SYLLABUS - MECHANIC MOTOR VEHICLE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 175 Hrs; Professional Knowledge 49 Hrs	Check & perform Measuring & marking by using various Measuring & Marking tools(Vernier Calliper, Micrometer, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.) following safety precautions	1. Familiarisation with institute, Job opportunities in the automobile sector, Machinery used in Trade. Types of work done by the students in the shop floor. (10Hrs) 2. Importance of maintenance and cleanliness of Workshop. (10Hrs) 3. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers. (10 Hrs) 4. Practice operation of different workshop equipment. (10 Hrs) 5. Demonstrate Energy saving Tips of ITI electricity Usage. (10Hrs)	**Admission & introduction to the trade:** Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute, facilities available– Hostel, Recreation, Medical and Library working hours and time table **Occupational Safety & Health** Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles. **Energy conservation**- Definition, Energy

			Conservation Opportunities (ECOs)-Minor ECos and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips**.** **Introduction to road safety and Automotive emissions.** (14 hrs)
		6. Practice using all marking aids, like steel rule with spring callipers, dividers, scriber, punches, Chisel etc. (15 Hrs) 7. Layout a work piece- for line, circle, arcs and circles. (5 Hrs) 8. Practice to measure a wheel base of a vehicle with measuring tape. (10 Hrs) 9. Practice to measure valve spring tension using spring tension tester. (10 Hrs) 10. Practice to remove wheel lug nuts with use of an air impact wrench.(15 Hrs) 11. Practice on General workshop tools & power tools. (20 Hrs)	**Hand & Power Tools: -** Marking scheme, **Marking material-**chalk, Prussian blue. Cleaning tools- Scraper, wire brush, Emery paper**,** Description, care and use of Surface plates, steel rule, measuring tape, try square. Callipers-inside and outside. Dividers, surface gauges, scriber, punches**-**prick punch**,** centre punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, lump, mallet. Screw drivers-blade screwdriver, Phillips screw driver, 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, Circlips 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. (21 hrs)
		12. Carryout Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers. (5 Hrs) 13. Carryout 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. (5 Hrs) 14. Carryout Measuring practice on valve spring free length. (5 Hrs) 15. Carryout Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges. (5 Hrs) 16. Carryout Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges.(5 Hrs)	**Systems of measurement**, Description, care & use of - Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier callipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge. (17 hrs)

		17. Perform Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator. (5 Hrs) 18. Perform Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge. (5 Hrs) 19. Perform Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge. (5 Hrs) 20. Practice to check engine manifold vacuum with vacuum gauge. (5 Hrs) 21. Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting. (5 Hrs)	
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Plan & perform basic fastening & fitting operation by using correct hand tools, Machine tools &equipments.	22. Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. (20 Hrs) 23. Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of	**Drilling machine** - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits. **Taps and Dies:** Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of

		stud extractor. (20 Hrs) 24. Practice Cutting Threads on a Bolt/ Stud. Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface. (10 Hrs)	Die and Die stock. Screw extractors. **Hand Reamers** – Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps. (14 hrs)
Professional Skill 175 Hrs; Professional Knowledge 49 Hrs	Trace and Test all Electrical & Electronic components & circuits and assemble circuit to ensure functionality of system.	25. Practice in joining wires using soldering Iron, Construction of simple electrical circuits, measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, and circuit breakers. (50 Hrs)	**Basic electricity**, Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings (14 hrs)
		26. Diagnose series, parallel, series-parallel circuits using Ohm's law, Check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter, use of service manual wiring diagram for troubleshooting. (25 Hrs)	Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits , Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel. (07 hrs)
		27. Carryout Cleaning and topping up of a lead acid battery, Testing battery with hydrometer. (15 Hrs) 28. Connect battery to a charger for battery	Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-

		charging, Inspecting & testing a battery after charging, Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. Testing of relay and solenoids and its circuit. (20 Hrs). 29. Test diode for functionality. (10 Hrs) 30. Practice checking Transistors. (5 Hrs)	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. **Basic electronics**: Description of Semi conductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs). (14 hrs)
		31. Identify Hydraulic and pneumatic components used in vehicle. (20 Hrs) 32. Trace hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. (20 Hrs) 33. Identify components in Air brake systems. (10 Hrs)	**Introduction to Hydraulics & Pneumatics: -** Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator). (14

			hrs)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Check & Interpret Vehicle Specification data & VIN and Select & operate various Service Station Equipments.	34. Carryout Identification of different type of Vehicle. (20 Hrs) 35. Perform Demonstration of vehicle specification data(20 Hrs) 36. Perform Identification of vehicle information Number (VIN). Demonstration of Garage, Service station equipments.- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands. (10 Hrs)	Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), & Automobile Association. Definition: - Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.(14 hrs)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Dismantle & assemble of Engine from vehicle (LMV/HMV) along with other accessories.	37. Identify parts in a Diesel engine of LMV/ HMV. (07 Hrs) 38. Identify parts in a Petrol engine of LMV/ HMV. (07Hrs) 39. Practice on starting and stopping of engines. (07 Hrs) 40. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on	Introduction to Engine: Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2&4-stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect

		load condition. (07 Hrs) 41. Practice identification of difference in components of Petrol and Diesel Engines. (07 Hrs) 42. Practice on dismantling engine of LMV/HMV as per procedure. (15 Hrs)	injection, Technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle-Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light. Different type of starting and stopping method of Diesel Engine Procedure for dismantling of diesel engine from a vehicle. Petrol Engine Basics: 4-stroke spark-ignition engines- Basic 4-stroke principles. Spark-ignition engine components- Basic engine components, Engine cams & camshaft, Engine power transfer, Scavenging, Counter weights, Piston components. Intake & exhaust systems - Electronic fuel injection systems, Exhaust systems. Intake system components, Air cleaners, Carburettor air cleaners, EFI air cleaners, Intake manifolds, Intake air heating. Gasoline Fuel Systems:

			Description of Gasoline fuel, Gasoline fuel characteristics, Controlling fuel burn, Stoichiometric ratio, Air density, Fuel supply system, Pressure & vacuum.(14 hrs)
Professional Skill 225 Hrs; Professional Knowledge 63 Hrs	Overhaul Engine and check functionality.	43. Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters, Practice on removing rocker arm assembly manifolds. (10 Hrs) 44. Practice on removing the valves and its parts from the cylinder head, cleaning. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. (10 Hrs) 45. Perform Checking valve seats & valve guide – Replacing the valve if necessary check valve overlap. Testing leaks of valve seats for leakage – Dismantle rocker shaft assembly -clean & check rocker shaft-and levers, for wear and cracks and reassemble. (10 Hrs) 46. Check valve springs, tappets, push rods, tappet screws and valve stem cap. (10 Hrs) 47. Reassemble valve parts in	**Engine Components:** Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Petrol and Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence **Valves & Valve Trains-** Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats**,** and Valve seats inserts in cylinder heads**,** importance of Valve rotation**,** Valve stem oil seals, size of Intake valves, Valve trains, Valve-timing diagram, concept of Variable valve timing. Description of Camshafts & drives **,** Description of Overhead camshaft**,** importance of Cam lobes**,** Timing belts & chains**,** Timing belts & tensioners. (14 hrs)

		sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments. (10 Hrs)	
		48. Practice Overhauling piston and connecting rod Assembly. Use of service manual for clearance and other parameters(5 Hrs) 49. Practice on removing oil sump and oil pump – clean the sump. Practice on removing the big end bearing, connecting rod with the piston. (5 Hrs) 50. Practice on removing the piston rings; Dismantle the piston and connecting rod. Check the side clearance of piston rings in the piston groove & lands for wear. Check piston skirt and crown for damage and scuffing, clean oil holes. (5 Hrs) 51. Measure -the piston ring close gap in the cylinder, clearance between the piston and the liner, clearance between crank pin and the connecting rod big end bearing. (5 Hrs) 52. Check connecting rod for bend and twist. Assemble	Description & functions of different types of **pistons**, piston rings and piston pins and materials. Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy. Compression ratio. Description & function of **connecting rod,** importance of big- end split obliquely, Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins. (07 hrs)

		the piston and connecting rod assembly. (5 Hrs)	
		53. Carryout Overhauling of crankshaft by referring service manual for clearance and other parameters. (20 Hrs) 54. Practice on removing damper pulley, timing gear/timing chain, flywheel, main bearing caps, bearing shells and crankshaft from engine checking oil retainer and thrust surfaces for wear.(20 Hrs) 55. Measure crank shaft journal for wear, taper and ovality, Checking crankshaft for fillet radii, bend & twist. (10 Hrs)	Description and function of **Crank shaft**, camshaft, Engine bearings- classification and location – materials used & composition of bearing materials- Shell bearing and their advantages- special bearings material for diesel engine application bearing failure & its causes-care & maintenance. Crank-shaft balancing, Firing order of the engine. (14 hrs)
		56. Perform Checking of flywheel and mounting flanges, spigot, bearing. (10 Hrs) 57. Check vibration damper for defects, Practice on removing cam shaft from engine block, Check for bend & twist of camshaft. (10 Hrs) 58. Perform Inspection of cam lobe, camshaft journals and bearings and measure cam lobe lift. (10 Hrs) 59. Practice Fixing bearing inserts in cylinder block & cap check nip and spread	Description and function of the **fly wheel** and vibration damper. Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc. Function of clutch & coupling units attached to flywheel. (14 hrs)

		clearance & oil holes & locating lugs fix crank shaft on block-torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit. (20 Hrs)	
		60. Practice Cleaning and Checking of cylinder blocks. (10 Hrs) 61. Check cylinder blocks Surface flatness visually. (10 Hrs) 62. Measure cylinder bore for taper & ovality, clean oil gallery passage and oil pipe line, Bore - descale water passages. (10 Hrs) 63. Practice Removing cylinder liners from scrap cylinder block, practice in measuring and refitting new liners as per maker's recommendations precautions while fitting new liners. (20 Hrs)	Description of Cylinder block, Cylinder block construction, and Different type of Cylinder sleeves (liner). (14 hrs)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Trace, Test & Repair Cooling and Lubrication System of engine.	64. Practice on Checking &Top up coolant, (5 Hrs) 65. Drain & refill coolant, Checking / replacing a coolant hose, Testing cooling system pressure, Practice on Removing & replacing radiator/ thermostat. (5 Hrs) 66. Inspect the radiator	**Need for Cooling systems,** Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems, **Basic cooling system components-** Radiator,

		pressure cap, testing of thermostat. (5 Hrs) 67. Perform Cleaning & reverse flushing. (5 Hrs) 68. Carryout overhauling water pump and refitting. (10 Hrs) 69. Practice on Checking engine oil, Draining engine oil, Replacing oil filter, Refilling engine oil. (10 Hrs) 70. Carryout Overhauling of oil pump, oil coolers, air cleaners and air filters and adjust oil pressure relief valves, repairs to oil flow pipe lines and unions if necessary. (10 Hrs)	Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch. **Need for lubrication system**, Functions of oil, Viscosity and its grade as per SAE , Oil additives, Synthetic oils, The lubrication system**, Splash system,** Pressure system**,** Corrosion/noise reduction in the lubrication system. Lubrication system components **-** Description and function of Sump, Oil collection pan, Oil tank, Pickup tube**,** different type of Oil pump & Oil filters Oil pressure relief valve**,** Spurt holes & galleries**,** Oil indicators**,** Oil cooler. (14 hrs)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Trace & Test Intake and Exhaust system of engine.	71. Carryout Dismantling & assembling of turbocharger check for axial clearance as per service manual. (15 Hrs) 72. Check Exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage. (10 Hrs) 73. Practice on Exhaust manifold removal and	**Intake system components-** Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material**,** **Exhaust system components- Description** and function of Exhaust manifold**,** Exhaust pipe**,** Extractors**,** Mufflers- Reactive, absorptive, Combination.**,** Catalytic converters**,** Flexible

		installation. (13 Hrs) 74. Practice on Catalytic converter removal and installation. (12 Hrs)	connections, Ceramic coatings, Back-pressure, Electronic mufflers.(14 hrs)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Service Fuel System and check proper functionality.	75. Practice Testing of MPFI components and replacement if necessary. (10 Hrs) 76. Check delivery from fuel Pump. Replacing a fuel filter. (10 Hrs) 77. Bleed air from the fuel lines, Servicing primary & secondary filters. (15 Hrs) 78. Remove 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. (15 Hrs)	Diesel Fuel Systems- Description and function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology & Clean diesel technology. Diesel fuel system components – Description and function of Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump, Inline injection pump, Distributor-type injection pump, Diesel injectors, Glow plugs, Cummins & Detroit Diesel injection. Electronic Diesel control- Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, Hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.(14 hrs)
Professional Skill 50 Hrs; Professional	Test Engine Performance and set idling speed.	79. Reassemble all parts of engine in correct Sequence and torque all bolts and nuts as per	**Engine assembly** procedure with aid of special tools and gauges used for engine assembling. Introduction to

Knowledge 14 Hrs		workshop manual of the engine. (10 Hrs) 80. Perform Engine component assembly procedures- Testing cylinder compression, checking idle speed, Removing & replacing a cam belt, Inspecting & adjusting an engine drive belt, Replacing an engine drive belt. (15 Hrs) 81. Practice on Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking (5 Hrs) 82. Test Performance of engine with off load adjusting timings. (5 Hrs) 83. Start engine- adjusting idle speed of the engine fitted with mechanical governor checking- high speed operation of the engine. (5 Hrs) 84. Check performance for missing cylinder by isolating defective injectors and test-dismantle and replace defective parts and reassemble and refit back to the engine (10 Hrs)	Gas Turbine, Comparison of single and two stage turbine engine, Different between gas turbine and Diesel Engine.(14 hrs)
Professional Skill 25 Hrs;	Monitor emission of vehicle and execute different operation	85. Practice Monitoring emissions procedures by use of Engine gas analyser	**Emission Control:- Vehicle emissions** Standards- Euro and Bharat

Professional Knowledge 07 Hrs	to obtain optimum pollution as per emission norms.	or Diesel smoke meter. (5 Hrs) 86. Checking & cleaning a Positive crank case ventilation (PCV) valve. Obtaining & interpreting scan tool data. (5 Hrs) 87. Perform Inspection of EVAP canister purge system by use of scan Tool. (5 Hrs) 88. Perform EGR /SCR Valve Removal and installation for inspection. (10Hrs)	II, III, IV, V Sources of emission, Combustion, Combustion chamber design. **Types of emissions**: Characteristics and Effect of Hydrocarbons, Hydrocarbons in exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, , Controlling air-fuel ratios, Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic Reduction (SCR), EGR VS SCR (07 hrs)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Carryout overhauling of Alternator and Starter Motor.	89. Practice on removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles. (13 Hrs) 90. Practice on removing starter motor Vehicle and overhauling the starter motor, testing of starter motor (12 Hrs)	Description .of charging circuit operation of alternators, regulator unit, ignition warning lamp-troubles and remedy in charging system. Description of starter motor circuit, Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit. (07 hrs)
Professional Skill 25 Hrs;	Diagnose & rectify the defects in LMV/HMV to ensure	91. Practice on troubleshooting in LMV/HMV for Engine Not	Troubleshooting : Causes and remedy for Engine Not starting –

Professional Knowledge 07 Hrs	functionality of vehicle.	starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise. (25 Hrs)	Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise. (07 hrs)
Project Work/ Industrial Visit: - **Broad Area:** a) Testing of engine after assembling. b) Intake and Exhaust System. c) Emission control d) Charging system e) Vehicle Troubleshooting			