

CRAFTSMEN TRAINING SCHEME (CTS)

ANNUAL INSTRUCTIONAL PLAN

MECHANIC MOTOR VEHICLE (2ND YEAR – 42 WEEKS)

Curriculum as per DGT / CSTARI Guidelines for Mechanic Motor Vehicle CTS Scheme

Trade Name	MECHANIC MOTOR VEHICLE (MMV)
NSQF Level & Duration	NSQF Level-4 Two Years (Second 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.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
WEEK 01	Heavy Vehicle Aggregates & Clutch Removal: - Identify different major aggregates of Heavy vehicle and their function for various vehicle manufacturers. - Practice on adjusting clutch pedal play. - Removing gearbox and clutch assembly from light & heavy vehicle.	Heavy Vehicle Layout & Clutch Principles: - Study of different major components & assemblies of heavy vehicle. - Leading manufacturers in heavy vehicle industry. - Clutch principles, single-plate clutches, multi-plate clutches, dual-mass flywheels. - Operating mechanisms, clutch plate types, pressure plate, driven plate, throw-out bearing, fluid coupling.
WEEK 02	Clutch Overhaul & Flywheel Servicing: - Dismantling clutch assembly, cleaning, inspecting parts. - Removing & fitting new pilot bearing, removing & fitting ring gear on flywheel, relining clutch plate. - Assembling pressure plate, adjusting fingers, checking flywheel runout, aligning clutch with flywheel.	Manual Transmissions & Gear Ratios: - Gear ratios, compound gear trains, gear selection, bearings, oil seals & gaskets. - Overview of modern manual transmissions: Automated Manual Transmission (AMT), Intelligent Manual Transmission (iMT), CVT. - Sliding mesh, constant mesh, and synchromesh principles.
WEEK 03	Manual Gearbox Overhauling: - Dismantling, cleaning, assembling gearshift mechanism, changing oil in gearbox. - Dismantle synchromesh gearbox, inspect parts, replace worn components, assemble & test, rectify gearbox noise.	Gearbox Construction & Baulk Ring: - Gearbox layouts, transaxle designs, torque converter basics. - Baulk-ring synchromesh unit, transaxle synchromesh unit. - Dual Clutch Transmission (DCT) construction and working.
WEEK 04	Propeller Shaft & Universal Joints: - Remove open type propeller shaft, remove universal joints, clean, replace worn parts, reassemble & align. - FWD driveshaft removal and replacement.	Final Drive & Drive Shafts: - Driveline layouts: Front-wheel drive (FWD), Rear-wheel drive (RWD), Four-wheel drive (4WD), All-wheel drive (AWD), 4WD vs AWD. - Types of universal joints, Constant Velocity (CV) joints, slip joints.
WEEK 05	Rear Axle & Differential Overhaul: - Practice on overhauling & inspection of rear axle. - Practice on overhauling & inspection of differential assembly.	Differentials & Axle Types: - Rear-wheel final drives, Salisbury axles, semi-floating, full-floating axles. - Differential action, crown wheel and pinion backlash, Limited Slip Differentials (LSD). 4WD transfer case, freewheeling hubs, AWD center differential.
WEEK 06	Driveline Troubleshooting & Automatic Transmission Intro: - Troubleshooting clutch slip, noise, binding, hard pedal, gearbox noise, gear slip, axle noise, propeller shaft noise, differential noise. - Identify automatic transmission components.	Torque Converters & Automatic Transmissions: - Torque converter principles: impeller, turbine, stator, lock-up clutch, fluid coupling. - Torque multiplication, heat exchanger, transmission fluid coolers.
WEEK 07	Automatic Transmission Fluid & Planetary Gear Sets: - Check ATF level, condition, replace fluid and internal filter. - Adjust oil pressure control cable play, inspect shift lever switch, TPS, speed sensor, and wiring harness.	Planetary Gearing & Electronic Controls: - Simple and compound planetary gear sets, brake bands, multi-disc clutches. - Transmission Control Unit (TCU/TCM), electronic shift programs, shift solenoids, Drive-by-Wire (DBW).
WEEK 08	Automatic Transmission Hydraulic Controls & CVT: - Trace hydraulic control valve body, test shift solenoids, inspect line pressure ports. - Identify CVT components, inspect steel belt and variator pulleys.	Hydraulic Valve Body & CVT Principles: - Hydraulic spool valves, pressure regulating valves, governor pressure, kick-down pressure. - Continuously Variable Transmission (CVT) operation: variable pulleys, steel push belt.

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
WEEK 09	Steering Geometry & Linkages: - Remove drop arm, check and adjust turning angle, align steering wheel with front wheels, check and correct toe-in. - Service and replace steering linkages, tie-rod ends, idler arm, and drag link bushes.	Steering Principles & Geometry: - Principles of steering: Ackermann steering geometry. - Wheel alignment fundamentals: Wheelbase, wheel track, King Pin Inclination (KPI), Caster, Camber, Scrub radius, Toe-in, Toe-out on turns, turning radius, thrust angle.
WEEK 10	Steering Gearbox Overhaul: - Remove steering wheel and steering column. - Inspect, dismantle, overhaul and adjust backlash and pre-load in rack-and-pinion and recirculating-ball steering gearboxes.	Steering Mechanisms: - Collapsible steering columns. - Rack-and-pinion gearbox, variable ratio steering, worm and roller gearbox, recirculating ball and nut gearbox.
WEEK 11	Power Steering & Wheel Balancing: - Check & top up power steering fluid, pressure test hydraulic power steering, flush fluid. - Inspect Electronic Power Steering (EPS) using scan tool. - Service/replace wheel bearings, perform wheel balancing (dynamic runout).	Power Steering & Diagnostics: - Hydraulic power steering: vane pump, rotary spool valve, pressure relief valve. - Electric Power Assisted Steering (EPS): torque sensor, steering ECU, assist motor. - Troubleshooting: abnormal tyre wear, wheel wobbling, poor self-centering, hard steering, vehicle pulling.
WEEK 12	Suspension Components & Leaf Springs: - Visual inspection of chassis frame for cracks, bends, and twists. - Overhaul and inspect shackle pins, leaf springs, front & rear suspension mounts, lubricate suspension.	Suspension Fundamentals: - Principles of suspension, sprung vs unsprung weight, wheel oscillation damping. - Non-independent vs independent suspension, solid axle, dead axle. - Leaf springs, coil springs, torsion bars, rubber springs.
WEEK 13	Shock Absorbers & Air Suspension: - Remove, inspect, test and assemble hydraulic and gas-pressurized shock absorbers. - Inspect MacPherson struts, wishbone arms, ball joints, anti-roll stabilizer bar.	Dampers & Advanced Suspension: - Telescopic hydraulic shock absorbers, gas-pressurized dampers, adaptive dampers. - MacPherson strut, double wishbone, torsion bar suspension. - Electronically Controlled Air Suspension (ECAS), height sensors, air bellows. - Troubleshooting: wheel hop, bottoming, low ride height, body roll, suspension noise.
WEEK 14	Tyre Servicing & TPMS: - Remove wheels, dismount tyres/tubes, repair puncture in tubed tyre. - Tubeless tyre puncture repair using repair plug kit. - Inflate tyre, inspect tyre wear patterns, perform tyre rotation, calibrate TPMS sensors.	Tyres, Wheels & TPMS: - Wheel rim types, sizes, designations, wheel offset. - Cross-ply vs Radial-ply tyre construction, aspect ratio, speed/load ratings. - Run-flat tyres, Low Rolling Resistance tyres (EV), Nitrogen vs air. - Tyre Pressure Monitoring System (direct and indirect TPMS).
WEEK 15	Hydraulic Brakes & Master Cylinder: - Adjust brake pedal free play, dismantle, inspect, overhaul and assemble tandem master cylinder. - Overhaul front and rear drum brake assemblies, inspect brake drums, shoes, wheel cylinders. - Bleed hydraulic brake system.	Hydraulic Braking Principles: - Principles of braking, friction materials, hydraulic pressure and force distribution. - Brake fluid types (DOT 3, DOT 4, DOT 5.1), boiling points, hygroscopic properties, bleeding procedures. - Master cylinders, tandem master cylinders, proportioning valves.
WEEK 16	Disc Brakes & Vacuum Boosters: - Overhaul disc brake caliper assembly, inspect rotors for runout, replace pads and rotors. - Overhaul vacuum-assisted brake booster unit. - Adjust parking brake cable and inspect Electronic Parking Brake (EPB) actuator.	Disc Brakes & Power Boosters: - Disc brake operation, ventilated rotors, floating vs fixed calipers. - Vacuum brake boosters, hydraulic brake boosters, Electro-Hydraulic Braking (EHB). - Mechanical handbrake vs Electronic Parking Brake (EPB).

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
WEEK 17	Air Brake System & Servicing: - Adjust heavy vehicle air brakes, repair air tank, air compressor, brake chamber, slack adjuster. - Locate air leaks in lines, replace unloader valve, dual brake valve, quick release valve.	Heavy Vehicle Pneumatic Brakes: - Air brake layout and operation, compressor, air dryer, reservoir, unloader valve. - Brake chambers (single/spring brake), S-cam mechanism, automatic slack adjusters. - Engine exhaust brakes, retarders (hydraulic and electromagnetic retarders).
WEEK 18	ABS, EBD, ESP & Traction Control: - Inspect and test wheel speed sensors, tone rings, and ABS hydraulic modulator unit. - Troubleshoot heavy vehicle Anti-Slip Regulation (ASR) and Electronic Stability Program (ESP).	Advanced Vehicle Stability Systems: - Anti-lock Braking System (ABS) operation and hydraulic control cycle. - Electronic Brakeforce Distribution (EBD), Brake Assist (BA), Traction Control (TCS/ASR). - Vehicle Stability Control (VSC/ESP), Hill Start Assist, Hill Descent Control.
WEEK 19	Electronic Control Unit (ECU) & Engine Sensors (Part I): - Identify Electronic Control Unit (ECU) and locate automotive sensors. - Test dashboard instrument cluster gauges and indicator lights. - Test Coolant Temperature Sensor (ECT), Manifold Absolute Pressure (MAP) sensor, Mass Air Flow (MAF) sensor.	Electronic Fuel Injection (EFI) Management: - Electronic Engine Management architecture, open-loop vs closed-loop modes. - Air measurement methods (speed-density vs mass airflow). - ECU construction, microcontroller, input analog/digital conditioning, driver circuits.
WEEK 20	Engine Sensors (Part II) & Scan Tool Diagnostics: - Test Throttle Position Sensor (TPS), Crankshaft Position (CKP) sensor, Camshaft Position (CMP) sensor, Oxygen (O₂) sensor. - Connect diagnostic scan tool, read Diagnostic Trouble Codes (DTCs), monitor live data, clear fault memory.	Sensors, Actuators & OBD-II Architecture: - Sensor working principles: Thermistors, Piezo-resistive, Hall Effect, Optical, Inductive. - Malfunction Indicator Lamp (MIL), Diagnostic Trouble Code (DTC) structure (P, B, C, U codes). - Actuators: Idle Air Control (IAC) valve, electronic throttle actuators, variable intake flaps.
WEEK 21	Electronic Ignition Systems & Coil-on-Plug: - Check and set ignition timing, inspect and change spark plugs. - Test ignition coils, Distributorless Ignition System (DIS), Coil-on-Plug (COP) modules, test spark plug firing voltage.	Ignition Physics & Modern Systems: - Faraday's laws of induction, primary and secondary coil saturation, spark plug heat ranges. - Distributor ignition vs Distributorless Ignition System (DIS). - Coil-on-Plug (COP) architecture, ignition driver transistors, electronic spark advance control.
WEEK 22	Alternator Overhaul & Rectifier Testing: - Remove alternator from vehicle, dismantle, clean, inspect rotor slip rings, stator windings, rectifiers. - Test rotor for short/ground, measure field resistance, test diodes, replace brushes and bearings. - Inspect and adjust alternator drive belt, tensioner pulley alignment.	Automotive Charging Systems: - Alternator operating principles, 3-phase alternating current generation. - Diode rectification (full-wave 6-diode bridge), avalanche diodes. - Electronic IC voltage regulators, smart charging systems, charging system troubleshooting (undercharge, overcharge, warning light).
WEEK 23	Starter Motor Overhaul & Performance Bench Testing: - Trace starter motor circuit, test starter relay and solenoid switch. - Remove starter motor, dismantle, clean, check armature on growler, inspect commutator and brushes. - Perform pull-in, hold-in, pinion return, and no-load bench performance tests.	Automotive Starting Systems: - Starting system circuit, high-current draw requirements. - Starter motor construction: Series wound, compound wound, permanent magnet starters. - Starter drive mechanisms: Overrunning roller clutch, pinion gear, reduction gear starters. - Solenoid switch operation and starter troubleshooting.

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
WEEK 24	Exterior Lighting Circuits & Headlamp Alignment: - Trace lighting circuits, replace halogen, HID, and LED headlamp bulbs, check headlight relays and switches. - Align and focus headlamps using optical headlamp beam aligner. - Troubleshoot turn signal, hazard flasher, brake light, reverse light circuits.	Automotive Lighting Systems: - Sealed beam, halogen bulbs, High-Intensity Discharge (HID/Xenon), LED and Matrix LED headlights. - Headlight leveling systems, dimmer switches, flasher relays. - Smart lighting systems, Daytime Running Lights (DRL), adaptive front lighting.
WEEK 25	Dashboard Gauges & Body Electrical Accessories: - Troubleshoot fuel gauge, coolant temperature gauge, oil pressure warning light, brake warning light circuits. - Trace and troubleshoot dual electric horn circuit and horn relay. - Service windshield wiper motor, linkage, washer pump, check intermittent delay relay.	Vehicle Instrumentation & Accessories: - Analog and digital dashboard instrument clusters, sender units. - Horn circuits, electromagnetic tone generation, relay wiring. - Wiper motors, park switch mechanism, intermittent wipe control, rain-sensing wipers.
WEEK 26	Power Windows, Central Locking & Infotainment: - Troubleshoot power window motor, master switch, lockout switch. - Troubleshoot central door locking actuators, remote keyless entry, immobilizer transponder. - Remove and refit multimedia/infotainment head unit, check wiring harness.	Body Control & Security Electronics: - Power window regulators, anti-pinch safety mechanism. - Central locking solenoids, remote keyless entry architecture. - RF immobilizer system, transponder chip in ignition key, infotainment integration.
WEEK 27	Passive Safety Systems (Airbags & Seatbelts): - Identify SRS airbag modules, clock spring, crash sensors, seatbelt pre-tensioners. - Scan SRS system for trouble codes, verify circuit resistance using manufacturer guidelines.	Supplemental Restraint Systems (SRS): - Airbag safety regulations and handling precautions. - Crash impact sensors, pyrotechnic inflators, curtain and side airbags. - Seatbelt pre-tensioners, load limiters, passenger occupancy detection.
WEEK 28	Air Conditioning (HVAC) Fundamentals & Manifold Testing: - Identify automotive AC components: compressor, condenser, evaporator, receiver-drier, TXV. - Connect AC manifold gauge set, measure high-side and low-side pressures under running conditions.	Automotive Air Conditioning Principles: - Thermodynamic principles of refrigeration, latent heat, evaporation, condensation. - Refrigerants: R-134a, R-1234yf, ozone depletion potential, global warming potential. - Pressure-temperature relationship of refrigerants.
WEEK 29	AC Servicing: Recovery, Evacuation & Charging: - Recover refrigerant using automated AC recovery-recycling station. - Evacuate AC system with vacuum pump, perform deep vacuum leak check. - Replenish compressor oil, charge precise amount of refrigerant by weight.	HVAC Components & Refrigerant Cycle: - Swash plate compressors, variable displacement compressors, magnetic clutch. - Parallel flow condensers, cooling fans, receiver-driers, accumulator. - Thermal Expansion Valve (TXV) vs fixed orifice tube, evaporator core.
WEEK 30	Automatic Climate Control & HVAC Diagnostics: - Inspect blend door actuators, blower resistor/PWM module, evaporator temperature sensor. - Diagnose HVAC faults: insufficient cooling, intermittent cooling, abnormal compressor noise.	Electronic Climate Control: - Automatic Temperature Control (ATC) ECU, cabin temperature sensor, sunload sensor. - Servo actuators for air distribution and blend doors. - High/low pressure cutoff switches, thermal protection, HVAC troubleshooting guide.
WEEK 31	Driver Training & Road Safety Regulations: - Practice straight driving, lane changing, curves on closed track. - Practice reverse driving, parallel parking, diagonal parking. - Practice driving on wet surfaces and hill starting using handbrake.	Traffic Regulations & Road Conduct: - Motor Vehicles Act rules, traffic signs, signals, road markings. - Defensive driving techniques, blind spots, overtaking rules. - Emergency response procedures during tyre blowout or brake failure.

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
WEEK 32	Advanced Driver Assistance Systems (ADAS): - Identify ADAS radar and front camera modules. - Inspect and demonstrate Pre-Collision System (PCS), Dynamic Radar Cruise Control (DRCC). - Test Lane Departure Alert / Lane Tracing Alert (LDA/LTA), Automatic High Beam (AHB).	ADAS Architecture & Sensors: - Introduction to ADAS Level 1 and Level 2 technologies. - Millimeter-wave radar, LiDAR, forward-facing cameras, ultrasonic sensors. - Autonomous Emergency Braking (AEB), Adaptive Cruise Control, Lane Keep Assist principles.
WEEK 33	Electric Vehicle Architecture & Powertrain: - Identify Electric Vehicle (EV) major aggregates: Traction Motor, Inverter/PCU, Battery Pack, On-Board Charger. - Inspect instrument cluster display and tell-tale indicators of EV vs ICE vehicle.	Electric Vehicle Technology Overview: - Classification of EVs: Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid (PHEV), Fuel Cell Electric Vehicle (FCEV). - Performance, emissions, efficiency comparison between EV and ICE vehicles. - EV powertrain layout and single-speed reduction transmission.
WEEK 34	EV High Voltage Safety & Disconnect: - Identify High-Voltage (HV) orange cabling, High-Voltage safety interlock loops (HVIS/HVIL). - Practice manual service disconnect (MSD) removal following standard safety protocol and PPE.	HV Safety Protocols & Personal Protection: - High-voltage hazards, DC arc flashes, insulation requirements. - Class 0 insulated gloves, face shields, insulated hand tools. - Manual Service Disconnect (MSD), pre-charge contactors, isolation resistance monitoring.
WEEK 35	EV Traction Motors & Power Control Unit (PCU): - Inspect Permanent Magnet Synchronous Motor (PMSM) and BLDC motor construction. - Identify Power Control Unit (Inverter, DC-DC converter) and liquid cooling lines.	Electric Motors & Drives: - Traction motor types: BLDC, Permanent Magnet Synchronous Motor (PMSM), AC Induction Motor. - Motor sizing, torque-speed characteristics, regenerative braking energy recovery. - Inverter switching using IGBTs/MOSFETs, bidirectional DC-DC converters.
WEEK 36	Traction Battery Pack & Battery Management System (BMS): - Identify battery cells (cylindrical, prismatic, pouch), module connections, busbars. - Read BMS parameters: State of Charge (SoC), State of Health (SoH), cell voltages, battery temperature.	Battery Chemistry & BMS Functions: - Traction battery chemistries: Lithium-Ion (NMC, LFP), Solid-State batteries. - Battery pack design, thermal management (liquid cooling/heating). - Battery Management System (BMS): Cell balancing, over-voltage/under-voltage protection, thermal runaway prevention.
WEEK 37	EV Charging Standards & Infrastructure: - Demonstrate AC Type 2 and DC Fast Charging (CCS2, CHAdeMO) gun connections. - Inspect charging port locking actuator and charging communication indicators.	EV Charging Stations & Protocols: - AC Level 1, Level 2 charging vs DC Fast Charging. - Charging connector standards: Type 2, Combined Charging System (CCS 2), CHAdeMO, GB/T. - Charging etiquette, grid interaction, EV charging safety standards in India.
WEEK 38	Comprehensive Vehicle Health Check & DTC Diagnostic: - Perform comprehensive CAN-bus scan across Powertrain, BCM, ABS, EPS, HVAC, and EV control modules. - Analyze DTCs, perform guided diagnostic routines, clear codes, verify roadworthiness.	CAN-bus & Diagnostic Flowcharts: - Multiplex wiring, Controller Area Network (CAN-bus) protocols. - Systematic end-to-end diagnostic flowcharts for complex multi-system automotive faults.
WEEK 39-42	On the Job Training (OJT) / Group Project Work:	On the Job Training (OJT) / Group Project Work:
Sign of Instructor	Sign of Group Instructor (GI)	Sign of Superintendent / Principal