paper, tire, wheel rim, suspension arm, chassis, shock absorber, coil spring strut, ball joint, balancing rod, stabilizer bar, steering wheel angle sensor, shock absorber control module, engine control module, shock absorber control actuator, G-sensor, height sensor, wire harness, wheel counter weight and electronically controlled shock absorber Tools - Jack, jack stands, ball joint remover, coil spring compressor, wheel wedge, bush extractor, wheel wrench, auto mechanic hand tool set, tire lever, torque wrench, inflating nozzle and valve key Instrument - Tire pressure gauge, camber gauge, measuring tape, multimeter, vernier caliper, dial gauge and hydraulic pressure gauge Equipment - Hydraulic jack/car lift, impact wrench, hydraulic press, tire changer, air compressor, wheel balancing machine and diagnostic scan tool PPE - Safety goggles, safety shoes, safety helmet, working dress, safety gloves, dust mask and hand sanitizer
Underpinning skills	- Team work - Communication - Negotiation - Creativity - Problem solving - Time management

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of chassis and undercarriage components		
Module Code	3115-Diploma-M1		
Learning Outcome 3	Perform troubleshooting of steering system		
Duration	Theory:17 hours	Practical: 57 hours	Total: 74 hours
Assessment Criteria	• Uneven tire wear is troubleshot as per job requirement following the standard procedure • Steering noise is troubleshot as per job requirement following the standard procedure • Steering wheel vibration is troubleshot as per job requirement following the standard procedure • Hard steering is troubleshot as per job requirement following the standard procedure • Steering wheel play is troubleshot as per job requirement following the standard procedure • Steering wheel off-center is troubleshot as per job requirement following the standard procedure • Malfunction of EPS is troubleshot as per job requirement following the standard procedure		
Content	A3.01 Troubleshooting uneven tire wear Knowledge • Principle of wheel alignment • Problem associated with wheel misalignment • Causes and remedies of excessive tire wear Skills • Using computerized wheel alignment machine • Using wheel balancing machine • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation A3.02 Troubleshooting steering noise Knowledge • Causes and remedies of steering noise Skills • Interpreting service manual • Observation skills		

	● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation A3.03 Troubleshooting steering wheel vibration <i>Knowledge</i> ● Mechanism of vibration generation ● Causes and remedies of steering wheel vibration <i>Skills</i> ● Using vernier caliper ● Using dial gauge ● Using wheel balancing machine ● Using Camber Caster Kingpin gauge ● Using Turn table ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensuring to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation A3.04 Troubleshooting hard steering <i>Knowledge</i> ● Working of electrically controlled power steering system ● Working of hydraulic controlled power steering system ● Causes and remedies of hard steering <i>Skills</i> ● Using Spring scale ● Using dial gauge ● Using multi meter ● Using Camber Caster Kingpin gauge ● Using Turn table ● Using diagnostic scan tool
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	● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensuring to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation A3.05 Troubleshooting steering wheel play <i>Knowledge</i> ● Construction of steering linkages ● Causes and remedies of steering wheel play <i>Skills</i> ● Using dial gauge ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Effective time management ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensuring to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation A3.06 Troubleshooting steering wheel off-center <i>Knowledge</i> ● Principles of steering system ● Definition of steering wheel off-center ● Causes and remedies of steering wheel off-center <i>Skills</i> ● Using computerized wheel aligning machine ● Using diagnostic scan tool ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources
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	● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensuring to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation A3.07 Troubleshooting malfunction of EPS <i>Knowledge</i> ● Functions of EPS sensors and control module ● Working of Electronic Power Steering ● Causes and remedies of EPS malfunction <i>Skills</i> ● Using diagnostic scan tools ● Using multimeter ● Using spring gauge ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensuring to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation
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Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, paper, ball joint, link rod, tire, tie-rod end, steering gear box, counter weight, wheel rim, steering column, steering cross bearing, power steering pump, steering knuckle arms, steering rack end, steering rack end boot, power steering fluid, power steering motor, power steering belt, gasket kits, O-ring, silicon sealant, wheel, wheel hub, wheel hub bearing, rack and pinion, pitman arm, gear box mount bush, shim, lower arm, upper arm, coil spring, leaf spring, torsion bar spring, shock absorber, Power steering control module, Torque sensor, drive belt, power steering pressure switch, power steering pressure regulator, power steering vane pump, WB grease, hub oil seal, lock nut, lock washer, spacer, steering wheel nut, spiral cable, EPS motor, EPS control module, CV joint, steering angle sensor, wire harness, vehicle speed sensor, fuse, relay, insulation tape/heat shrink insulator, cable tie, soldering lead and soldering flux Tools • Auto technician tool set, inflating nozzle, tire lever, ball joint remover, torque wrench, steering wheel holder, adjustable wrench, pry bar, gasket scrapper, stethoscope, safety stand, check nut wrench, bearing puller, hub puller, steering wheel puller, Trox set and soldering iron Instrument • Tire pressure gauge, vernier caliper, dial gauge, camber caster kingpin gauge, turn table, spring gauge, hydraulic pressure gauge, multimeter, clamp meter and belt tension gauge Equipment • Tire changer, air compressor, Hydraulic jack/car lift, impact wrench, computerized wheel alignment machine, wheel balancing machine, bench vice, diagnostic scan tool, heat gun and oscilloscope PPE • Safety goggles, safety shoes, safety helmet, working dress, safety gloves and dust mask
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Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module 2
on
Carrying out diagnosis and servicing of engine systems

MODULE INFORMATION

Occupation	Automotive Technologist
Competency Area	Carryout diagnosis and servicing of engine systems
Module Title	Carrying out diagnosis and servicing of engine system
Module Code	3115- Diploma-M2
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to troubleshoot engine system faults, fuel system, lubrication & colling system, air intake & induction system and emission control system
Nominal Duration	385 Hours
Certificate level/Qualification	Diploma
Pre-requisite	Completed module 3115-Diploma-M1
Learning Outcome	1.Perform troubleshooting of engine system fault 2.Perform troubleshooting of fuel system 3.Perform troubleshooting of lubrication and cooling system 4.Perform troubleshooting of air intake and induction system 5.Perform troubleshooting of emission control system

Module Title	Carrying out diagnosis and servicing of engine system		
Module Code	3115- Diploma-M2		
Learning Outcome 1	Perform troubleshooting of engine system faults		
Duration	Theory: 23 hours	Practical: 82 hours	Total: 105 hours
Assessment Criteria	- Abnormal engine noise is troubleshot as per job requirement following the standard procedure - Engine knocking is troubleshot as per job requirement following the standard procedure - Consumption of engine oil is troubleshot as per job requirement following the standard procedure - Engine overheating is troubleshot as per job requirement following the standard procedure - Rough engine idling is troubleshot as per job requirement following the standard procedure - Engine starting fault is diagnosed as per job requirement following the standard procedure - Low engine power is troubleshot as per job requirement following the standard procedure - Abnormal exhaust smoke is diagnosed as per job requirement following the standard procedure		
Content	B1.01 Troubleshooting abnormal engine noise <i>Knowledge</i> - Construction and working principle of engine - Air-fuel ratio adjustment mechanism of engines - Causes and remedies of abnormal engine noise <i>Skills</i> - Using diagnostic scan tool - Using sound scope - Interpreting service manual - Observation skills - Numeracy skills <i>Attitude, safety and environmental concern</i> - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation B1.02 Troubleshooting engine knocking <i>Knowledge</i> - Functions of knock sensor		

	● Characteristics of fuel (cetane & octane) ● Causes and remedies of engine knocking Skills ● Using diagnostic scan tool ● Using timing light ● Interpreting service manual ● Observation skills ● Numeracy skills Attitude, safety and environmental concern ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B1.03 Troubleshooting consumption of engine oil Knowledge ● Viscosity and oil grades ● Working of positive crank case ventilation system ● Causes and remedies of engine oil consumption Skills ● Using oil pressure gauge ● Using cylinder bore gauge ● Using engine compression tester ● Interpreting service manual ● Observation skills ● Numeracy skills Attitude, safety and environmental concern ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B1.04 Troubleshooting engine overheating Knowledge ● Causes and remedies of engine overheating Skills ● Using Hydrometer or Refractometer ● Using Combustion leak tester
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	● Using engine compression tester ● Using cooling system pressure tester ● Using diagnostic scan tool ● Using thermometer ● Using multimeter ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environment concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B1.05 Troubleshooting rough engine idling <i>Knowledge</i> ● Working variable valve timing mechanism ● Causes and remedies for rough idling <i>Skills</i> ● Using compression gauge ● Using diagnostic scan tool ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environment concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B1.06 Troubleshooting engine starting faults <i>Knowledge</i> ● Interpretation of valve timing ● Causes and remedies of engine starting faults <i>Skills</i> ● Using compression gauge ● Interpreting service manual ● Observation skills
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	• Numeracy skills <i>Attitude, safety and environment concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B1.07 Troubleshooting low engine power <i>Knowledge</i> • Causes and remedies of low engine power. • Consequences of inaccurate valve clearance <i>Skills</i> • Using compression gauge • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environment concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B1.08 Troubleshooting abnormal exhaust gas <i>Knowledge</i> • Types of exhaust gas • Causes and remedies of abnormal exhaust smoke <i>Skills</i> • Using compression gauge • Using cooling system compression tester • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environment concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Being a team player • Proper handling of tools, materials and equipment
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	• Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, note book, oil strainer, oil pressure switch, fuel, contact breaker, spark plug, air filter, air induction pipe, cam shaft, rocker arm, drive belt, alternator, A/C compressor, Water pump, Cooling fan, Oil Pump, Injector, Connecting rod, Connecting rod bearing, Piston, Piston ring, Piston Pin, Cylinder block, VVT actuator oil control valve, Timing chain, Timing belt, Timing belt tensioner, Timing chain Tensioner, Timing chain guide, engine gasket set, Coolant, Engine oil, Oil filter, plasti gauge, knock sensor, throttle body, detergent, coolant temperature, oxygen sensor, oil level gauge, PCV valve, Purge valve, turbocharger, cylinder block, valve stem oil seal, water paper, hoses, radiator, thermostat, water pump, coolant temperature sensor, radiator flush solution, hose clamp, radiator pressure cap, reservoir tank, radiator fan, engine valve, lash adjuster, cylinder block, valve grinding paste, oil control valve and cylinder liner Tools • Auto technician hand tool set, Torque wrench, Sound Scope, valve spring compressor, piston ring compressor, piston ring expander, oil filter wrench, try square, straight edge, V-block, surface plate, torx wrench, Allen key, valve lapping tool, valve spring compressor, air gun and timing gear locking tool set Instrument • Vernier caliper, dial gauge, feeler gauge, belt tension gauge, oil pressure gauge, timing light, head bolt angle gauge, dial gauge, telescopic gauge, hydrometer/refractometer, combustion leak tester, cooling system pressure tester, thermometer, multimeter and compression gauge Equipment • Hydraulic jack/car lift, impact wrench, engine hoist, air compressor, valve spring tension tester, diagnostic scan tool, injector tester, PCV valve tester and oscilloscope PPE

	• Safety goggles, safety shoes, safety helmet, work dress and safety gloves
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of engine systems		
Module Code	3115- Diploma-M2		
Learning Outcome 2	Perform troubleshooting of fuel system		
Duration	Theory: 22 hours	Practical: 61 hours	Total: 83 hours
Assessment Criteria	• Low fuel pressure is troubleshot as per job requirement following the standard procedure • Poor engine idling is troubleshot as per job requirement following the standard procedure • Poor acceleration/hesitation is troubleshot as per job requirement following the standard procedure • Faulty EFI system is troubleshot as per job requirement following the standard procedure • Black exhaust gas (CI engine) is troubleshot as per job requirement following the standard procedure • Fuel injection pump timing fault (inline or VE pump) is troubleshot as per job requirement following the standard procedure • CRDI system fault is troubleshot as per job requirement following the standard procedure		
Content	B2.01 Troubleshooting low fuel pressure (SI engine) Knowledge • Construction and working of SI engine fuel system • Causes and remedies of low fuel pressure Skills • Using fuel pressure gauge • Using multimeter • Using diagnostic scan tool • Interpreting drawing • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B2.02 Troubleshooting poor engine idling Knowledge • Properties of fuel • Causes and remedies of poor engine idling		

	Skills ● Using fuel pressure gauge ● Using diagnostic scan tool ● Interpreting service manual ● Observation skills ● Numeracy skills Attitude, safety and environmental concern ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B2.03 Troubleshooting poor acceleration/hesitation Knowledge ● Definition of poor acceleration/hesitation ● Causes and remedies of poor acceleration or hesitation Skills ● Using diagnostic scan tool ● Using circuit tester ● Using fuel pressure gauge ● Using multimeter ● Interpreting service manual ● Observation skills ● Numeracy skills Attitude, safety and environmental concern ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B2.04 Troubleshooting faulty EFI system Knowledge ● Working of EFI system. ● Causes and remedies of faulty EFI system Skills ● Using diagnostic scan tool ● Using multimeter ● Using oscilloscope
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	● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B2.05 Troubleshooting black exhaust gas (CI engine) <i>Knowledge</i> ● Causes and remedies of black exhaust gas <i>Skills</i> ● Using multimeter ● Using injector nozzle pressure tester ● Using diagnostic scan tool ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B2.06 Troubleshooting fuel injection pump's timing faults (VE pump) <i>Knowledge</i> ● Construction and working of VE FIP pump ● Causes and remedies of fuel injection pump's timing faults (VE pump) <i>Skills</i> ● Using plunger stroke dial indicator ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity
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	• Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B2.07 Troubleshooting CRDI/DDIS system faults Knowledge • Construction and working of CRDI/DDIS system • Causes and remedies of CRDI/DDIS system faults Skills • Using diagnostic scan tool • Using fuel pressure gauge • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, note book, Markin cloth, water paper, fuel hoses, fuel pump, fuel filter, fuel rail, fuel tank, fuel pressure regulator, fuel hose clamp, fuel delivery pipe, fuel pulsation damper, fuel injector, Mass Air Flow (MAF) sensor, Oxygen(O₂) sensor, Throttle Position (TP) sensor, spark plugs, vacuum hose, intake hose, ignition coils, distributor, high-tension cables, fuel, throttle body assembly, battery, MAP sensor, CRK position sensor, CMP sensor, APS sensor, IAT sensor, IAC valve, ECU, wire harness, FIP pump, injection nozzle and

	nozzle holder, crank angle sensor, boost pressure sensor, air filter, regulator switch, FI pump service kit, Engine sensors, common rail injector nozzles, fuel pipes, regulator switch, fuel pump, hand pumps, high pressure pipe, fuses, relays, pipe clamps, railing, high pressure pump, injector nozzle seal, rail pressure sensor, fuel temperature sensor, pressure regulator valve, intake modulating valve and injector driver Tools • Auto Technician hand tool, allen key, torx wrench, universal fuel pump removal tool, stethoscope, wheel wrench, flare nut wrench, air gun and injector nozzle puller Instrument • Fuel pressure gauge, multimeter, circuit tester, vernier calliper, dial gauge, injector nozzle pressure tester, plunger stroke adjuster gauge and plunger stroke dial indicator Equipment • Hydraulic jack/car lift, impact wrench, diagnostic scan tool, exhaust gas analyzer and oscilloscope PPE • Safety goggles, safety shoes, safety helmet, work dress and safety gloves
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of engine systems		
Module Code	3115- Diploma-M2		
Learning Outcome 3	Perform troubleshooting of lubrication and cooling system		
Duration	Theory:18 hours	Practical:54 hours	Total: 72 hours
Assessment Criteria	- Engine overheating is troubleshot as per job requirement following the standard procedure - Coolant consumption is troubleshot as per job requirement following the standard procedure - Engine overcooling is troubleshot as per job requirement following the standard procedure - Low lubricant pressure is troubleshot as per job requirement following the standard procedure - Corrosion of engine gallery is troubleshot as per job requirement following the standard procedure		
Content	B3.01 Troubleshooting engine overheating Knowledge - Working of lubrication and cooling system - Causes and remedies of engine overheating pressure Skills - Using diagnostic scan tool - Using cooling system pressure tester - Using viscometer - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation B3.02 Troubleshooting coolant consumption Knowledge - Causes and remedies of the engine coolant consumption - Causes of coolant consumption due to overheating - Causes and remedies of coolant contamination Skills - Using radiator pressure tester - Using engine compression tester - Using Multi meter		

- Interpreting service manual
 - Observation skills
 - Numeracy skills
- Attitude, safety and environmental concern***
- Being efficient in using resources
 - Being vigilant and patient
 - Having work ethics and integrity
 - Proper handling of tools, materials and equipment
 - Having sense of ownership and accountability
 - Ensuring appropriate use of PPE
 - Ensuring proper disposal of waste
 - Ensure to follow environmental rules and regulations
 - Ensuring to follow OHS rules and regulation
- B3.03 Troubleshooting engine overcooling**
- Knowledge***
- Effects of over cooling
 - Causes and remedies of engine over cooling
- Skills***
- Using diagnostic scan tool
 - Using multimeter
 - Interpreting service manual
 - Observation skills
 - Numeracy skills
- Attitude, safety and environmental concern***
- Being efficient in using resources
 - Being vigilant and patient
 - Having work ethics and integrity
 - Proper handling of tools, materials and equipment
 - Having sense of ownership and accountability
 - Ensuring appropriate use of PPE
 - Ensuring proper disposal of waste
 - Ensure to follow environmental rules and regulations
 - Ensuring to follow OHS rules and regulation
- B3.04 Troubleshooting low lubricant pressure**
- Knowledge***
- Operation of lubrication system
 - Causes and remedies of low lubricant pressure
 - Causes and remedies of engine oil contamination
- Skills***
- Using oil pressure gauge
 - Interpreting service manual
 - Observation skills
 - Numeracy skills
- Attitude, safety and environmental concern***
- Being efficient in using resources
 - Being vigilant and patient

	● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B3.05 Troubleshooting corrosion of engine gallery <i>Knowledge</i> ● Types of engine corrosion ● Causes and remedies of engine gallery corrosion ● Electrochemical reaction of coolant <i>Skills</i> ● Using multimeter ● Using ultrasonic flow detector ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation
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Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, notebook, coolant, coolant reservoir, engine oil, radiator hose, hose clamps, radiator, oil pan, water pump, oil filters, radiator cap, oil seals, piston, piston ring, timing belt/ chain, engine valve, freezer plug, radiator fan, drive belt, thermostat, heater hose, heater core, heater valve, relay, fuse, distributor, engine oil pump, oil strainer, intake air pipe, intake manifold, exhaust pipe, coolant temperature tester, fuel injector, silicon sealant, wire harness, oil pressure switch, pressure relief valve, gasket kit, high-temperature paint or coating, replacement Bolts & nuts and detergent Tools • Auto technician hand tool set, Allen key set, torx set, piston ring expander, torque wrench, filter clamp, straight edge, pry bars, wire brushes & scrapers, tap & die set and bolt extractor Instrument • Oil pressure gauge, feeler gauge, multi meter, engine compressor tester, radiator pressure tester, cooling system pressure tester and infrared thermometer Equipment • Hydraulic jack/car lift, impact wrench, air compressor, ultrasound flow detector, drill machine and diagnostic scan tool PPE • Safety goggles, safety shoes, safety helmet, work dress and safety gloves
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of engine system		
Module Code	3115-Diploma-M2		
Learning Outcome 4	Perform troubleshooting of air intake and induction system		
Duration	Theory:15 hours	Practical:37 hours	Total: 52 hours
Assessment Criteria	● Rough idling is troubleshoot as per the job requirement following standard procedure ● Engine misfire is troubleshoot as per the job requirement following standard procedure ● Black exhaust gas is troubleshoot as per the job requirement following standard procedure ● Abnormal noise is troubleshoot as per the job requirement following standard procedure		
Content	B4.01 Troubleshooting rough idling Knowledge ● Working and construction of air induction system ● Causes and remedies of rough engine idle related to air intake system Skills ● Using multimeter ● Using tachometer ● Using diagnostic scan tool ● Interpreting service manual ● Observation skills ● Numeracy skills Attitude, safety and environmental concern ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B4.02 Troubleshooting engine misfire Knowledge ● Definition of engine misfiring ● Effect of misfire ● Causes and remedies of engine misfire and poor drivability Skills ● Using diagnostic scan tool ● Using Multimeter ● Using oscilloscope ● Interpreting service manual ● Observation skills ● Numeracy skills		

	<i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B4.03 Troubleshooting black exhaust gas <i>Knowledge</i> • Causes and remedies for black exhaust gas <i>Skills</i> • Using diagnostic scan tool • Interpreting service manual • Using multimeter • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B4.04 Troubleshooting abnormal noise <i>Knowledge</i> • Types of noise • Construction and working of turbocharger and super charger • Causes and remedies for abnormal noise from intake/induction system <i>Skills</i> • Using diagnostic scan tool • Using multimeter • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment
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	• Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, note book, markin cloth, water paper, MAF sensor, oxygen sensor, vacuum hoses, throttle body, throttle position sensor, accelerator position sensor, rust removing spray, IAC valve, intake manifold, hose clamp, intake manifold gasket, air filter element, high tension cable, catalytic convertor, ignition coil, spark plug, fuel filter, fuel injector, fuel pressure regulator, engine control unit, MAF sensor cleaning agent, EGR unit, hoses, throttle body cleaning agent, intake manifold, PCV and turbocharger Tools • Auto technician hand tool set, Allen key set, Torx set, wheel wrench, automotive stethoscope and torque wrench Instrument • Multimeter and tachometer Equipment • Hydraulic jack/car lift, air compressor, impact wrench, fuel pressure gauge, oscilloscope and diagnostic scan tool PPE • Safety goggles, safety shoes, safety helmet, work dress and safety gloves
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of engine system		
Module Code	3115-Diploma-M2		
Learning Outcome 5	Perform troubleshooting of emission control system		
Duration	Theory:28 hours	Practical:45 hours	Total: 73 hours
Assessment Criteria	- Excessive exhaust emission is troubleshot as per the job requirement following standard procedure - Diesel particulate matter emission is troubleshot as per the job requirement following standard procedure - Rough, slow idle or stalling is troubleshot as per the job requirement following standard procedure - Overheating of catalytic converter is troubleshot as per the job requirement following standard procedure - Vehicle reeking of fuel is troubleshot as per the job requirement following standard procedure		
Content	B5.01 Troubleshooting excessive exhaust emission Knowledge - Types of exhaust emission - Formation of exhaust emission - Effect of exhaust emission to human health and environment - Definition of Lean NOx Trap - Working of Lean NOx Trap (LNT) catalyst - Causes and remedies of excessive exhaust emission - Functions and operation of Selective Catalytic Reduction (SCR) - Definition and working of Diesel Exhaust Fluid (DEF) - Vehicle emission standards Skills - Using diagnostic scan tool - Using exhaust gas analyzer - Using multimeter - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation		

	B5.02 Troubleshooting diesel particulate matter emission <i>Knowledge</i> ● Definition, function and working of DPF system ● Methods of DPF regeneration ● Causes and remedies of diesel particulate matter emission <i>Skills</i> ● Using multi meter ● Using exhaust gas analyzer ● Using diagnostic scan tool ● Using opacity meter ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation B5.03 Troubleshooting rough, slow idle or stalling <i>Knowledge</i> ● Types of idle speed control system ● Causes and remedies of rough, slow idle or stalling <i>Skills</i> ● Using diagnostic scan tool ● Using oscilloscope ● Using multimeter ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation
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	B5.04 Troubleshooting overheating of catalytic convertor <i>Knowledge</i> • Working of catalytic converter • Types of catalytic converter • Causes and remedies of catalytic converter overheating <i>Skills</i> • Using diagnostic scan tool • Using oscilloscope • Using timing light • Interpreting service manual • Using multimeter • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B5.05 Troubleshooting vehicle reeking of fuel <i>Knowledge</i> • Working of EVAP system • Causes and remedies of vehicle reeking of fuel <i>Skills</i> • Using diagnostic scan tool • Using multimeter • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
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Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, notebook, EGR valve, oxygen sensor, NOx sensor, LNT catalyst, fuel injectors, fuel filter, catalytic convertor, spark plug, piston ring, piston, EGR cooler, EGR pipe/tube, EGR control solenoid, EGR filter, water paper, catalytic system cleaner, Markin cloth, DPF, DPF pressure sensor, DPF cleaning kit, gasket, MAP sensor, MAF sensor, APPS, throttle body, turbo Charger, hoses, muffler, valves, relays, FIP pump, Silencer pipe, silencer gasket, exhaust manifold, ignition coil, charcoal canister, charcoal canister filter, check valve, purge control valve, fuel tank and alligator clip Tools • Auto technician hand tool set, torque wrench, torx wrench, Allen key set, flare nut wrench, air pressure gun, universal fuel pump opener and hand-held vacuum pump Instrument • Multimeter, smoke meter, opacity meter, flow meter, timing light and back pressure gauge Equipment • Diagnostic scan tool, air compressor, oscilloscope and exhaust gas analyzer PPE • Safety goggles, safety shoes, safety helmet, work dress and safety gloves
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module 3
on
Carrying out diagnosis and servicing of Power Train System

MODULE INFORMATION

Occupation	Automotive Technologist
Competency Area	Carryout diagnosis and servicing of power train system
Module Title	Carrying out diagnosis and servicing of power train system
Module Code	3115-Diploma-M3
Module Description	This module is structured to provide learners the knowledge, skills and right attitude required to troubleshoot automatic transmission system, manual transmission/transaxle system and driveline system
Nominal Duration	293 Hours
Certificate Level/Qualification	Diploma
Pre-requisite	Completed 3115-Diploma-M2
Learning Outcome	1. Perform troubleshooting of automatic transmission system 2. Perform troubleshooting of manual transmission/transaxle system 3. Perform troubleshooting of driveline system

Module Title	Carrying out diagnosis and servicing of power train system		
Module Code	3115- Diploma-M3		
Learning Outcome 1	Perform troubleshooting of automatic transmission system		
Duration	Theory: 30 hours	Practical:76 hours	Total: 106 hours
Assessment Criteria	- Abnormal shift shock is troubleshot as per the job requirement following standard procedure - ATF contamination is troubleshot as per the job requirement following standard procedure - Low ATF pressure is troubleshot as per the job requirement following standard procedure - Clutch slippage is troubleshot as per the job requirement following standard procedure - Abnormal noise is troubleshot as per the job requirement following standard procedure - Engine stalling is troubleshot as per the job requirement following standard procedure - Overheating of automatic transmission is troubleshot as per the job requirement following standard procedure - Gear engagement failure is troubleshot as per the job requirement following standard procedure		
Content	C1.01 Troubleshooting abnormal shift shock Knowledge - Types of AT - Working and construction of automatic transmission - Advantages and disadvantages of automatic transmission - Components and function of AT hydraulic system - Function of clutches and bands - Operation of one-way clutch and planetary gear - Causes and remedies of abnormal shift shock - Causes and remedies of gear engagement failure Skills - Using ATF pressure gauge - Using multimeter - Using diagnostic scan tool - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE		

	• Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C1.02 Troubleshooting ATF contamination <i>Knowledge</i> • Classification of ATF • Types of contamination • Interval of changing ATF • Causes, symptoms and remedies of ATF contamination <i>Skills</i> • Using diagnostic scan tool • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C1.03 Troubleshooting low ATF pressure <i>Knowledge</i> • Causes and remedies of low ATF pressure <i>Skills</i> • Using ATF pressure tester • Using multimeter • Using diagnostic scan tool • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
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	C1.04 Troubleshooting clutch slippage Knowledge • Causes and remedies of clutch slippage (AT) Skills • Using ATF pressure tester • Using multimeter • Using diagnostic scan tool • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C1.05 Troubleshooting abnormal noise Knowledge • Working of CVT and DCT transmission system • Causes and remedies of abnormal noise Skills • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations C1.06 Troubleshooting engine stalling Knowledge • Causes and remedies of engine stalling (AT) Skills • Using ATF tester • Using multimeter • Using Diagnostic scan tools • Interpreting service manual
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	• Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C1.07 Troubleshooting overheating of automatic transmission <i>Knowledge</i> • Causes and remedies of overheating automatic transmission <i>Skills</i> • Using diagnostic scan tool • Using ATF Pressure Gauge • Using Multimeter • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials • Competency Based 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 - Pen, pencil, note book, markin cloth, throttle position sensor, VE pump, pressure accumulator, AT wet type clutch, AT brake, torque convertor, ATF, ATF tester, ATF strainer, chamber gasket, solenoid, pressure relief valve, pump, regulating valve, gear cable, gear knob, gear lever, gearbox mounting, bearings, gears, clutch gear, input & output shaft, valve body, water paper, vehicle speed sensor, transmission shifting solenoid, ATF dip stick, Automatic transmission, solenoid valve, control valve, Planetary gear set, oil pump, seals & gasket, band brake, AT fluid, cooling system components, coolant, actuator lock shift, AT controller and Transmission Cooler Cleaner Tools - Auto technician hand tool set, Allen key set, trox wrench, torque wrench, wheel wrench, filler plug adapter, SST for AT, gear puller, automotive stethoscope and AT brake spring compressor set Instrument - ATF pressure gauge, multimeter and overflow level gauge Equipment - Hydraulic jack/car lift, diagnostic scan tool, ATF changer, impact wrench, ATF tester, transmission jack and cooling system pressure tester PPE - Safety goggles, safety shoes, safety helmet, work dress and safety gloves
Underpinning skills	- Team work - Communication - Negotiation - Creativity - Problem solving - Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial visit/training - Guided practice - Group practice 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 observation - Oral/viva-voce - Written test - Assignment - Project work

Module Title	Carrying out diagnosis and servicing of power train system		
Module Code	3115- Diploma-M3		
Learning Outcome 2	Perform troubleshooting of manual transmission/transaxle system		
Duration	Theory: 14 hours	Practical:51 hours	Total: 65 hours
Assessment Criteria	- Abnormal noise and vibration is troubleshot as per the job requirement following standard procedure - Hard shifting is troubleshot as per the job requirement following standard procedure - Slipping out of gear is troubleshot as per the job requirement following standard procedure - Gear clash in shifting is troubleshot as per the job requirement following standard procedure - No power through transmission is troubleshot as per the job requirement following standard procedure - Gear sticking is troubleshot as per the job requirement following standard procedure		
Content	C2.01 Troubleshooting abnormal noise/vibration Knowledge - Construction and working of manual transmission system - Types of transmission noise - Causes and remedies of abnormal noise/vibration Skills - Using vernier caliper - Using dial gauge - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C2.02 Troubleshooting hard shifting Knowledge - Working of synchromesh and shift linkages mechanism - Causes and remedies of hard shifting Skills - Using vernier caliper - Interpreting service manual		

	• Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C2.03 Troubleshooting slipping out of gear <i>Knowledge</i> • Causes and remedies of transmission slipping out of gear <i>Skills</i> • Using vernier caliper • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C2.04 Troubleshooting gear clash in shifting <i>Knowledge</i> • Causes and remedies of gear clash in shifting <i>Skills</i> • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	• Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C2.05 Troubleshooting no power through transmission Knowledge • Causes and remedies of no power through transmission Skills • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations C2.06 Troubleshooting gear sticking Knowledge • Causes and remedies of sticking gear Skills • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, note book, markin cloth, synchronizer unit, bearings, input shaft, output shaft, gear shift fork, gasket, drain plug, silicon sealant, manual transmission oil, manual transmission lever linkage, oil seal, transmission gear, detent ball & spring, clutch plate, pressure plate, release bearing, gear shift lever, pilot bearing, gear box, gear cable, clutch cable, slave cylinder, counter gear, gear selector and circlip lock Tools • Auto technician hand tool set, center punch, torx wrench set, snap ring expander, wheel wrench, torque wrench, bearing puller, V-block, automotive stethoscope, flexible magnetic pickup tool and feeler gauge Instrument • Vernier caliper, dial gauge and micrometer Equipment • Hydraulic jack/car lift, transmission jack, air compressor, hydraulic press, gear oil dispenser and impact wrench PPE • Safety goggles, safety shoes, safety helmet, work dress and safety gloves
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of power train system		
Module Code	3115- Diploma-M3		
Learning Outcome 3	Perform troubleshooting of driveline system		
Duration	Theory: 30 hours	Practical:92 hours	Total: 122 hours
Assessment Criteria	- Abnormal noise/vibration of clutch is troubleshot as per the job requirement following standard procedure - Clutch slippage is troubleshot as per the job requirement following standard procedure - Spongy clutch pedal is troubleshot as per the job requirement following standard procedure - Hard clutch pedal is troubleshot as per the job requirement following standard procedure - Clutch grab is troubleshot as per the job requirement following standard procedure - Noise/vibration of propeller shaft is troubleshot as per the job requirement following standard procedure - Noise/vibration of wheel hub is troubleshot as per the job requirement following standard procedure - Noise/vibration of constant velocity joint is troubleshot as per the job requirement following standard procedure - Noise/vibration of differential is troubleshot as per the job requirement following standard procedure		
Content	C3.01 Troubleshooting abnormal noise/vibration of clutch Knowledge - Introduction to driveline system - Construction and operation of hydraulic and mechanical clutch - Causes and remedies of abnormal noise/vibration of clutch Skills - Using dial gauge - Using vernier caliper - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation		

	C3.02 Troubleshooting clutch slippage • Methods of testing clutch slippage • Causes and remedies of clutch slippage Skills • Using Vernier caliper • Using dial gauge • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C3.03 Troubleshooting spongy clutch pedal Knowledge • Causes and remedies of spongy clutch pedal Skills • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C3.04 Troubleshooting hard clutch pedal Knowledge • Causes and remedies of hard clutch pedal Skills • Using vernier caliper • Using dial gauge • Interpreting service manual • Observation skills • Numeracy skills
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	<i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C3.05 Troubleshooting clutch grab <i>Knowledge</i> • Introduction to clutch grab • Causes and remedies of clutch grab <i>Skills</i> • Using vernier caliper • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations C3.06 Troubleshooting noise/vibration of propeller shaft <i>Knowledge</i> • Causes and remedies of noise/vibration of propeller shaft <i>Skills</i> • Using dial gauge • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations
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	- Ensuring to follow OHS rules and regulation C3.07 Troubleshooting noise/vibration of wheel hubs Knowledge - Causes and remedies of noise/vibration of wheel hubs Skills - Using dial gauge - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C3.08 Troubleshooting noise/vibration of constant velocity joint Knowledge - Construction and working of CV joint - Causes and remedies of noise/vibration of CV joint drive shaft Skills - Using dial gauge - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C3.09 Troubleshooting noise/vibration of differential Knowledge - Classifications of differentials - Working and construction of differentials - Causes and remedies of differential noise/vibration - Causes and remedies of differential lock up/binding
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	Skills • Using dial gauge • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, note book, markin cloth, water paper, clutch fluid, transmission mounting, clutch disc, pressure plate, release bearing, clutch master cylinder, slave cylinder, fork, clutch cable, clutch pedal, clutch fluid line, bleeding nipple, grease, rust removing spray, fly wheel, pilot bearing, gasket, universal joint, propeller shaft, propeller shaft mounting bolts, yoke, center bearing, Wheel bearing, hubs, hubs oils seal, claw washer, lock nut, cotter pin, CV joint shaft, CV joint boot, boot clamp, Ring gear, gear oil, bevel gear shaft, side gear, pinion gear, drive pinion, silicon sealant, oil seals, spacers, washer, shim, side bearing, pinion cover oil seal, drive pinion oil seal, differential case, differential side bearing adjuster and companion flange Tools • Auto technician hand tool set, clutch bleeding tools, Allen key set, torx set, wheel wrench, torque wrench, straight edge, clutch alignment tools, flare nut spanner, ruler, manual brake bleeding kits, V-block, surface plate, hub puller, wheel bearing lock nut remover, automotive stethoscope, companion flange holder, side bearing adjusting nut wrench, bench vice and oil seal puller

	Instrument • Dial gauge, micrometer, preload gauge and Vernier caliper Equipment • Hydraulic jack/car lift, transmission jack, air compressor, impact wrench, clutch fluid tester, grease gun, oil dispenser, bench vice, hydraulic press and safety stand PPE • Safety goggles, safety shoes, safety helmet, work dress and safety gloves
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module 4
on
Carrying out diagnosis and servicing of electrical and electronic
systems

MODULE INFORMATION

Occupation	Automotive Technologist
Competency Area	Carryout diagnosis and servicing of electrical and electronic systems
Module Title	Carrying out diagnosis and servicing of electrical and electronic systems
Module Code	3115-Diploma-M4
Module Description	This module is structured to provide learners the knowledge, skills and right attitude required to service electrical system components, heating ventilation & mobile air conditioning system, electric vehicle and troubleshooting of ignition, starting, battery and charging system
Nominal Duration	532 Hours
Certificate level/Qualification	Diploma
Pre-requisite	Completed 3115-Diploma-M3
Learning Outcome	1. Perform troubleshooting of electrical system components 2. Perform troubleshooting of ignition and starting system 3. Perform troubleshooting of battery and charging system 4. Perform troubleshooting of Heating Ventilation and Mobile Air Conditioning system 5. Perform troubleshooting of Electric Vehicle

Module Title	Carrying out diagnosis and servicing of electrical and electronic system		
Module Code	3115- Diploma-M4		
Learning Outcome 1	Perform troubleshooting of electrical system components		
Duration	Theory: 51 hours	Practical:102 hours	Total: 153 hours
Assessment Criteria	- Faulty lighting system is troubleshot as per the job requirement following standard procedure - Faulty central locking system is troubleshot as per the job requirement following standard procedure - Faulty power window system is troubleshot as per the job requirement following standard procedure - Faulty sun roof system is troubleshot as per the job requirement following standard procedure - Faulty wiper and washer system is troubleshot as per the job requirement following standard procedure - Faulty infotainment is troubleshot as per the job requirement following standard procedure - Faulty SRS is troubleshot as per the job requirement following standard procedure - Faulty alarm and immobilizer is troubleshot as per the job requirement following standard procedure - Faulty power mirror system is troubleshot as per the job requirement following standard procedure - Faulty power seat system is troubleshot as per the job requirement following standard procedure - Faulty instrument panel is troubleshot as per the job requirement following standard procedure		
Content	D1.01 Troubleshooting faulty lighting system Knowledge - Functions of BCM in lighting system - Working of automatic lighting system - Types of lighting system - Causes and remedies of faulty lighting system Skills - Using diagnostic scan tool - Using multimeter - Using circuit tester - Interpreting circuit diagram - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability		

	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D1.02 Troubleshooting faulty center locking system Knowledge • Types of central locking system • Working of central locking system • Causes and remedies of faulty central locking system Skills • Using Multimeter • Using diagnostic scan tool • Using key programming device • Using circuit tester • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D1.03 Troubleshooting faulty power window system Knowledge • Types of power window system • Working and construction of power window system • Causes and remedies of faulty power window system Skills • Using multimeter • Using circuit tester • Interpreting circuit diagram • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations
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	- Ensuring to follow OHS rules and regulation D1.04 Troubleshooting faulty sun roof system Knowledge - Types of sun roof system - Construction and operation of sun roof system - Causes and remedies of faulty sunroof system Skills - Using diagnostic scan tool - Using multimeter - Using circuit tester - Interpreting circuit diagram - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation D1.05 Troubleshooting faulty wiper and washer system Knowledge - Construction and operation of wiper and washer system - Causes and remedies of faulty wiper and washer system Skills - Using multimeter - Using circuit tester - Using diagnostic scan tool - Interpreting circuit diagram - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations
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	D1.06 Troubleshooting faulty infotainment system Knowledge • Working and construction of infotainment system • Causes and remedies of faulty infotainment system Skills • Using Multimeter • Using diagnostic scan tool • Using circuit tester • Interpreting circuit diagram • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D1.07 Troubleshooting faulty SRS Knowledge • Working of SRS • Seatbelt Pre-Tensioners mechanism • Types of sensors in SRSs • Importance of disposing air bag inflaters and pretensioner seat belt properly • Importance of referring manufacturer's specification • Causes and remedies of faulty SRS Skills • Using Multimeter • Using of diagnostic scan tool • Using circuit tester • Interpreting circuit diagram • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations
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	- Ensuring to follow OHS rules and regulation D1.08 Troubleshooting faulty alarm and immobilizer system Knowledge - Types of immobilizer system - Working and components of a vehicle security alarm system - Construction and working of immobilizer system - Causes and remedies of faulty alarm and immobilizer system Skills - Using diagnostic scan tool - Using multimeter - Using circuit tester - Interpreting circuit diagram - Using key programming device - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation D1.09 Troubleshooting faulty power mirror system Knowledge - Types of power mirror system - Working and components of power mirror system - Causes and remedies of the faulty power mirror system Skills - Using circuit tester - Using multimeter - Interpreting circuit diagram - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations
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	- Ensuring to follow OHS rules and regulation D1.10 Troubleshooting faulty power seat system Knowledge - Working and components of power seat system - Benefits of power seat and memory setting system - Causes and remedies of faulty power seat system Skills - Using multimeter - Using diagnostic scan tool - Using circuit tester - Interpreting circuit diagram - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Being a team player - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation D1.11 Troubleshooting faulty instrument panel Knowledge - Types of instrument panel - Construction and working of instrument panel - Causes and remedies of the faulty instrument panel Skills - Using multimeter - Using circuit tester - Using diagnostic scan tool - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations
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Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, note book, fuses, relays, switches, electric wire, BCM, water paper, insulation tape/heat shrink insulator tube, lead acid battery, single & double filament bulbs, headlight bulbs, flasher, instrument panel, male & female connector, eye terminal, soldering lead & flux, cable tie, key fob, blade key, center locking module, actuator, rust removal spray, wire harness, 3V lithium battery, test lamp, wire connectors, power window switch, power window motor, window regulator, sunroof screen, sunroof motors, sunroof tracks & rail, seals, sunroof position sensor, windshield washer fluid tank, windshield washer motor, wiper blade, wiper switch, speaker, infotainment unit, radio antenna, air bag & inflator, seat belt tensioner, collision sensor, spiral cable, SRS control module, shock sensor, power mirror assembly, crocodile clip, power mirror control module, power mirror control switch, seat switch, motors, seat ECU, rain sensor and plugin bulb Tools • Auto technician hand tool set, flashlight, Allen key set, torx set, mini-socket set, wire stripper, wire crimping tool, soldering iron, trim remover and panel popper tools Instruments • Multi meter and circuit tester Equipment • Hydraulic jack/car lift, heat gun, key programming devices, impact wrench, vacuum cleaner, air compressor and diagnostic scan tool PPE • Safety goggles, safety shoes, safety helmet, work dress, safety gloves and dust mask
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of electrical and electronic system		
Module Code	3115- Diploma-M4		
Learning Outcome 2	Perform troubleshooting of ignition and starting system		
Duration	Theory: 22 hours	Practical:60 hours	Total: 82 hours
Assessment Criteria	- Ignition system fault is troubleshot as per the job requirement following standard procedure - Ignition timing fault is troubleshot as per the job requirement following standard procedure - Pre-heating system fault is troubleshot as per the job requirement following standard procedure - Starting system fault is troubleshot as per the job requirement following standard procedure - Faulty idling stop system is troubleshot as per the job requirement following standard procedure		
Content	D2.01 Troubleshooting ignition system fault Knowledge - Types of ignition system - Working and construction of ignition system - Causes and remedies of ignition system faults Skills - Using Multimeter - Using diagnostic scan tool - Using timing light - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation D2.02 Troubleshooting ignition timing fault Knowledge - Importance of setting ignition timing - Causes and remedies of faulty ignition timing Skills - Using Multimeter - Using diagnostic scan tool - Using circuit tester - Interpreting service manual		

	• Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D2.03 Troubleshooting pre-heating system faults <i>Knowledge</i> • Working and construction of pre-heating system • Causes and remedies of pre-heating system faults <i>Skills</i> • Using Multimeter • Using Circuit tester • Using diagnostic scan tool • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D2.04 Troubleshooting starting system fault <i>Knowledge</i> • Working and construction of conventional and keyless starting system • Causes and remedies of starting system faults <i>Skills</i> • Using multimeter • Using diagnostic scan tool • Using circuit tester • Using key programming device • Interpreting service manual • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources
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	• Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D2.05 Troubleshooting faulty idling stop system Knowledge • Working and construction of engine idle stop system • Causes and remedies of faulty idle stop system Skills • Using multimeter • Using circuit tester • Using diagnostic scan tool • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations
Learning Conditions	Learning Materials • Competency Based 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 • Pen, pencil, note book, markin cloths, water paper, fuse, insulation tape, spark plug, ignition coil, distributor assembly, sensors, igniter, heat shrink tube, soldering lead & flux, lead acid battery, wires, wire connectors, CRK sensor, CMP sensor, wire harness, ECU, cable ties, glow plug, ECT sensor, glow plug timer, test lamp, start/stop switch, transponder chips, ignition switch, 3V lithium battery, lithium battery, rust removal spray, transmission neutral position sensor, wheel

	speed sensor, skid control computer, intelligent battery sensor, bonnet switch, body control module, safety clutch switch, starter motor and seat belt buckle switch Tools • Auto technician hand tool set, torx wrench, soldering iron, Allen key set, wheel wrench, wire stripper, crimping tool, timing light, flash light and spark plug gauge Instrument • Multimeter and circuit tester Equipment • Diagnostic scan tool, impact wrench, hydraulic jack/car lift, key programming device, heat gun and air compressor PPE • Safety goggles, safety shoes, work dress and safety gloves
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of electrical and electronic system		
Module Code	3115- Diploma-M4		
Learning Outcome 3	Perform troubleshooting of battery and charging system		
Duration	Theory: 14 hours	Practical:36 hours	Total: 50 hours
Assessment Criteria	- Faulty battery is troubleshot as per the job requirement following standard procedure - Faulty charging system is troubleshot as per the job requirement following standard procedure - Noise from alternator is troubleshot as per the job requirement following standard procedure		
Content	D3.01 Troubleshooting faulty battery Knowledge - Types of battery - Introduction to parasitic drain - Causes and remedies of faulty battery Skills - Using multimeter - Using hydrometer - Using battery load tester - Using battery charger - Using refractometer - Using circuit tester - Interpreting service manual - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation D3.02 Troubleshooting faulty charging system Knowledge - Working and construction of charging system - Causes and remedies of faulty charging system Skills - Using circuit tester - Using multimeter - Using diagnostic scan tool - Using charging analyzer - Interpreting service manual		

	• Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D3.03 Troubleshooting noise from alternator <i>Knowledge</i> • Working principle of alternator • Causes and remedies of noise from alternator <i>Skills</i> • Observation skills • Analytical skills • Planning skills • Numeracy skills • Problem solving skill <i>Attitude, safety and environmental concern</i> • Effective time management • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Being a team player • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials • Competency Based 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 - Pen, pencil, note book, markin cloths, lead acid battery, distilled water, battery terminal cleaner spray, battery terminal end, petroleum jelly, battery cable, heat shrink tube, battery terminal cover, alternator, drive-belt, wire, fuse, soldering flux and lead, rust removing spray, baking soda, jumper cable, idler pulley & tensioner, battery temperature sensor, carbon brush, IC regulator, slip ring, diode, relay, rotor, stator and alternator bearings Tools - Auto technician hand tool set, copper wire brush, vent plug opener, wire stripper, wire crimper, bearing puller, automative stethoscope and post terminal battery brush Instrument - Multi meter, hydrometer, circuit tester, belt tension gauge, refractometer and battery load tester Equipment - Diagnostic scan tool, charging system analyzer and battery charger PPE - Safety goggles, safety shoes, safety helmet, working dress, safety gloves, dust mask and hand sanitizer
Underpinning skills	- Team work - Communication - Negotiation - Creativity - Problem solving - Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial visit/training - Guided practice - Group practice 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 observation - Oral/viva-voce - Written test - Assignment - Project work

Module Title	Carrying out diagnosis and servicing of electrical and electronic system		
Module Code	3115- Diploma-M4		
Learning Outcome 4	Perform troubleshooting of Heating Ventilation and Air Conditioning System		
Duration	Theory: 14 hours	Practical:40 hours	Total: 54 hours
Assessment Criteria	● Heating system fault is troubleshot as per the job requirement following standard procedure ● Faulty mobile air conditioning system is troubleshot as per the job requirement following standard procedure ● Abnormal noise and foul odor is troubleshot as per the job requirement following standard procedure		
Content	D4.01 Troubleshooting heating system fault Knowledge ● Introduction to Heating Ventilation and Air conditioning system ● Types of heating system ● Working and construction of heating system ● Causes and remedies of heating system faults Skills ● Using multimeter ● Using circuit tester ● Interpreting service manual ● Observation skills ● Numeracy skills Attitude, safety and environmental concern ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation D4.02 Troubleshooting faulty air conditioning system Knowledge ● Types of refrigerants and lubricants used in A/C ● Working of A/C system ● Causes and remedies of air conditioning system faults Skills ● Using Multimeter ● Using Circuit tester ● Using diagnostic scan tool ● Using manifold pressure gauge ● Interpreting service manual ● Observation skills ● Numeracy skills		

	<i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation D4.03 Troubleshooting abnormal noise and foul odor <i>Knowledge</i> ● Causes and remedies of abnormal noise and foul odor <i>Skills</i> ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials ● Competency Based 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 ● Pen, pencil, note book, markin cloth, water paper, heater core & hoses, thermostat, blower motor, cabin air filter, blend door actuator, fuses, relay, soldering flux & lead, coolant, heater control panel, HP/LP hose, jumper wires, insulation tape, heat shrink tube, lead acid battery, compressor O-ring, A/C refrigerant, magnetic clutch, A/C compressor oil, A/C pressure sensor, temperature sensor, service valve, A.C filter, evaporator, blower, compressor and drive belt

	Tools • Auto technician hand tool set, flash light, torx wrench, soldering iron, wire stripper, wire crimper, torque wrench, A/C clutch hub puller, and Allen key sets and refrigerant leak detector Instrument • Multimeter, micron gauge, circuit tester, weighing scale and manifold pressure gauge Equipment • Hydraulic jack/car lift, diagnostic scan tool, vacuum pump, recovery cylinder, recovery machine and impact wrench PPE • Safety goggles, safety shoes, safety helmet, work dress, safety gloves and respiratory mask
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice 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 observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out diagnosis and servicing of electrical and electronic system		
Module Code	3115- Diploma-M4		
Learning Outcome 5	Perform troubleshooting of electric vehicle		
Duration	Theory: 61 hours	Practical:132 hours	Total: 193 hours
Assessment Criteria	- Safe shut down of high voltage system is performed as per the job requirement following standard procedure - High voltage harness system is checked as per the job requirement following standard procedure - EV charging is performed as per the job requirement following standard procedure - Traction/drive battery is replaced as per the job requirement following standard procedure - Battery management system fault is troubleshot as per the job requirement following standard procedure - Faulty inverter is troubleshot as per the job requirement following standard procedure - Faulty on-board charger is troubleshot as per the job requirement following standard procedure - Faulty electric motor is troubleshot as per the job requirement following standard procedure - Faulty electronic control unit is troubleshot as per the job requirement following standard procedure - Faulty regenerative braking system is troubleshot as per the job requirement following standard procedure - Faulty DC-DC converter is troubleshot as per the job requirement following standard procedure - Conditioning system fault is troubleshot as per the job requirement following standard procedure - Faulty EV cooling system is troubleshot as per the job requirement following standard procedure - Faulty EV reduction gear box is troubleshot as per the job requirement following standard procedure		
Content	D5.01 Performing safe shut down of high voltage system Knowledge - Types of electric vehicle - Functions of EV components - Working of electric vehicle - Standard operating procedure for electric vehicle maintenance - Construction of Lithium-ion battery - Safety signs for EV system Skills - Using HV two pole tester - Interpreting service manual - Observation skills - Numeracy skills		

	<i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation D5.02 Checking high voltage harness system <i>Knowledge</i> ● Purpose of insulation resistance testing <i>Skills</i> ● Using mega ohm meter ● Using diagnostic scan tool ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation D5.03 Performing EV charging <i>Knowledge</i> ● Types of EV charger and charging port ● Working mechanism of EV charging ● State of charge and state of battery health ● Causes and remedies of on-board charging faults <i>Skills</i> ● Using EV battery charger ● Using on-board charger ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability
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	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D5.04 Replacing traction/drive battery Knowledge • Types of Lithium-ion battery • Principle and chemical reaction of lithium-ion battery • Components of Lithium-ion battery and its function • Factors affecting Lithium-ion battery Health • Lithium-ion battery protection system • Safe handling of lithium-ion battery Skills • Using high voltage two pole tester • Using insulation tester (Mega Ohm meter) • Using battery lifter and pallet • Using diagnostic scan tool • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D5.05 Troubleshooting battery management system fault Knowledge • Definition and functions of BMS • Causes and remedies of battery failure and BMS malfunction Skills • Using high voltage multimeter • Using diagnostic scan tool • Using module charger balancer • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE
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	• Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations D5.06 Troubleshooting faulty inverter Knowledge • Working principle and functions of inverter • Causes and remedies of faulty inverter Skills • Using high voltage clamp on meter • Using high voltage multimeter • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D5.07 Troubleshooting faulty electric motor Knowledge • Classification and working of electric motors • Causes and remedies of faulty electric motor Skills • Using high voltage multimeter • Using megohm-meter • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation D5.08 Troubleshooting faulty Electronic Control Unit (ECU) Knowledge • Function of ECU • Causes and remedies of faulty ECU
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	<i>Skills</i> ● Using multimeter ● Using diagnostic scan tools ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation D5.09 Troubleshooting faulty regenerative braking system <i>Knowledge</i> ● Functions of regenerative braking system ● Construction and working of regenerative braking system ● Causes and remedies of faulty regenerative braking system <i>Skills</i> ● Using diagnostic scan tool ● Using high voltage multimeter ● Interpreting service manual ● Observation skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being efficient in using resources ● Being vigilant and patient ● Having work ethics and integrity ● Proper handling of tools, materials and equipment ● Having sense of ownership and accountability ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to follow environmental rules and regulations ● Ensuring to follow OHS rules and regulation D5.10 Troubleshooting faulty DC-DC convertor <i>Knowledge</i> ● Functions of DC-to-DC converter ● Working mechanism of DC-to-DC converter ● Causes and remedies of faulty DC to DC converter <i>Skills</i> ● Using Infrared Thermometer ● Using megaohm meter ● Using diagnostic scan tool ● Observation skills
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	• Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations D5.11 Troubleshooting air conditioning system fault <i>Knowledge</i> • Working and construction of EV A/C system • Causes and remedies of EV air conditioning system faults • Difference between mobile and EV air conditioning system <i>Skills</i> • Using multimeter • Using diagnostic scan tool • Using manifold pressure gauge • Using refrigerant leak detector • Using refrigerant recover machine • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations D5.12 Troubleshooting faulty EV cooling system <i>Knowledge</i> • Function of EV cooling system • Working and construction of EV cooling system • Causes and remedies of faulty EV cooling system <i>Skills</i> • Using multimeter • Using diagnostic scan tool • Using megaohm meter • Using clamp on meter • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient
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	• Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations D5.13 Troubleshooting faulty EV reduction gearbox Knowledge • Function of reduction gearbox • Construction and operation of reduction gearbox • Causes and remedies of the faulty EV reduction gearbox Skills • Using diagnostic scan tool • Interpreting service manual • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations
Learning Conditions	Learning Materials • Competency Based 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 • Pen, paper, safety service plug, drive battery cable, PTC heater cable, motor cable, inverter, relays, fuses, heat shrink tube, high voltage cable, lithium-ion cell, battery module, BMS, seal packing, circuit breaker, inverter assembly, electric motor, ECU, wire harness, cable tie, thermal pad, thermal grease, potting compounds, epoxy resins, electronic component cleaner, anti-static mats & wrist strap, soldering lead & flux, wire terminals, connectors, brake pad, rotors, insulation tape, DC-DC convertor, compressor, condenser, air conditioning wire, pressure sensor, air conditioning control panel, room temperature sensor, blower with fan motor, pollen filter, cooler expansion valve, pressure hose, blend

	actuators, ECT sensor, refrigerant pressure sensor, A/C auto amplifier, EV cooling system pump, drive motor inverter, on-board charger, cooling fan control module, cooling fan, radiator, reservoir tank, coolant, gears, bearings, gear oil, gearbox mountings, fasteners, park lock actuators, gaskets, oil seal, silicon sealant, differential and drain plug Tools - Auto technician hand tool set, insulated hand tool set, expandable safety barrier, lockout tagout, insulated torque wrench, rotor puller, bearing puller, wire stripper, crimping tools, copper wire brush, terminal release tool, panel remover tools, battery terminal cleaning tools, safety lock out kit, expandable safety barrier, refrigerant leak detector, recovery cylinder, torx wrench, fluid tractor, oil analysis kit, pry bar and bearing puller Instrument - HV two pole tester, megaohm meter, HV multimeter, HV clamp on meter, infrared thermometer, manifold pressure gauge and radiator pressure tester Equipment - Diagnostic scan tool, electromechanical crimping tool, heat gun, charging station, two post car lift, battery lifter & pallet, computer with internet connection, impact wrench, module charger balancer, EV battery charger, bearing press, refrigerant recovery machine, vacuum pump, transmission jack, air compressor and oil dispenser PPE - Safety goggles, safety shoes, safety helmet, work dress, HV safety gloves and respiratory mask
Underpinning skills	- Team work - Communication - Negotiation - Creativity - Problem solving - Time management
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial visit/training - Guided practice - Group practice 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 observation - Oral/viva-voce - Written test - Assignment - Project work

ANNEXES

Time Distribution (Regular course)					
Automotive Technology Diploma					
Module Title	Learning outcomes	Tasks	Theory (Hours)	Practical (Hours)	Total (hours)
A: Carryout diagnosis and servicing of Chassis and Undercarriage components	A1: Troubleshoot brake system	A1.00 Introductory knowledge	6	0	6
		A1.01 Troubleshoot excessive pedal travel	6	12	18
		A1.02 Troubleshoot spongy brake pedal	2	11	13
		A1.03 Troubleshoot hard brake pedal	2	11	13
		A1.04 Troubleshoot brake grab	2	6	8
		A1.05 Troubleshoot vehicle pull to one side	2	6	8
		A1.06 Troubleshoot brake lock	2	6	8
		A1.07 Troubleshoot brake noise	2	6	8
		A1.08 Troubleshoot ABS malfunctions	2	10	12
		A1.09 Troubleshoot brake pedal pulsation/vibration	2	6	8
		A1.10 Troubleshoot parking brake malfunctions	3	6	9
		A1.11 Troubleshoot faulty electronically controlled brake system	2	10	12
	Sub Total Duration		33	90	123
	A2: Troubleshoot suspension system	A2.01 Troubleshoot suspension noise	2	6	8
		A2.02 Troubleshoot suspension vibration	2	6	8
		A2.03 Troubleshoot uneven tire wear	2	6	8
		A2.04 Troubleshoot faulty electronic suspension control system	3	6	9
	Sub Total Duration		9	24	33
	A3: Troubleshoot steering system	A3.01 Troubleshoot uneven tire wear	2	6	8
		A3.02 Troubleshoot steering noise	2	10	12
		A3.03 Troubleshoot steering wheel vibration	2	6	8
		A3.04 Troubleshoot hard steering	3	9	12
		A3.05 Troubleshoot steering wheel play	2	6	8
		A3.06 Troubleshoot steering wheel off-center	2	6	8
		A3.07 Troubleshoot malfunction of EPS	4	14	18
	Sub Total Duration		17	57	74
	Total Duration (A)		59	171	230
B. Carryout diagnosis and servicing of engine systems	B1: Troubleshoot engine system fault	B1.01 Troubleshoot abnormal engine noise	3	18	21
		B1.02 Troubleshoot engine knocking	3	9	12
		B1.03 Troubleshoot consumption of engine oil	3	9	12
		B1.04 Troubleshoot engine overheating	2	10	12
		B1.05 Troubleshoot rough engine idling	3	9	12
		B1.06 Troubleshoot engine starting faults	3	9	12

		B1.07 Troubleshoot low engine power	3	9	12
		B1.08 Troubleshoot abnormal exhaust gas	3	9	12
	Sub Total Duration		23	82	105
	B2: Troubleshoot fuel system fault	B2.01 Troubleshoot low fuel pressure	3	6	9
		B2.02 Troubleshoot poor engine idling	3	9	12
		B2.03 Troubleshoot poor acceleration/hesitation	2	6	8
		B2.04 Troubleshoot faulty EFI system	4	8	12
		B2.05 Troubleshoot black exhaust gas (CI engine)	2	10	12
		B2.06 Troubleshoot fuel injection pump timing faults (inline or VE pump)	4	8	12
		B2.07 Troubleshoot CRDI system faults	4	14	18
	Sub Total Duration		22	61	83
	B3: Troubleshoot lubrication and cooling system	B3.01 Troubleshoot engine overheating	6	18	24
		B3.02 Troubleshoot coolant consumption	4	8	12
		B3.03 Troubleshoot engine overcooling	2	10	12
		B3.04 Troubleshoot low lubricant pressure	3	9	12
		B3.05 Troubleshoot corrosion of engine gallery	3	9	12
	Sub Total Duration		18	54	72
	B4: Troubleshoot air intake and induction system	B4.01 Troubleshoot rough idling	4	6	10
		B4.02 Troubleshoot engine misfire	3	9	12
		B4.03 Troubleshoot black exhaust gas	2	10	12
		B4.04 Troubleshoot abnormal noise	6	12	18
	Sub Total Duration		15	37	52
	B5: Troubleshoot emission control system	B5.01 Troubleshoot excessive exhaust emission	12	12	24
		B5.02 Troubleshoot diesel particulate matter emission	6	12	18
		B5.03 Troubleshoot rough, slow idle or stalling	3	9	12
		B5.04 Troubleshoot overheating of catalytic convertor	3	6	9
		B5.05 Troubleshoot vehicle reeking of fuel	4	6	10
	Sub Total Duration		28	45	73
	Total Duration (B)		106	279	385
C: Carryout diagnosis and servicing of Power Train System	C1: Troubleshoot automatic transmission system	C1.01 Troubleshoot abnormal shift shock	12	18	30
		C1.02 Troubleshoot ATF contamination	4	6	10
		C1.03 Troubleshoot low ATF pressure	2	6	8
		C1.04 Troubleshoot clutch slippage	2	12	14
		C1.05 Troubleshoot abnormal noise	6	12	18

		C1.06 Troubleshoot engine stalling	2	10	12
		C1.07 Troubleshoot overheating of automatic transmission	2	12	14
	Sub Total Duration		30	76	106
	C2: Troubleshoot manual Transmission/transaxle system	C2.01 Troubleshoot abnormal noise and vibration	3	12	15
		C2.02 Troubleshoot hard shifting	3	12	15
		C2.03 Troubleshoot slipping out of gear	2	9	11
		C2.04 Troubleshoot gear clash in shifting	2	6	8
		C2.05 Troubleshoot no power through transmission	2	6	8
		C2.06 Troubleshoot gear sticking	2	6	8
	Sub Total Duration		14	51	65
	C3: Troubleshoot driveline system	C3.01 Troubleshoot abnormal noise/vibration of clutch	6	12	18
		C3.02 Troubleshoot clutch slippage	3	9	12
		C3.03 Troubleshoot spongy clutch pedal	2	12	14
		C3.04 Troubleshoot hard clutch pedal	2	10	12
		C3.05 Troubleshoot clutch grab	3	9	12
		C3.06 Troubleshoot noise/vibration of propeller shaft	2	6	8
		C3.07 Troubleshoot noise/ vibration of wheel hubs	2	10	12
		C3.08 Troubleshoot noise/vibration of constant velocity joint	4	6	10
		C3.09 Troubleshoot noise/vibration of differential	6	18	24
		Sub Total Duration	30	92	122
	Total Duration (C)		74	219	293
D: Carryout diagnosis and servicing of electrical and electronic systems	D1: Service electrical system components	D1.01 Troubleshoot faulty lighting system	12	18	30
		D1.02 Troubleshoot faulty central locking system	4	6	10
		D1.03 Troubleshoot faulty power window system	4	6	10
		D1.04 Troubleshoot faulty sun roof system	4	6	10
		D1.05 Troubleshoot faulty wiper and washer system	3	6	9
		D1.06 Troubleshoot faulty infotainment system	3	6	9
		D1.07 Troubleshoot faulty SRS	6	12	18
		D1.08 Troubleshoot faulty alarm and immobilizer system	4	12	16
		D1.09 Troubleshoot faulty power mirror system	4	6	10
		D1.10 Troubleshoot faulty power seat system	4	12	16
		D1.11 Troubleshoot faulty Instrument Panel	3	12	15

		0	0	0
Sub Total Duration		51	102	153
D2: Troubleshoot ignition and starting system	D2.01 Troubleshoot ignition system faults	6	12	18
	D2.02 Troubleshoot ignition timing faults	3	12	15
	D2.03 Troubleshoot pre-heating system faults	3	6	9
	D2.04 Troubleshoot starting system faults	6	18	24
	D2.05 Troubleshoot faulty idling stop system	4	12	16
Sub Total Duration		22	60	82
D3: Troubleshoot battery and charging system	D3.01 Troubleshoot faulty battery	4	6	10
	D3.02 Troubleshoot faulty charging system	6	18	24
	D3.03 Troubleshoot noise from alternator	4	12	16
Sub Total Duration		14	36	50
D4: Service Heating Ventilation and Mobile Air Conditioning system	D4.01 Troubleshoot heating system faults	6	18	24
	D4.02 Troubleshoot faulty air conditioning system	6	12	18
	D4.03 Troubleshoot abnormal noise and foul odor	2	10	12
Sub Total Duration		14	40	54
D5: Service Electric Vehicle	D5.01 Perform safe shut down of high voltage system	12	12	24
	D5.02 Check high voltage harness system	3	6	9
	D5.03 Perform EV charging	6	6	12
	D5.04 Replace traction/drive battery	6	18	24
	D5.05 Troubleshoot battery management system fault	3	6	9
	D5.06 Troubleshoot faulty inverter	3	12	15
		0	0	0
	D5.08 Troubleshoot faulty electric motor	3	12	15
	D5.09 Troubleshoot faulty electronic control unit	3	6	9
	D5.10 Troubleshoot faulty regenerative braking system	4	12	16
	D5.11 Troubleshoot faulty DC to DC convertor	4	6	10
	D5.12 Troubleshoot air conditioning system fault	4	12	16
	D5.13 Troubleshoot faulty EV cooling system	6	12	18
	D5.14 Troubleshoot faulty EV reduction gear box	4	12	16

	Sub Total Duration	61	132	193
	Total Duration (D)	162	370	532
Grand Total Duration (Hours)		401	1039	1440

Annex II: Module Recognition

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 III: Lesson Plan

Lesson Plan

[illegible]

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:
Module code:		Duration:
Module Title		
Learning outcome		
Skills/Task Title:		Task no:

Terminal Performance Objective:

Given:

Cue:

Who:

What:

Within:

How well:

—

—

—

Enabling Objectives (Related Skills):

By the end of a lesson, the learners will be able to:

i)

ii)

iii)

iv)

Activities	Who (T/L)	How (methods/ media)	Duration

Project/Assignment:

TS-2/4: Tool and Equipment required:

<i>Sl no.</i>	<i>Particulars</i>	<i>Specifications</i>	<i>Qty.</i>	<i>Remarks</i>

Training Materials required:

<i>Sl no.</i>	<i>Particulars</i>	<i>Specifications</i>	<i>Qty.</i>	<i>Rate</i>	<i>Amount</i>	<i>Remarks</i>

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)

Safety Precaution

- i)
- ii)
- iii)

Prepared by :	Signature	Date:
Revised By:	Signature	Date:
Approved by :	Signature	Date:

Annex IV: 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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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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

P.O. Box153; Gelephu

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