Syllabus for Automobile Serviceman – Level 4

Course Name	**AUTOMOBILE SERVICEMAN-LEVEL 4, V2**
Course Code	**STC-AUT/AUSE/0405,V2**
Occupation	Vehicle - Service, Repair & Maintenance
Job Description	Servicing, repair and maintenance of a vehicle including 2-wheelers, 3-wheelers and 4-wheelers
Anticipated Volume of Training	720 Hrs (Theory- 150 Hrs + Practical- 360 Hrs Employability Skill 60 Hrs + OJT 150 Hrs)
Trainees' Entry Qualification	Class 8 Pass + ITI (2 Yrs) with 2 years experience, OR Class 10 Pass + ITI (1Yr) after class 10 with 1 year experience, OR Class 10 Pass + ITI (2 yrs) after class 10, OR Class 10 Pass with 2 years experience, OR Class 10 Pass and pursing continuous regular schooling, OR 3 years diploma after class 10 or Class 12 Pass with 6 months experience, OR Previous Relevant Qualification of NSQF Level 3 with 2 yrs experience.
Trainers Qualification	Degree in Automobile / Mechanical Engg. (with specialization in Automobile) from a recognized college/University with one year experience in the automobile industry and should possess valid LMV driving license. OR Diploma in Automobile / Mechanical (specialization in automobile) from recognized board of Technical Education with two years experience in the automobile industry and should possess a valid LMV driving license. OR B.SC Major in Automobile Maintenance from a recognized university with 2 years' experience in Automobile Servicing. OR 10th Passed + NTC/NAC in the Trade of "Mechanic Motor Vehicle" with 3 years' post qualification experience in the relevant field and should possess a valid LMV driving license.

Structure of Course:

Module No.	Outcome	Theory (hrs)	Practical (hrs)	OJT (hrs)	Total (hrs)
1	Identity a variety of hand tools and power tools and describe their purpose, application and operate them in a safe and proper manner.	10	20		30
2	Identify and test various electrical and electronic components	10	20		30
3	Demonstrate various components of SI and CI engines; dismantle, assemble, overhaul and service Petrol/Diesel engines and their accessories.	20	40		60
4	Identify various components of cooling and lubrication system, explain their function, test and repair them	10	20		30
5	Describe various components of the fuel feed system of a petrol and diesel engine, Service and check proper functionality	20	40		60
6	Classify different chassis layout and to dismantle and assemble components of suspension system, wheels and tyres from the chassis	20	40		60
7	Plan & perform maintenance, diagnosis and servicing of the steering assembly and braking system in automobiles	20	40		60
8	Diagnose and repair the Defects in various components of Auto electrical system.	20	70		90
9	Identify the elements of transmission system and perform				

Module No.	Outcome	Theory (hrs)	Practical (hrs)	OJT (hrs)	Total (hrs)
	maintenance, diagnosis and servicing of transmission system.	20	70		90
10	**OJT**			150	150
11	**Employability skill**	60			60
	TOTAL	**210**	**360**	**150**	**720**

SYLLABUS:

MODULE NO.1: Introduction – Occupational Safety, Hand and Power Tools

Outcome: Identity a variety of hand tools and power tools and describe their purpose, application and operate them in a safe and proper manner.

Theory Content:

1. **Occupational Safety & Health**- Importance of Safety and general precautions to be observed in Automobile workshop - Basic first aid - safety signs, Safe handling of Fuel Spillage, Safe disposal of toxic dust, safe handling of lifting equipment, **Concept About Housekeeping & 5S Method, PPE - Personal Protective Equipment**. Fire Safety & Fire extinguishers used for different types of fire, Electrical safety tips.
2. **Hand & Power Tools** –
3. Marking scheme, Marking material, Cleaning tools- Scraper, wire brush, Emery paper, Surface plates - Description and use, surface gauges, scriber, punches - prick punch, center punch, pin punch, hollow punch, number and letter punch. Chisel - flat, cross-cut. Hammer- ball peen, lump, mallet. Screwdrivers- blade screwdriver, Phillips screwdriver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories, Pliers - Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers, external circlips pliers.Air impact wrench, air ratchet wrenches- Torque wrenches, pipe wrenches, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing
4. **Measuring Tools** - Calipers- inside and outside, Micrometers- Outside and depth micrometer, Telescope gauges, Dial bore gauges, Dial indicators, feeler gauge, thread pitch gauge, vacuum gauge, tyre pressure gauge
5. **Fasteners** - Screws, nuts, studs & bolts, locking devices - lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers Function of Gaskets, oil seals.
6. **Cutting tools** :- Hacksaw, File - Definition, components of file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.
7. **Limits, Fits & Tolerances**:- Definition of limits, fits & tolerances with examples used in auto components
8. **Maintenance management**– Types of maintenance – Preventivemaintenance,
9. Scheduled maintenance, Breakdown maintenance – their applications, General servicing procedure.

Practical Contents

1.1 Study of safety charts.
1.2 Study and use of fire extinguishers
1.3 Demonstration on safe handling and Periodic testing of lifting equipments.
1.4 Demonstration on safety disposal of Used engine oil.
1.5 Practice using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, Chisel etc.
1.6 Practice on General workshop tools & power tools.
1.7 Practice to measure a wheel base of a vehicle with measuring tape.
1.8 Practice to measure valve spring tension using spring tension tester
1.9 Practice to remove wheel lug nuts with use of an ai r impact wrench.

1.10 Measuring practice on Cam height, Camshaft Journal diameter, crankshaft journal diameter, Valve stem diameter, piston diameter, and piston pin diameter with outside Micrometers.

1.11 Measuring practice on the height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer.

1.12 Measuring practice on valve spring free length.

1.13 Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges.

1.14 Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges.

1.15 Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator.

1.16 Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge.

1.17 Measuring practice to check the end gap of a piston ring, piston-to- cylinder wall clearance with feeler gauge.

1.18 Practice to check engine manifold vacuum with vacuum gauge.

1.19 Practice to check the air pressure inside the vehicle tyres is maintained at the recommended setting.

1.20 Practice on keeping workshop records – history sheet, work order, activity file.

Module No-2 : Basic Electrical & Electronics

Outcome: Identify and test various electrical and electronic component

Theory Content:

1. **Basic Electrical -** Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Fuses & circuit breakers Conductors & insulators, Wires, cable colour codes, Resistors in Series circuits and Parallel circuits Shielding, Length vs. resistance, Resistor ratings,

   Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermisters, Thermo couples, Electrochemical energy, Photo- voltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.

2. **Basic Electronics -** Description of Semiconductors, Solid state devices - Diodes, Transistors, Thyristors, UniJunction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates - OR, AND & NOT and Logic gates using switches.

Practical Content:

2.1 Practice in joining wires using soldering Iron.
2.2 Construction of simple electrical circuits.
2.3 Measuring current, voltage and resistance using a digital multimeter.
2.4 Practice continuity test for fuses, jumper wires, fusible links and circuit breakers.
2.5 Cleaning and topping up of a lead acid battery.
2.6 Testing battery with hydrometer.
2.7 Connecting battery to a charger for battery charging.
2.8 Inspecting & testing a battery after charging
2.9 Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective

action.
2.10 Testing of relay and solenoids and its circuit.
2.11 Identify and test different types of Diodes, NPN & PNP Transistors for its functionality**.**
2.12 Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches.

Module No-3 : Engine – Concept and Constructional Features

Outcome: List various components of SI and CI engines; dismantle, assemble, overhaul and service Petrol /Diesel engines and their accessories

Theory Content:

1. **Introduction to Automobile:** History,leading manufacturers, development in automobile industry, recent trends.

2. **Introduction to Engine:** Concept of HEAT Engine - Concept of IC Engine - Classification of IC engines- P-V diagram of Otto Cycle & Diesel Cycle - Principle & working of 2 & 4 -stroke petrol/diesel engine - comparison between 2-stroke and 4 stroke engine, C.I engine and S.I Engine – engine nomenclature - Engine specification.

3. **Basic engine components:** Constructional features of – Cylinder block, Cylinder Head, Cylinder Liner, Oil Sump, Piston – nomenclature, Pistons Rings - Compression Ring & Oil control Ring, Gudgeon Pin, Crank Shaft, Vibration Damper, Connecting Rod, Flywheel, Camshaft Drive, Cylinder Head Gasket, Main & Big End Bearing, Intake Manifold, Exhaust manifold, Exhaust Muffler

4. **Valves & Valve Actuating Mechanism:** Valves – poppet valve, valve actuating mechanism - Over Head Valve actuating mechanism, Side Valve actuating mechanism

Prtactical Content:

3.1 Dismantling the SI engine and CI engine, cleaning and inspecting the parts, assembling all the parts.

3.2 Practice on Dismantling Two, Three & Four wheeler engine and inspection of cylinder head, piston, piston ring, connecting rod.

3.3 Practice on measurement of piston ring gap, the piston ring to groove clearance, piston OD, cylinder –to- piston clearance, piston pin OD, piston pin hole ID in an X and Y axis, piston- to-pin clearance connecting rod small end ID, connecting rod small end-to- piston pin clearance and compare the measurements with service manual.

3.4 Practice on removing of piston and connecting rods from engine

3.5 Checking Cylinder bore wear for ovality and taper.

3.6 Practice on checking valves - replacing worn guides and weak springs, assembling valves and cylinder head and adjusting tappet clearance in engine.

3.7 Inspection of rocker arm and rocker arm shaft, camshaft, valve spring, valve guide, and replacement of valve guide and valve seat.

3.8 Inspection of valve clearance and ignition timing and setting.

3.9 Troubleshooting of Excessive smoke, overheating, knocking or abnormal noise.

Module No-4 : Engine Cooling and Lubrication System

Outcome : Name various components of cooling and lubrication system, explain their function, test and repair them.

Theory Content:

1. **Cooling System:** Necessity of cooling system - Types of Cooling System - Air Cooling system - Advantages & disadvantages of Air Cooling system - Water Cooling system – Components of Water Cooling System – Radiator - Water Pumps – Fan - Thermostat Valves - Maintenance of Cooling system - Troubleshooting of cooling system.
2. **Lubrication System:** Purpose of Lubrication system - Types of oil used in Lubrication system - Properties of lubricants - Types of Lubrication System - Main components of lubrication system - Oil Pumps - Oil Filters - crankcase ventilation - Troubleshooting.

Practical Content:

4.1 Removing radiator from engine, cleaning & reversing flushing, testing the thermostat and refitting on engine.

4.2 Removing water pump from engine and refitting.

4.3 Adjusting fan belt tension and connecting water pump with radiator by hoses & flushing cooling system of the engine.

4.4 Practice on - (a) Checking engine oil**,** (b) Draining engine oil**,** (c) Replacing oil filter**,** (d) Refilling engine oil**.**

4.5 Overhauling of oil pump, oil coolers, air cleaners and air filters and adjust oil pressure relief valves.

Module No-5: **Engine Fuel Feed System**

Outcome : Remember various components of the fuel feed system of a petrol and diesel engine, Service and check proper functionality

Theory Content:

1. **Fuel Feed System In Petrol Engine: Types -** Gravity feed system - Forced feed system, Components - Fuel Tank, Fuel Pump - Mechanical & Electrical Pump, Fuel filter, Troubleshooting.Carburetor: - Principle of Simple Carburetor - Working of Carburetor, Circuits in Carburetor, Servicing & Maintenance of Carburetor, Limitations of Carburetor, TroubleShooting.

2. **Petrol Engine Fuel Injection System (MPFI):** Classification of Multi Point Fuel Injection System - Specification - Components - Advantages.

3. **Fuel Feed System in Diesel Engine**: Layout of Fuel Feed system in diesel engines - Method and Types of Injection, Basic components – Fuel tank, Fuel lines, Fuel filters, Fuel feed pump, Air Cleaner, Fuel injection pump, Fuel injectors. Types of F.I.P. - Working of Plunger type Feed Pump - Phasing & Calibration of Injection Pump. Working of Distributor - Governor, Types of Governor – Working.

4. **Common Rail Direct Injection System (C.R.D.I.)**: Introduction to CRDI System - Basic Parameters of CRDI - Components of CRDI system with working.

5. **Fuel & Emission Control**: Classification of Fuel – Properties of fuel - Calorific Value – Octane Number - Cetane Number. Engine Knocking - Control of Knocking. Automobile Emission Control – Emission Norms: BSI, BSII, BSIII, BSIV, BSV. Initiative taken for Emission Reduction.

Practical Content:

5.1 Overhauling of fuel pump, carburetors, fuel filters and air cleaners.

5.2 Practice in engine tune up in a vehicle – testing vacuum and compression of engine, Demonstration about ECU, Sensors, Actuators, Petrol Nozzle. Fault finding practice.

5.3 Practice on removing & Cleaning fuel tanks, checking leaks in the fuel lines, soldering & repairing pipe lines. Bleeding of air from the fuel lines.

5.4 Removing a fuel injection pump from an engine-refit the pump to the engine re- set timing - fill lubricating-oil start

and adjust slow speed of the engine.

5.5 Practice on overhauling of injectors and testing of injector.

5.6 General maintenance of Fuel Injection Pumps (FIP).

5.7 Monitoring emissions procedures by use of Engine gas analyser or Diesel smoke meter.

5.8 EGR /SCR Valve Remove and installation for inspection.

Module No-6 : **Chassis – Suspension System, Wheel & Tyres**

Outcome: Classify different chassis layout and to dismantle and assemble components of suspension system, wheels and tyres from the chassis.

Theory Content:

1. **Automobile Chassis:** Description of Chassis - main components, Frame - Function of Frame, Types - Conventional Frame, Frameless or Integral Frame Chassis, Half Integral or half frame Chassis, Chassis Maintenance - Safety standard.
2. **Suspension Systems:** Basic function of suspension system, Types - Leaf Spring and their types, Mounting of Springs, Coil Spring, Independent Suspension system – McPherson Strut and Wishbone type, Torsion Bar
3. **Shock Absorber**: Function, Types - Mechanical shock absorber, Hydraulic shock absorber, Working of Telescope Shock Absorber, Testing, and Fitting & Inspection of Shock Absorber.
4. **Wheels & Tyres:** Wheel types & sizes, Rim sizes & designations, Types of wheels,Tyre types & characteristics- Radial, Cross ply, Working and comparison of tubed and tubeless tyre, Tyre distortion, Tyre materials, Specification of Tyre, Tyre tread designs, Factors affecting tyre performance and life

Practical Content:

6.1 Demonstration & identification of Chassis, Frame, Body. Demonstration about accident repair safety standard.

6.2 Practice on visual inspection of chassis frame for crack, bent and twists.

6.3 Overhauling and inspection of shackle, leaf spring, front & rear suspension.

6.4 Practice on removing, inspection and assembling of shock absorber and lubricating a suspension system.

6.5 Trouble shooting for Suspension system defects - wheel hop, ride height (unequal and low), noises under operation, fluid leakage, excessive travel, bounce, worn dampers, worn joints/damaged linkages, vehicle "crabbing".

6.6 Practice on removing wheels from vehicle, dismantling tyres and tubes checking puncture. Assembling inflating to correct pressure. Checking & adjusting tyre pressure.

6.7 Practice wheel balancing to balance the weight of tyre and wheel assembly

Module No 7: Steering & Braking System

Outcome:
Plan & perform maintenance, diagnosis and servicing of the steering assembly and braking system in automobiles

Theory Content :

1. **Steering System**: Necessity of Steering system, Components of Steering system - Steering Wheel, Steering outer tube, Steering column, steering Shaft, Drop Arm, Steering Box, Working of Steering system, Types of Steering Boxes, Steering Gear Ratio, Types of Steering Linkages.
2. **Steering Geometry**: Camber Angle, Toe-in , Toe-out, Ackerman Steering, Caster Angle, Negative Camber, King Pin Inclination, Negative Caster, Wheel Alignment.
3. **Power Steering**: Concept & function – Advantages - Hydraulic Assisted Steering - Electronic power steering.
4. **Brake System:** Requirement of a good Braking System, Types of Brake - Mechanical brakes, Parking Brakes, Hydraulic Brakes - Master Cylinder, Working of Master Cylinder, Brake shoes steady post, Brake shoe equalizing

system, Brake Shoe adjusting method, Bleeding of Brakes, Brake shoe lining, Brake Drums, Vacuum operated Brakes or Vacuum Servo Brakes, Exhauster, Air assisted hydraulic brakes, Air Brakes system, Brake Valve, Unloader valve, Line Filter, Stop Light Switch, Brake Chamber, Slack adjuster, Air Compressor, Air tank, Disc Type Brakes, Testing Of Brakes.

5. **Anti lock braking (ABS) system:** ABS brake system - Operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with EBD electronic control unit. The construction and operation of heavy vehicle Anti-Slip Regulation / Traction Control (ASR) system.

Practical Content:

7.1 Practice on removing the drop arm, Check and adjust the turning angle, align the drop arm and steering wheel with the front wheel. Check and correct toe-in.

7.2 Practice on removing steering wheel, steering gearbox.

7.3 Inspect and overhaul steering boxes, adjusting steering gear backlash, pre- load and adjust toe-in, toe-out, camber angle, castor angle, kingpin inclination and wheel run out.

7.4 Checking & adjusting power steering fluid**,** Pressure testing a power steering system**,** Flushing a power steering system**,** Inspecting & adjusting an engine drive belt**.**

7.5 Servicing a steering system**,** Servicing wheel bearings**.**

7.6 Practice on Adjusting brake pedal play.

7.7 Overhauling and inspection of tandem master cylinder assembly.

7.8 Overhauling and inspection of front and rear brake assembly.

7.9 Overhauling and inspection of wheel cylinder assembly.

7.10 Bleeding hydraulic brakes & Disk brakes.

7.11 Overhauling and inspection of vacuum assisted brake assembly.

7.12 Overhauling and inspection of disc brake.

7.13 Adjusting Air brakes- repair to tank unit, air compressor, wheel brake adjuster- locating air leaks in the brake lines and rectifying – general maintenance and care.

7.14 Practice on Brake Maintenance - checking & adjusting brake fluid**,** replacing brake fluid**,** checking brake pads**,** replacing brake pads**, r**eplacing brake linings**,** adjusting a parking brake cable

Module No:8 Auto Electrical System

Outcome: Identify, diagnose and repair the defects in various components of Auto electrical system.

Theory Content:

1. **Dynamo:** Function, Working & Components of Dynamo, Testing & Checking of Dynamo parts, Maintenance of Dynamo, Voltage & Current Regulator, Third Brush control system, Adjusting of Cut-out.

2. **Alternator:** Advantages of Alternator, Working & Components, Trouble shooting & Precaution to be taken in vehicles fitted with Alternator.

3. **Starter Motor:** Working & Construction of Starter Motor, Components of Self-Starter, Bendix Drive, Starting circuit for Starter Motor, Solenoid Switch, Axial type self-starter, Fault finding.

4. **Ignition System:** Types of Magneto Ignition System, Working of Flywheel Magnets, Comparison Between Coil & Magneto Ignition, Battery Ignition system, Ignition Coil, Polarity of Coil, Condensor, Distributors, Construction of Distributors, Spark advance mechanism, Setting of Contact Breaker Gap, Distribution Point Air Gap, Spark Plug, Function & Working of Spark Plug, Types Of Spark plug, - According to Thread, Reach, Shape of electrode, Hot & Cold Plug, Difference between Hot & Cold Plug, Spark Plug Identification Marks, Causes of Spark Plug failure, Ignition Timing, Final adjustment with timing light,

5. **Electronic Ignition System:** Disadvantages of conventional Contact breaker system, advantages of Electronic Ignition system, Electronic solid state ignition system, Electronic Distributor, Primary Winding Energized.

6. **Battery:** Construction & Main components of Battery, Chemical action in Battery, Maintenance of Battery, Specific Gravity, High rate Discharge Tester, Charging of Battery.

7. **Wiring & Electrical Accessories**: Role of electricity in modern vehicles, Automobile wirings, Colour Code, Wiring Harness, Types of Wiring, Types & Grade of Wire, Heater Plug, Glow Plug, heater Coil, Lighting System. Trouble Shooting.

Practical Content:

8.1 Removing & replacing an alternator

8.2 Inspection of rotor for ground, open circuit – field coil resistance, slip ring surface, Fan, bearing.

8.3 Inspection of stator for ground, open circuit, Inspection of Drive end bearing rotation, Rectifier, brush length compare with service manual.

8.4 Inspecting & adjusting an engine drive belt**,** Replacing an engine drive belt **/** pulleys / Tesnionsers and their alignments.

8.5 Removing starter motor from vehicle and performance test for pull-in test, Hold-in test, pinion (plunger) return test, No-load performance test. Solenoid test for Hold in coil open circuit, Armature test – Ground test, Open circuit test, pull- in coil open circuit test, field coil test. Inspections of brush length wear as per service manual.

8.6 Check and replace ignition coil, overhauling Distributor Assembly. Checking ignition timing**,** Checking & changing a spark plug**,** Removing & replacing contact points.

8.7 Demonstration about the Electronic ignition system and its main parts, Trouble shooting.

8.8 Demonstration of Battery, main parts, charging circuit, parallel & series connection, Specific Gravity Measurement practice, Use of High Rate Discharge Tester.

8.9 Practice on light circuit - test bulbs, align head lamps, aiming headlights**.** changing a headlight bulb, checking of a head light switch and to replace if faulty.

8.10 Trouble shooting for Headlight - headlight - do not light up, only one headlight does not light up, Only one beam ("Hi" or "Low") does not light.

8.11 Trouble shooting for turn signal and hazard warning lights -Flash rate high or one side only flashes, No Flashing, flash rate low.

Module NO : 9 Automobile Transmission system

Outcome: Identify the elements of transmission system and to perform maintenance, diagnosis and Servicing of transmission system.

Theory Content:

1. **Clutch:** Function, Qualities of good clutch, Types of Clutches - Cone Clutch, Single plate clutch, Multi plate clutch, Wet clutch, Clutch Adjustment, Hydraulic operated clutch, Clutch repair & maintenance.
2. **Fluid Flywheel & Torque Converter**: Function, Components of fluid flywheel, Torque converter, Advantages, Maintenance.
3. **Gear Box**: Necessity of Gear Box, Resistance on moving vehicle, Gear Ratio, Mechanical Advantage, Torque Ratio in Gears, Types of Gears, Types of Gear Boxes - Sliding Mesh, Constant Mesh, Synchromesh Gear Box, Gear Shifting, Hand gear lever, Gear selector Mechanism, Slipping out of Gear, Planetary Type Gear Box.
4. **Universal Joint & Propeller Shaft**: Types of Universal Joints - Cross type, Constant Velocity type, Rubber coupling, Pot type of joint, Lay rub type joint, Propeller Shaft, Type of drive for Rear Axle, Radius Rod Drive, Torque tube drive, Torque arm drive, Hotchkiss drive.

5. **Rear Axle & Differential**: Function & Types - Dead Axle, Live Axle, Main parts of Rear Axle, Type of Axle Drive, Differential Assembly, Types of Crown Wheel & Pinion Drive, Spur Gear, Helical Gear, Hypoid gear, Worm Gear, Thrust Pad, Crown wheel and pinion adjustment, Adjusting of Backlash, Two speed rear axle, Differential Trouble shooting.

6. **Front Axle**: Function, Axle types, Layout of Front axle, Checking Axle Beam & Stub Axle for bent, Checking for King Pin Inclination, Drag Link - Tie Rod & Ball Joints.

Practical Content:

9.1 Practice on adjusting clutch pedal play.
9.2 Removing gearbox and clutch assembly from light vehicles.
9.3 Dismantling clutch assembly, cleaning & inspecting parts.
9.4 Removing & fitting of new pilot bearing.
9.5 Removing & fitting of ring gear in fly wheel.
9.6 Relining a clutch plate.
9.7 Checking condition of flywheel and pressure plate surface for reconditioning.
9.8 Assembling of pressure plate adjusting the fingers checking run out of fly wheel and aligning clutch assembly with flywheel.
9.9 Dismantling, cleaning and assembling of gearshift mechanism.
9.10 Dismantling a synchromesh gear box, cleaning, inspecting parts replacing worn out defective parts assembling & testing for correct performance.
9.11 Practice on removing open type propeller shaft from vehicle,
9.12 Practice on removing universal joints, cleaning, replacing worn out parts, re-assembling & refitting to vehicle - and their alignment special precautions while removing torque tube drive shaft.
9.13 Practice on FWD Driveshaft removal and replacement.
9.14 Practice on overhauling & inspection of rear axle.
9.15 Practice on overhauling & inspection of differential assembly.

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1.	Identity a variety of hand tools and power tools and describe their purpose, application and operate them in a safe and proper manner.	***After completion of this module tudents will be able to*** 1.1 List the safety rules for hand tools. 1.2 Describe the purpose, use of various auto hand tools. 1.3 Explain the working principles of measuring instruments and special tools required for automobile workshop. 1.4 Select the correct tool for a given job. 1.5 Select, care and use different measuring instrument. 1.6 Set up the measured value with workshop manual and quality concepts and proper safety.

Module No.	Outcome	Assessment Criteria
2.	Identify and test various electrical and electronic components	***After ompletion of this module, students will be able t*** 2.1 Plan and prepare, as per procedure and safety methods, soldering cable ends using an electric soldering iron. 2.2 Use crimping tool to make a circuit joint. 2.3 Explain the connection of an ammeter, voltmeter, and ohmmeter in a circuit trouble shooting. 2.4 State open & short circuit, series and parallel circuits. 2.5 Verify DC series & parallel circuits and its characteristics. 2.6 Check out the open and short circuits in the lighting circuits. 2.7 Verify ohm's law and measure resistance using rheostat. 2.8 Check the voltage drop in the auto electrical system by using multimeter. 2.9 Determine the forward to reverse resistance ratio of diodes and identify good / bad diodes. 2.10 Perform battery charging and check.
3.	List various components of SI and CI engines; dismantle, assemble, overhaul and service Petrol/Diesel engines and their accessories.	***After completion of this module, students will be able to*** 3.1 Remove accessories fitted to the engine prior to engine removal. 3.2 Remove the engine mountings and the engine from vehicle. 3.3 Measure different engine parameters and compare the measurements with service manual like piston ring gap, piston ring to groove clearance, piston outer diameter etc. 3.4 Remove piston and connecting rods from engine. 3.5 Check cylinder bore wear for ovality and taper. 3.6 Mount the engine on the vehicle and refit the accessories to the engine. 3.7 Diagnose high fuel consumption, engine overheating, excessive oil consumption, low/high oil pressure, abnormal engine noise.
4.	Name various components of cooling and lubrication system, explain their function, test and repair them	***After completion of this module tudents will be able to*** 4.1 Overhaul radiator, water pump, oil pump, air cleaner. 4.2 Check the engine oil pressure at different r.p.m. 43 Check & top up coolant; drain & refill coolant. 4.4 Test cooling system pressure & clean & reverse flush Thermostat. 4.5 Overhaul oil pump and refit & repair oil flow pipe lines and unions if necessary. 4.6 Check proper functioning of radiator fan.
5.	Explain various components of the fuel feed system of a petrol and diesel engine, Service and check proper functionality	***After completion of this module, students will be able to*** 5.1 Overhaul and test fuel injectors. 5.2 Overhaul and service fuel feed pump, fuel injector pump. 5.3 Carry out general maintenance of FIP. 5.4 Remove & clean fuel tanks and check leaks in the fuel lines. 5.5 Bleed of air from the fuel lines. 5.6 Monitor engine emission by exhaust gas analyzer.

6.	Classify different chassis layout and to dismantle and assemble components of suspension system, wheels and tyres from the chassis	***After completion of this module, students will be able to*** 6.1 Use the tools and equipment in the way specified by manufacturers to overhaul suspension system, shackle, leaf spring. 6.2 Identify chassis, frame, body and visually inspect chassis for bent, crack and twists. 6.3 Carry out wheel balancing to within acceptable limits. 6.4 Carry out the recommended trouble shooting procedure as per Workshop manual for a) Abnormal wear b) Wheel wobbling c) Poor self centering d) Hard steering. 6.5 Remove wheels from vehicle, dismantle tyres and tubes and check for puncture.
7.	Plan & perform maintenance, diagnosis and servicing of the steering assembly and braking system in automobiles	***After completion of this module students will b able to*** 7.1 Use the tools and equipment in the way specified by manufacturers to overhaul steering and braking system. 7.2 Overhaul and inspect: a) Master cylinder, b) Tandem Master cylinder, c) Front and rear brake, d) Wheel cylinder, e) Vacuum booster, f) Air servo unit, g) Air tank (reservoir), h) Brake valve, i) Hand/parking brake, j) Single brake chamber, k) Disc brake. 7.3 Adjust brake pedal play. 7.4 Overhaul steering box and adjust steering gear backlash, toe-in, toe-out, camber angle, castor angle, kingpin inclination and wheel run out.
8.	Identify, diagnose and repair the Defects in various components of Auto electrical system.	***After completion of this module, students will be able to*** 8.1 Remove starter motor from vehicle and perform performance test to check its functionality. 8.2 Remove and replace alternator, ignition coil and battery. 8.3 Illustrate the different components of a car battery. 8.4 Inspect the light circuit - test bulbs, align head lamps, aim headlights**,** change a headlight bulb. 8.5 Trouble shoot the headlight assembly and signal light assembly.
9.	Identify the elements of transmission system and perform maintenance, diagnosis and servicing of transmission system.	***After completion of this module students will be able to*** 9.1 Select tools and materials for a job and make them available for use in a timely manner. 9.2 Use the tools and equipments in the way specified by manufacturers to overhaul vehicle transmission unit. 9.3 Adjust clutch pedal play. 9.4 Overhaul and inspect: a) Gear box, b) Single plate clutch assembly, c) Diaphragm clutch assembly, d) Constant mesh Gear box, e) synchromesh gear box, f) Gear linkages, g) Propeller shaft, h) Universal Slip Joint, i) Rear axle assembly, j) Differential assembly.

Tools, Equipments & material needed for 30 Trainees

Sl No	Name of the tools & equipment	Specification	Quantity (Nos)
1.	Adjustable spanner (pipe wrench)	350 mm	7 (6+1)
2.	Allen Key set of 12 pieces	2mm to 14mm	7 (6+1)
3.	Air ratchet	with standard accessories	5 (4+1)
4	Air impact wrench	with standard accessories.	5 (4+1)
5	Anvil with Stand	50 Kgs	5 (4+1)
6	Auto Electrical test bench	For checking Dynamo, alternator & Starter.With minimum 2HP AC Motor, Digital Voltmeter & ammeter. Transformer minimum 150A.	1
7	Automotive oil pump for dismantling and assembling		2
8	Automotive water pump for dismantling and Assembling2		2
9	Battery —charg1er	Capable to charge batteries from SAH — 150AH.	2
10	Car – old/used1	With all accessories and components for practice of dismantling and assembling.	1
11	Chassis of ca7r (old) with suspension sy2stem, steering system, brakin7g system etc for practice of dismant2ling the components and assembling	Chassis with all accessories and components	1
12	Chisel flat	10 cm	7 (6+1)
13	Circlip pliers Expanding and contracting	15cm and 20cm	2
14	Cleaning tray	45x30 cm.	7 (6+1)
15	Compression testing gauge	suitable for diesel engine with standard accessories	2
16	Copper bit soldering iron	0.25 Kg	7 (6+1)
17	Cut section of cross ply and radial tyres		2
18	Depth micrometer	0-25 mm	2
19	Different type of Engine Bearing model	10 Different types on board	2
20	Different type of piston model	5 Different Types on board	2
21	Disk brake assembly in working condition with all parts	Exhibiting Brake disc, Caliper assembly, tandem master cylinder, brake hoses, oil bottle, pedal, etc.	2
22	Drum brake assembly in Working Condition	Brake drum, tandem master cylinder, oil container, brake hose, brake pedal.	2
23	Drill twist (various sizes)	1.5 mm to 8 mm by 0.5mm	7 (6+1)
24	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	7 (6+1)
25	Exhaust Gas Analyzer		1
26	File flat , bastard	20 cm	7 (6+1)

Sl No	Name of the tools & equipment	Specification	Quantity (Nos)
27	File, half round ,second cut	20 cm	7 (6+1)
28	File, Square second cut	20 cm	7 (6+1)
29	File, triangular , second cut	15 cm	7 (6+1)
30	Flat File , second cut	25cm	7 (6+1)
31	Fuel feed pump for Diesel	Hand operated Plunger Type	2
32	Fuel injection pump (Diesel) inline	4/6 cylinders RSV Mechanical Pneumatic Governor Type.	2
33	Grease Gun		2
34	Hacksaw frame	adjustable 20-30 cm	7 (6+1)
35	Hammer Ball Peen	0.75 Kg	7 (6+1)
36	Hammer Chipping	0.25 Kg	7 (6+1)
37	Hammer copper with handle	1 kg	7 (6+1)
38	Hammer Mallet		7 (6+1)
39	Hammer Plastic		7 (6+1)
40	Hand vice	Up to 37 mm	7 (6+1)
41	Hollow Punch set of seven pieces	6mm to 15mm	7 (6+1)
42	Injector testing set	(Hand tester)	2
43	Insulated Screw driver	20 cm x 9mm blade	7 (6+1)
44	Magneto spanner set with 8 spanners		2
45	Multimeter digital	LCD Display	2
46	Oil can	0.5/0.25 liter capacity	2
47	Outside micrometer	0 to 25 mm, 25 to 50 mm	2
48	Petrol and diesel engine (old/used engines) of cars for practice of dismantling the components and assembling	Engine with all accessories and components	1+1
49	Piston ring compressor		2
50	Piston Ring expander and remover		2
51	Piston Ring groove cleaner		2
52	Pliers flat nose	15 cm	7 (6+1)
53	Pliers round nose	15 cm	7 (6+1)
54	Pliers side cutting	15 cm	7 (6+1)
55	Portable electric drill Machine	Upto 10mm (heavy duty)	2
56	Prick Punch	15 cm	7 (6+1)
57	Radiator cut section	Radiator with sectioned upper & lower tanks, radiator core and cap.	2
58	Scraper Triangular	25 cm	7 (6+1)
59	Scriber	15 cm	7 (6+1)
60	Spanner, adjustable	15 cm	7 (6+1)
61	Spark plug spanner 14mm x 18mm x Size	Long bit for Alto/800	2
62	Steel measuring tape in a case	10 meter	7 (6+1)
63	Steel rule 15 cm inch and metric		7 (6+1)
64	Steering assembly – 1.Rack &	1. Rack & Pinion with steering wheel, column, tie rod end. 2. Worm & Roller steering	1 each

Sl No	Name of the tools & equipment	Specification	Quantity (Nos)
	pinion, 2.Worm & roller 3. Recirculating ball, 4.Power steering, 5. Electric Assisted Power Steering	assembly with drop arm. 3. Recirculating Ball steering with pitman shaft and drop Arm. 4. Hydraulic working power steering with steering wheel, column, flow pipe, hydraulic pump, oil reservoir. Electric Assisted Power Steering with Rack and pinion, Electric Motor and Motor Control Module	
65	Stud extractor set of 3		2
66	Stud remover with socket handle		2
67	Surface gauge with dial test indicator plunger type2	0.01 mm	2
68	Synchronous Gear b2ox with stand for Dismantling a2nd assembly	Gearbox with 5 Forward & 1 Reverse Gear.	2
69	Tachometer (Counting tvpe)		2
70	Tandem master cylinder with booster		2
71	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	2
72	Turbocharger cut sectional view	Latest WGT type to show, turbine, impeller and compressor wheels.	2
73	Tyre pressure gauge with holding nipple		2
74	Universal puller for removing pulleys, bearings		2
75	V' Block 75 x 38 mm pair with Clamps		7
76	Vacuum gauge	0 to 760 mm of Hg.	2
77	Valve Lifter		2
78	Valve spring compressor universal		2
79	Vernier calipers	0-300 mm with least count 0.02mm	7 (6+1)
80	Working model of Air Brake Assembly	Two front drum sectioned to show the internal working - Front drum run by hand - Rear brake drum assembly (without drum) with brake shoe & liner, vehicular air compressor, air dryer, different valves, air pressure gauges, Spring break actuator, Stop light, Brake Chamber with all accessories.	1
81	Working Model of layout of a motor car - electrical system	Wiring with parts and accessories of a car arranged	1

Sl No	Name of the tools & equipment	Specification	Quantity (Nos)
		accordingly - Working of Self-starter, Alternator, Wiper Motor, Horn, lighting system, sparks from plug to be shown with Distributor & battery - mounted on suitable table	
82	Wheel alignment Machine - computerized 3D (Optional)	Latest machine for four wheel alignment. With connected camera , IR Lighting Source min. 8mm, Reflector metal based, should work in sunlight	1
83	Wheel balancing machine	For wheel balancing of LMV. Motor 0.5 HP Shaft Diameter min 38mm. Hardened flange assy. Balancing catch nut of metal.	1

Marks Distribution

Outcome	Outcome Code	Total Th Marks	Total Pr Marks
Identity a variety of hand tools and power tools and describe their purpose, application and operate them in a safe and proper manner.	AUT/0405/OC1	10	40
Identify and test various electrical and electronic components	AUT/0405/OC2	10	40
Demonstrate various components of SI and CI engines; dismantle, assemble, overhaul and service Petrol/Diesel engines and their accessories.	AUT/0405/OC3	20	60
Identify various components of cooling and lubrication system, explain their function, test and repair them	AUT/0405/OC4	10	40
Describe various components of the fuel feed system of a petrol and diesel engine, Service and check proper functionality	AUT/0405/OC5	20	60
Classify different chassis layout and to dismantle and assemble components of suspension system, wheels and tyres from the chassis	AUT/0405/OC6	20	60
Plan & perform maintenance, diagnosis and servicing of the steering assembly and braking system in automobiles	AUT/0405/OC7	20	60
Diagnose and repair the Defects in various components of Auto electrical system.	AUT/0405/OC8	20	70
Identify the elements of transmission system and perform maintenance, diagnosis and servicing of transmission system	AUT/0405/OC9	20	70
Work in real job situation with special emphasis on basic safety and hazards in this domain (OJT).	AUT/0405/OC10	0	300
Employability Skill-60 Hrs	DGT/VSQ/N0102	50	0