

CRAFTSMEN TRAINING SCHEME (CTS)

ANNUAL INSTRUCTIONAL PLAN

MECHANIC MOTOR VEHICLE (MMV)

FIRST YEAR (42 WEEKS) — NSQF LEVEL 4 / CTS 3.0

Curriculum as per DGT / CSTARI Guidelines for Mechanic Motor Vehicle Trade

Trade Name	MECHANIC MOTOR VEHICLE (Engineering Trade)
NSQF Level & Duration	NSQF Level-4 Two Years (First Year - 42 Weeks)
Academic Session	20____ - 20____
Institute Name & Address	
Instructor Name & Designation	
Group Instructor (GI) Name	
Principal / Supt. Name	

WEEKLY INSTRUCTIONAL PLAN (WEEK 1 TO WEEK 42)

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
WEEK 01	Safety & Workshop Induction: 1. Familiarisation with institute, job opportunities in automobile sector, machinery used in trade, types of work done on shop floor. 2. Practice operation of different workshop equipment. 3. Demonstrate optimum resource management like electricity, water, raw materials, consumables at ITIs.	Trade Introduction & Shop Safety: 1. Introduction of Automobile, evolution of automotive. 2. Automotive bodies: ARAI, NCAP, BS Norms, SIAM. 3. Course duration, syllabus, general rules, facilities, 5S concept, 10 principles of workmanship, waste segregation. 4. Safety precautions, First aid, safety signs (Danger, Warning, Caution), fuel spillage handling, fire extinguishers.
WEEK 02	Hand Tools & Marking Aids: 1. Practice using marking aids: steel rule, spring callipers, dividers, scribe, punches, chisel, surface plate, magnetic stand, V-block, plastigauge, Vernier height gauge, angle plate, bore dial gauge. 2. Layout a work piece for straight lines, circles, arcs.	Marking & Hand Tools: 1. Safe disposal of toxic dust, safe handling and periodic testing of lifting equipment, electrical safety tips, road vehicles safety and automotive emissions. 2. Marking scheme and materials (chalk, Prussian blue), cleaning tools (scrapers, wire brush, emery paper). 3. Surface plates, steel rule, measuring tape, try square, callipers, dividers, scribe, prick/centre/pin/hollow punches, chisels, hammers.
WEEK 03	Power Tools & Fastening Tools: 1. Practice removing wheel lug nuts using air impact wrench. 2. Practice on general workshop tools & power tools. 3. Practice battery impact wrench & charging method. 4. Knowledge about nut runner linked to conveyor (fool-proof system).	Power Tools & Wrenches: 1. Screwdrivers, Allen keys, bench vice, C-clamps. 2. Spanners (ring, open, combination, universal adjustable), sockets & accessories. 3. Pliers (combination, multi-grip, long nose, flat nose, circlip pliers). 4. Air impact wrench, air ratchet, torque wrenches, pipe wrenches, car jet washers, pipe flaring & cutting tools, gear and bearing pullers.
WEEK 04	Precision Measurement (Engine Components): 1. Cam lift measurement. 2. Measuring practice on camshaft journal dia, crankshaft journal dia, valve stem dia, piston diameter, and piston pin dia with outside micrometers. 3. Measuring practice on height of rotor of oil pump from housing surface with depth micrometer.	Precision Measurement Systems: 1. Description, least count, care & use of outside and depth micrometers, micrometer adjustments. 2. Vernier callipers, telescope gauges, dial bore gauges, dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tyre pressure gauge. 3. Role of V-block and plastigauge in automotive measurements.
WEEK 05	Engine Clearance & Warpage Measurement: 1. Measuring practice on valve spring free length. 2. Measuring practice on cylinder bore for taper and ovality with dial bore gauges. 3. Measure wear on crankshaft end play, crankshaft runout, and valve guide with dial indicator. 4. Inspect cylinder block, cylinder head, manifold for warpage with straightedge and feeler gauge. 5. Check end gap, groove clearance of piston ring, piston-to-cylinder wall clearance with feeler gauge. 6. Check engine manifold vacuum with vacuum gauge.	Limits, Fits & Engine Clearances: 1. Limits, fits and clearances in automotive engines. 2. Measuring warpage of intake & exhaust sides of cylinder head. 3. Measuring piston ring side clearance and end gap. 4. Vacuum gauge testing principles and engine condition diagnostics.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
WEEK 06	Basic Fitting, Drilling & Tapping: 1. Practice marking and drilling clear and blind holes, sharpening of twist drills, safety precautions on drilling machines. 2. Tapping clear and blind holes, tap drill size selection, lubrication, use of stud extractor. 3. Cut threads on bolt/stud, adjust two-piece die, reaming hole/bush, scraping machined surfaces.	Drilling, Taps & Dies: 1. Engineering materials and metals. 2. Bench and portable drilling machines, drill holding and work holding devices, twist drill geometry. 3. Hand taps and wrenches, tap drill size calculations (metric & inch), dies, die stocks, screw extractors. 4. Hand reamers, drill sizes for reaming, lapping abrasives and laps.
WEEK 07	Basic Electricity & Circuit Measurement: 1. Practice joining wires using soldering iron, construct simple electrical circuits, measure current, voltage and resistance using multimeter. 2. Continuity test for fuses, jumper wires, fusible links, circuit breakers.	Electrical Principles: 1. Electricity principles, ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. 2. Voltmeter, Ammeter, Ohmmeter, Multimeter. 3. Conductors, Insulators, Wires, Shielding, Length vs resistance, Resistor ratings.
WEEK 08	Automotive Circuits & Wire Sizing: 1. Diagnose series, parallel, and series-parallel circuits. 2. Check electrical circuit with test lamp, voltage drop test using multimeter, measure current flow with multimeter/ammeter, use wiring diagrams.	Circuit Protection & Resistance: 1. Fuses & circuit breakers, ballast resistors, stripping wire insulation, cable colour codes and sizes. 2. Resistors in series, parallel, and series-parallel networks. 3. Electrostatic effects, capacitors and applications in DC circuits.
WEEK 09	Battery Maintenance & Testing: 1. Cleaning and topping up of lead acid battery, testing with hydrometer. 2. Measure specific gravity and freezing point through refractometer. 3. Connect battery to charger, test after charging, diagnose excessive key-off battery drain (parasitic draw).	Batteries & Chemical Effects: 1. Chemical effects of electric current, batteries and cells. 2. Lead-acid batteries and Sealed Maintenance Free (SMF) batteries. 3. Battery capacity rating, Ampere-Hour (AH) rating, charging methods, safety precautions.
WEEK 10	Relays, Solenoids & Basic Electronics: 1. Testing of relays, solenoids, and their circuits. 2. Test diodes for functionality. 3. Perform battery load test and cranking voltage, State of Charge (SoC), State of Health (SoH) check-up, decode battery numbers.	Electromagnetism & Solid State Devices: 1. Magnetic & heating effects, thermo-electric, thermistors, thermocouples, piezo-electric energy. 2. Electromagnetic induction, relays, solenoids, transformers, stator and rotor coils. 3. Semiconductors, solid-state devices (diodes, transistors), battery rating standards.
WEEK 11	Hydraulics & Pneumatics in Vehicles: 1. Identify hydraulic and pneumatic components used in vehicles. 2. Trace hydraulic circuits on hydraulic jack, hydraulic power steering, and brake circuit. 3. Identify components in air brake systems.	Fluid Power Systems: 1. Pascal's law, pressure, force, viscosity. 2. Hydraulic gear pumps (internal & external), single/double-acting cylinders, pressure relief valves, non-return valves, flow control valves. 3. Pneumatic symbols, reciprocating air compressors, FRL units.
WEEK 12	Vehicle Classification & Service Station Equipment: 1. Identify different types of vehicles, verify vehicle specification data. 2. Identify Vehicle Identification Number (VIN). 3. Operate garage and service station equipment: 2-post and 4-post hoists, engine hoists, jacks, jack stands, secondary supports.	Vehicle Specifications & Shop Equipment: 1. Automotive terminology: VVT, VTVT, CRDI, D4D, DCT, CVT, IVT, AMT, ABS. 2. Vehicle classification by load (CMVR), wheels, final drive, fuel used, axles, engine position. 3. Vehicle hoists, safety latches, secondary supports, hydraulic jacks and engine cranes.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
WEEK 13	Engine Construction (Petrol & Diesel): 1. Identify major components in diesel engine of LMV/HMV. 2. Identify major components in petrol engine of LMV/HMV. 3. Practice starting and stopping of engines. 4. Report readings of tachometer, odometer, temperature, fuel gauge under idle and load conditions.	Internal Combustion Engine Principles: 1. Internal vs external combustion engines, classification of IC engines. 2. Working principles of 4-stroke CI and SI engines, comparative analysis. 3. Direct vs indirect injection, technical terms (TDC, BDC, stroke, displacement, compression ratio). 4. Dashboard gauges, warning lamps (MIL, oil pressure, battery, temperature).
WEEK 14	Engine Dismantling Preparation & Petrol Basics: 1. Identification of differences in components of petrol and diesel engines. 2. Practice dismantling engine of LMV/HMV as per standard procedure.	Petrol Engine Induction & Fuel Systems: 1. 4-stroke spark-ignition engine components, cams, camshaft, scavenging, counterweights. 2. EFI intake systems, air cleaners, manifolds, heated intake air. 3. Gasoline fuel characteristics, stoichiometric ratio, fuel supply system, pressure and vacuum.
WEEK 15	Cylinder Head Overhauling: 1. Overhauling cylinder head assembly, use service manual for clearance and parameters. 2. Practice removing rocker arm assembly and manifolds. 3. Checking valve seats, valve guides, replace valves if necessary, check valve overlap.	Cylinder Head & Combustion Chambers: 1. Criteria for engine overhauling. 2. Cylinder head construction, head design, intake/exhaust passage sizing, cylinder head gaskets. 3. Petrol and diesel combustion chamber designs, importance of turbulence.
WEEK 16	Valves & Rocker Mechanism: 1. Test valve seat leakage; dismantle rocker shaft assembly, clean, check rocker shaft and levers for wear/cracks, reassemble. 2. Check valve springs, tappets, push rods, tappet screws, valve stem caps.	Valves & Operating Mechanisms: 1. Engine valves: types, materials, operating mechanisms, valve seats and inserts. 2. Valve rotation, valve stem oil seals, intake vs exhaust valve sizes. 3. Valve trains, valve timing diagram, Variable Valve Timing (VVT) principles.
WEEK 17	Valve Timing & Camshaft Drive: 1. Reassemble valve parts in sequence, refit cylinder head and manifold & rocker arm assembly. 2. Adjust valve clearances (tappet setting), start engine after adjustments.	Camshaft & Timing Drives: 1. Camshafts and drive mechanisms: Overhead camshafts (SOHC, DOHC). 2. Cam lobes, timing belts, timing chains, belt tensioners, and timing alignment marks.
WEEK 18	Piston & Connecting Rod Removal: 1. Overhauling piston and connecting rod assembly using service manual clearances. 2. Practice removing oil sump and oil pump, clean sump. 3. Practice removing big end bearings, connecting rod with piston.	Piston Assembly Theory: 1. Pistons: functions, types, materials, piston clearances, compression ratio. 2. Piston rings: compression rings, oil scraper rings, materials, ring clearances, ring fitting precautions.
WEEK 19	Piston Inspection & Rod Alignment: 1. Practice removing piston rings; dismantle piston and connecting rod. 2. Check ring side clearance in grooves & lands; check piston skirt and crown for scuffing; clean oil holes. 3. Measure piston ring end gap in cylinder, clearance between piston and liner. 4. Measure clearance between crankpin and connecting rod big end bearing. 5. Check connecting rod for bend and twist; assemble piston and connecting rod.	Connecting Rod & Bearings: 1. Connecting rod design, obliquely split big-end, materials used. 2. Big end and main bearing shells, piston pins (gudgeon pins) and pin locking methods. 3. Connecting rod alignment, checking rod twist and bend.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
WEEK 20	Crankshaft Removal & Inspection: 1. Carry out overhauling of crankshaft referring to service manual with crankshaft alignment gauge (manual/laser). 2. Practice removing damper pulley, timing gear/chain, flywheel, main bearing caps, bearing shells, crankshaft. 3. Check oil retainer and thrust surfaces for wear.	Crankshaft & Engine Bearings: 1. Crankshaft construction, crankshaft journals, crank webs, counterweights. 2. Engine bearings: classification, materials, shell bearings advantages, special diesel bearing materials. 3. Bearing failure causes, care and maintenance.
WEEK 21	Crankshaft Measurement & Flywheel: 1. Measure crankshaft journal for wear, taper, ovality; check fillet radii, bend & twist. 2. Check flywheel, mounting flanges, spigot bearing. 3. Check vibration damper for defects; remove camshaft from cylinder block, check for bend & twist; inspect cam lobes, journals, bearings, measure cam lift.	Crankshaft Balancing & Flywheel: 1. Crankshaft balancing, engine firing orders. 2. Flywheel function, starter ring gear, vibration dampers. 3. Crankcase, oil pump drive, timing marks, chain tensioners, flywheel clutch coupling.
WEEK 22	Cylinder Block Inspection & Plastigauge Fitting: 1. Fix bearing inserts in block & cap; check nip and spread clearance, oil holes, locating lugs; fix crankshaft on block; torque bolts; check end play; check seating; repeat for connecting rods. 2. Clean and check cylinder block, visually check surface flatness. 3. Measure cylinder bore for taper & ovality, bore diameter and stroke; clean oil galleries and descale water jackets.	Cylinder Block & Liners: 1. Cylinder block construction, materials, crankcase design. 2. Cylinder sleeves/liners: Dry liners and Wet liners, installation and replacement methods. 3. Oil galleries, water jackets, block inspection for cracks and distortion.
WEEK 23	Cooling System Servicing: 1. Practice checking & top up coolant, drain & refill coolant, replace coolant hose. 2. Test cooling system pressure, remove & replace radiator/thermostat. 3. Inspect radiator pressure cap, test thermostat. 4. Perform cooling system cleaning & reverse flushing. 5. Inspect water pump and replace/refit.	Engine Cooling Principles: 1. Need for cooling system, heat transfer principles, boiling point vs pressure. 2. Coolant properties, antifreeze solutions, recommended change intervals. 3. Cooling systems: direct air cooling, indirect liquid cooling (thermosiphon, forced circulation). 4. Radiator, hoses, water pump, thermostat, cooling fans (viscous/electric), expansion tank, thermo-switch.
WEEK 24	Lubrication System Servicing: 1. Check engine oil, drain oil, replace oil filter, refill engine oil. 2. Inspect oil pump, oil coolers, inspect oil pressure relief valves, repair oil lines and unions.	Engine Lubrication Principles: 1. Need for lubrication, functions of engine oil, SAE viscosity ratings, API classifications, additives, synthetic oils. 2. Lubrication systems: splash, full pressure, dry sump systems. 3. Oil pumps (gear, rotor, vane), relief valves, oil filters, oil coolers, spurt holes, pressure switches.
WEEK 25	Intake & Exhaust System Servicing: 1. Check intake systems: air filters, intake manifolds. 2. Inspect turbocharger / supercharger, replace if necessary. 3. Inspect, clean and refit intercooler. 4. Check exhaust system rubber mountings for deterioration, check leaks, dents; remove and install exhaust manifold and catalytic converter.	Intake & Exhaust Dynamics: 1. Intake components: air cleaners (dry, oil bath), intake manifolds. 2. Turbocharger (wastegate, VGT), superchargers, intercoolers. 3. Exhaust manifolds, extractors, mufflers (reactive, absorptive, combination), catalytic converters, back-pressure effects.
WEEK 26	Diesel Fuel Feed & Filter Servicing: 1. Check fuel delivery from fuel pump, replace fuel filters. 2. Bleed air from fuel lines, service primary and secondary fuel filters. 3. Remove fuel injection pump (FIP) from engine, refit pump, fill lubricating oil, start and adjust idle speed.	Diesel Fuel System Principles: 1. History of diesel injection, diesel fuel characteristics, quiet & clean diesel technology. 2. Fuel tanks, fuel lines, water separators, fuel feed pumps (mechanical/electrical), priming pump. 3. Inline injection pumps, distributor pumps, spill timing cut-off method.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
WEEK 27	Injectors & Electronic Diesel Control (CRDI): 1. Check resistance of injectors and calibrate. 2. Practice testing CRDI components and replacement.	Common Rail Diesel Injection (CRDI): 1. Electronic Diesel Control (EDC) systems, Common Rail Diesel Injection (CRDI) overview. 2. High-pressure pump, common rail, rail pressure sensor, pressure limiter. 3. Solenoid and Piezo injectors, sensors, actuators, and ECU in diesel engines.
WEEK 28	Petrol Injection Systems (MPFI / GDI / TFSI): 1. Practice testing MPFI / GDI / PGM-FI components and replacement. 2. Check fuel delivery from petrol pump, replace petrol filter.	Gasoline Injection Technologies: 1. Petrol fuel injection principles, fuel characteristics, fuel tank modules. 2. Multi-Point Fuel Injection (MPFI), Gasoline Direct Injection (GDI), PGM-FI, Turbocharged Fuel Stratified Injection (TFSI). 3. Electronic throttle body, fuel rail, high-pressure direct injectors.
WEEK 29	Engine Assembly & Timing Setting: 1. Reassemble all engine parts in correct sequence, torque bolts and nuts as per workshop manual. 2. Replace cam belt / timing chain, inspect & adjust engine drive belt, replace drive belt.	Engine Assembly Procedures: 1. Engine assembly standard operating procedures. 2. Special tools, torque wrenches, angular torque gauges. 3. Timing belt/chain tensioning procedures and alignment mark verification.
WEEK 30	Engine Performance & Cylinder Compression Testing: 1. Test cylinder compression pressure using compression gauge. 2. Check and adjust idle speed. 3. Test performance of engine off-load, adjust timings. 4. Check performance for misfiring cylinder by isolating injectors; test, dismantle, replace parts, reassemble to engine.	Engine Performance Evaluation: 1. Cylinder compression testing procedures and diagnostic interpretation. 2. Ignition and injection timing adjustments. 3. Misfire diagnostics, cylinder balance test, engine vacuum testing analysis.
WEEK 31	Vehicle Emission Monitoring & PCV / EVAP: 1. Practice monitoring emissions using exhaust 5-gas analyser or diesel smoke meter. 2. Check and clean Positive Crankcase Ventilation (PCV) valve. 3. Inspect EVAP canister purge system using scan tool.	Emission Norms & Evaporative Control: 1. Emission standards: Euro and Bharat Stage (BS-II, III, IV, VI), CAFÉ norms. 2. Sources of automotive emissions, combustion chamber influences. 3. Exhaust pollutants (HC, NOx, PM, CO, CO ₂ , SOx). 4. Crankcase emission control (PCV), Evaporative emission control (EVAP canister).
WEEK 32	EGR & Exhaust After-Treatment (SCR / DPF): 1. Perform EGR valve removal and installation for inspection. 2. Check SCR after-exhaust treatment system for proper functioning.	Catalytic Converters & After-Treatment: 1. Closed-loop control, catalytic converters, air-fuel ratio control. 2. Exhaust Gas Recirculation (EGR) valve operation. 3. Diesel Particulate Filter (DPF), Selective Catalytic Reduction (SCR), Diesel Exhaust Fluid (DEF/AdBlue), EGR vs SCR.
WEEK 33	Alternator Servicing & Bench Testing: 1. Remove alternator from vehicle, dismantle, clean, inspect for defects. 2. Test rotor for open/ground, measure field coil resistance, slip ring condition, bearings, inspect stator windings. 3. Assemble and bench test alternator for motoring/charging action, refit to vehicle.	Charging System Principles: 1. Purpose of charging system, charging circuits, alternator principles, AC to DC rectification. 2. Alternator components: rotor, stator, slip rings, brushes, diode rectifier pack, IC voltage regulator. 3. Charging system troubleshooting: undercharge, no charge, overcharge, warning light diagnosis.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
WEEK 34	Starter Motor Servicing & Testing: 1. Trace starter motor circuit. 2. Remove starter motor from vehicle; perform pull-in test, hold-in test, pinion return test, no-load bench performance test. 3. Jump-start a vehicle following safety procedures.	Starting System Principles: 1. Purpose of starting system, starter control circuits, starter motor principles. 2. Starter motor construction: armature, commutator, field coils, permanent magnets, solenoid switch. 3. Starter drive engagement (overrunning clutch, pinion gear), starter troubleshooting.
WEEK 35	Engine Mechanical Troubleshooting: 1. Practice troubleshooting LMV/HMV engine: Engine cranks but will not start (mechanical causes). 2. Diagnose high fuel consumption, engine overheating, low power generation.	Engine Fault Diagnosis (Part I): 1. Systematic troubleshooting methodology for mechanical engine faults. 2. Causes and remedies for hard starting, power loss, high fuel consumption. 3. Overheating causes (thermostat stuck, radiator clogging, water pump failure).
WEEK 36	Lubrication & Noise/Vibration Diagnostics (NVH): 1. Diagnose excessive oil consumption, low/high engine oil pressure. 2. Check engine for Noise, Vibration, and Harshness (NVH).	Engine Fault Diagnosis (Part II): 1. Causes and remedies for oil pressure faults and oil burning (blue smoke). 2. Abnormal engine noises: piston slap, rod knock, main bearing rumble, valve clatter. 3. Diagnostic techniques for Noise, Vibration, and Harshness (NVH).
WEEK 37	Electrical Causes of Engine Non-Starting: 1. Troubleshoot electrical causes for engine no-start condition: test ignition circuit, fuel pump relay, ECU power supply, immobilizer lock.	Electrical Fault Diagnostics: 1. Electrical troubleshooting flowcharts for starting failures, sensor signal drop, relay failures, and blown main engine fuses.
WEEK 38	Comprehensive Engine Diagnostic Scan: 1. Perform full electronic engine health check using automotive scan tool, live sensor data analysis, and clear diagnostic trouble codes (DTCs).	OBD-II Electronics Diagnostics: 1. OBD-II / EOBD diagnostic architecture, interpreting Live Data parameters, freeze frame data, and diagnostic decision-making.
WEEK 39	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
WEEK 40	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
WEEK 41	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
WEEK 42	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work

APPROVAL & SIGNATURES

_____	_____	_____
Sign of Instructor	Sign of Group Instructor (GI)	Sign of Superintendent / Principal