SYLLABUS FOR THE TRADE

OF

MECHANIC MOTOR VEHICLE
[Semester Pattern]

UNDER
CRAFTSMAN TRAINING SCHEME (CTS)

Designed in– 2013

By
Government of India
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Employment & Training
Ministry of Labour & Employment
EN-81, Sector-V, Salt Lake City
Kolkata-700 091

List of trade committee members approved the syllabus of semester system for the trade of "Mechanic Motor Vehicle " held at ATI, Chennai

Sl. No.	Name & Designation	Representing Organisation	Remarks
1	Shri R. Senthil Kumar, Director	ATI, Chennai	Chairman
2	Shri S.Harinath Babu, Joint Director of Training	ATI, Chennai	Member
3	Shri E.Balakrishna, Ex_Joint Director of Training	NIMI, Chennai	Member
4	Shri A.Suganthan, Assistant Training officer	Govt, ITI, Arakkonam	Member
5	Shri N. Ramesh Kumar, Training Officer	CTI, Chennai	Member
6	Shri T Nandagopal,	Anna University, Chennai	Member
7	Shri K. Thaniyarasau, Assistant Training officer	Govt . ITI, Trichy	Member
8	Shri P.K. Ramakrishnan Nair	Ram international Industrial Academy (p) Ltd, Chennai	Member
9	Shri S.Arul Selvan , Assistant professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
10	Shri S. Jayaraj, Associate Professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
11	Shri R. Lakshmanan	Bosch Ltd, Bangalore	Member
12	Shri V.ChandraMohan	NATRIP, Global Automotive Research centre, Chennai	Member
13	Shri V.Vadivelan	NATRIP, Global Automotive Research centre, Chennai	Member
14	Shri A.D.Shewale Training Officer	CTI, chennai	Member
15	Shri B. Gridharan	Visa Diesel Service, Chennai	Member
16	Shri K.k.Valasarajan , Vice president	Two Wheeler workshop owners Association, Chennai	Member
17	Shri Jayapal,	Two Wheeler workshop owners Association, Chennai	Member
18	Shri V. Vadivelan	Two Wheeler workshop owners Association, Chennai	Member
19	Shri Syedshwath	Two Wheeler workshop owners Association, Chennai	Member
20	P. Marveldass, Assistant Director of Training (Electronics)	ATI, Chennai	Member
21	K. ArulSelvi, Training Officer (Electronics)	ATI, Chennai	Member
22	Shri Gurcharan Singh, Assistant Director of Training	ATI, Ludhiana	Member
23	Shri O.R. Arjun Mohan, Assistant Executive Engineer	Agricultural Engg. Dept, Chennai	Member
24	Shri R.Murugesan, Assistant Executive Engineer	Agricultural Engg. Dept, Chennai	Member
25	Shri Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
26	C.Yuvaraj, Assistant Director of Training	ATI, Chennai	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Muhkerjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member

16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

1.	Name of the Trade	:	**Mechanic Motor Vehicle**
2.	N.C.O. Code No.	:	
3.	Duration of Craftsmen Training	:	2 Year (Four Semester)
4.	Power Norms	:	4.8 KW
5.	Space Norms	:	84 Sq. mtr. & Parking room 125 Sq. mt
6.	Entry Qualification	:	Passed in 10^{th} Class Examination.
7.	Unit strength	:	16
8.	Instructors Qualification	:	a) Degree in Automobile/Mechanical Engineering from recognized engg. college/university with one year experience in the relevant field OR Diploma in Automobile/Mechanical Engg From recognized board of technical education with two years experience in the relevant field OR 10^{th} Passed + NTC/NAC in the Trade of "**Mechanic Motor Vehicle)**" with 3 years post qualification experience in the relevant field b) Preference will be given to a candidate with Crafts Instructor Certificate (CIC)

* **Note**: At least one Instructor must have Degree/Diploma in Automobile/ Mechanical Engg. when applied for 02 units.

TRADE: "MECHANIC MOTOR VEHICLE"

FIRST SEMESTER

Semester Code: MMV;SEM-I

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Workshop calculation and Science
1 & 2	**Admission & introduction to the trade:** Familiarization with institute, Job opportunities in the automobile sector, Machinery used in Trade. Types of work done by the students in the shop floor.	Introduction to the course duration, course contain, study of the syllabus. General rule pertaining to the Institute, facilities available – Hostel, Recreation, Medical and Library working hours and time table		Units, Derived and fundamental, types of system FPS, CGS, MKS and their conversion. Metric weights and measurements, units conversion factors
3 & 4	Practical related to Safety and Health , Demonstration on PPE (Personal Protection Equipments) Interaction with health center and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers.	**Occupational Safety & Health** Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. emergency evacuation procedure, Safe handling of Fuel Spillage, Use of Fire extinguishers, safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment,	Introduction to Engineering drawing and Blue Print Reading, Free hand sketching of straight lines, rectangles, squares, circles, polygons etc	Common Fractions addition, subtraction Multiplication and Division of Common Fractions Simple Shop problems Involving Fractions.

		Authorization of Moving & road testing vehicles, Environment control of Running indoors engines, Safety disposal of Used engine oil, Electrical safety practices. House Keeping – 5S Concept.		
5	Measuring practice on engine components with aid of instrument studied.	Systems of measurement, conversion of English into metric Systems of measurement & vice- versa. Description, care & use of :- Micrometers- Inside, Outside and depth measurements, Thread Micrometer, Micrometer adjustments, Vernier calipers, vernier depth gauge, vernier height gauge Telescope gages, Dial bore gauges, Dial indicators, vacuum gauge, tire pressure gauge.	Free hand sketching of Vernier caliper and Micrometer, Dial gauge	Reduction of common fractions to decimal fractions-shop problems. Definition of least count, Accuracy, Calibration, Derive the least count for Vernier caliper and Micrometer.
6	Practice using all marking aids, like steel rule with spring calipers, dividers, surface gauges, scriber, punches, Chisel etc., Layout a work piece- for line, circle, arcs and circles.	**Hand & Power Tools:-** Marking scheme, Marking material, Description, care and use of Surface plates, steel rule, measuring tape, try square.	Free hand sketching of key and screw threads with dimensions from samples.	Properties and uses of cast iron, ferrous metal, gray cast iron, white cast iron, wrought iron, and plain carbon steel, high speed steel and alloy steel.

	Practice on General workshop tools & power tools and equipments. Practice on visual Identification of materials used in workshop.	Calipers, dividers, surface gauges, scriber, punches, Chisel, Hammer, Screw-drivers, Allen key, Vices & clamps, Spanners, Sockets & accessories, Pliers, Wrenches, air impact wrench, air ratchet, air chisel, air blowgun, Torque wrenches, jet washers and cleaners, Pipe flaring & cutting tool, pullers, Cleaning tools & equipment.		
7	Practice on General cleaning, checking and use of nut , bolts, & studs etc., Removal of stud/bolt from blind hole.	Fasteners- Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, Circlip, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Selection of materials for gaskets and packing, Description of Riveting tools	Free hand sketching with dimension of simple solid such as cubes, rectangular blocks, cylinders etc.	Use of scientific calculator

8	Practice on cutting tools like Hacksaw, file, chisel, OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.	**Cutting tools** :- Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., chisel, OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.	Sketching of views of simple solid bodies as cubes, rectangular blocks, cylinders when viewed perpendicular to their surfaces and axis.	Different Type of cutting fluids and their properties.
9	Practice on Filing-filing to line-marking off-use of centre punch, dividers, calipers, steel rule etc. Filing true and square.	**Limits, Fits & Tolerances**:- Definition of limits, fits & tolerances with examples used in auto components.	-do-	Properties and uses of copper, zinc, lead, tin, aluminum, brass, bronze, solder bearing metals, timber and rubber. Nylon, P.V.C., PP (poly prop line, polymer)
10	Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. Use of tap extractor	Drilling machine - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Drill bits. Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock.	Sketching of Files, drill bit.	Calculation of cutting speed, feed and drilling time.
11	Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Cutting Threads on a Bolt/ Stud.	Hand Reamers – Different Type of hand reamers, Lapping, Lapping abrasives, type of	Views of simple hollow and solid bodies with dimensions, use of different types of	Brief description of manufacturing process of steel copper, aluminum and P.V.C.

	Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface.	Laps. Function of Gaskets, oil seals,	lines and symbols for drawing.	
12	Visit to industries for observation of material testing, casting and forging process.	Mechanical properties of materials, Tensile, Compressive & Temperature stress, Forging process & Casting Processes used in auto components with examples**.** Classification of steel, the effect of alloying element on steel	Free hand sketching of rivets and washers with dimensions from samples.	Ratios and proportions.
13	Practice on Arc welding, Gas welding, Resistance welding.	Introduction to Heat treatment – Definition of Annealing, Normalizing, Hardening and tempering. Case hardening, Nitriding, Induction hardening and Flame Hardening, process used in auto components with examples. Introduction to Metallic and Non-metallic Coatings Necessity of metallic and non-metallic coatings, principles and processes of electroplating, galvanizing, vacuumizing, metal spraying, painting and their applications,	Sketching of Iron carbon diagram Free hand sketch of weld symbols.	Importance Iron-carbon diagram Meaning of tenacity elasticity, malleability, brittleness, hardness, compressibility & ductility and their examples.

		preparation of base materials. Uses of primers, paints and finish coatings, powder coating and its advantages, with examples used in auto components. Introduction to Welding Processes- Arc welding, Gas welding, GTAW (TIG), GMAW (MIG) & Resistance welding.		
14	Joining of metal parts by Soft Soldering , Simple marking out on sheet metal and cutting, Bending and folding. Practice in silver soldering, pipe bending, Nipples Unions soldering and Brazing of pipes.	Sheet metal worker's common hand tools- their names and description of simple soldering and brazing fluxes used on common joints. Sheet and wire-gauges. The blow lamp- its uses and pipe fittings. Explanation of various common metal Sheets used in Sheet Metal shop.	Drawing of riveted joints, lap and Butt joints.	Definition of cold rolling and Hot rolling and its properties on sheet metal. Advantage of Deep drawing material.
15	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, circuit breakers.	Basic electricity, Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors &	Free hand sketching of Millimeter, ammeter, voltmeter and their parts	Electricity and its effects static and dynamic electricity, AC and DC differences

		insulators, Wires, Shielding, Length vs. resistance, Resistor ratings		
16	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.	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.	Free hand sketching of electrical symbols and drawing of simple Electrical circuits.	Calculations relating to electric Circuits. Measurement of electrical power watt and kilowatt relationship with Horse Power.
17	Cleaning and topping up of a lead acid battery, Testing battery with hydrometer, Connecting battery to a charger for battery 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.	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.	-DO-	Explanation of open and short circuits – locating short-circuits with the help of meters

18	Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality**,** Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches.	Basic electronics: Description of Semi conductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches.	Free hand sketching of Electronic symbols and drawing of simple Electronic circuits.	Problems on Charging current, ampere-hours, Decimal-Binary number conversions, Simple set theory problems like Union, Intersection and Null sets
19	Introduction to centre lathe setting up work between centers. Use of side cutting tools. Parallel turning and stepped turning.	Lathe : Introduction, types of lathes, specifications, description and functions of lathe parts, feed mechanism, drives and transmission, work holding devices, turning tools, Lathe operations – plain turning, facing, centering, parting off, undercutting, taper turning, eccentric turning, drilling, reaming, thread cutting and knurling, speeds and feeds of cut.	Free hand Sketching of different type of cutting tools Block diagram of lathe and its parts.	Definition of Cutting speeds, feed and depth of cut and their calculation. Taper and thread calculation.
20	Identification of Hydraulic and pneumatic components. Tracing of hydraulic circuit on hydraulic power steering, hydraulic/Pneumatic press and Brake circuit.	**Introduction to Hydraulics :-** Definition of Pascal law, pressure, Force, viscosity, effect of viscosity with respect to temperature, Mechanical	Drawing of hydraulic and pneumatic symbol. Black Diagram of Hydraulic and pneumatic power pack unit.	Simple problems on work, energy and power. Simple piston Force , velocity calculation, General gas equation.

		Advantage with Hydraulics, Description and use of Gear pump-Internal & External, Vane pump, Hydraulic motor. Hydraulic symbols. Description, use and application of single acting, double acting & Double ended cylinder; Directional control valves-3/2, 4/2, 4/3 way valve, Pressure control valve, Non return valve, Flow control valve in automobile. **Introduction to Pneumatics: -** Boyle's law**,** Pneumatic Symbols, Description and function of air Reciprocating Compressor, function of Air service unit (FRL-Filter, Regulator & Lubricator).		
21	Practice on 5S	**Maintenance:** Preventive, Periodical & break down maintenance. Definition & importance of Quality control, Quality assurance, quality circle. Basic Concept of TPM, TQM, & ISO 9000.	Drawing of quality of awareness sign board.	Preparation of Maintenance schedule chart /week/month/yearly

22-23	**Introduction to computer basics :** Basic of computer, Ms Word, Ms Power Point, MS Excel	Familiarization & Identification of computer parts. Practice on computer for MS word, MS power point, Ms Excel.		
24	Identification of different type of engine components.	**Introduction to Engine:** Description of internal & external combustion engines different types of I.C. Engines. Definition: - Classification of vehicles on the basis of load, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load.	Drawing of I .C engine and their parts. Layout of an automobile chassis,	Vacuum and air pressure principles**,** Pressure & temperature, Pressure & volume, Temperature & energy, Understanding power and torque.
25	**i)Project Work** **ii) Industrial Visit (Optional)**			
26	**Examination**			

TRADE: "MECHANIC MOTOR VEHICLE"

SECOND SEMESTER

Semester Code: MMV;SEM-II

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Workshop calculation and science
1	Identification of different types of Vehicles	Auto Industry in India -History, leading manufacturers, development in automobile industry, trends, new product. Basic thermodynamics	Use of drawing instruments, T-square and drawing board. Use of different types of scales in inches and millimeters	Mensuration - area of rectangles, squares, tri-angles, circles, regular polygons etc. calculation of areas.
2	Identification of parts in a diesel engine. Practice on starting and stopping of diesel engines. Use of speed counter in determining the engine speed – running of engine on load, checking temperature fuel and oil.	**Diesel Engine Basics:** Introduction, Compression-ignition engines- Description of Basic 4-stroke diesel principles and cycle , Basic 2-stroke diesel principles and cycle, Three phases of combustion **Compression-ignition engine components** – Basic diesel engine components, Diesel engine passages, Diesel fuel delivery, Direct injection, Indirect injection, Diesel valves & components, scavenging, Crankshaft rotation, crankshaft, Diesel engine pistons	Lettering number & alphabet Free hand sketching of 4 stroke cycles & 2 stroke cycles of engine	Calculation of Horse Power- IHP, FHP and applied shop problem. Simple problems straight and ball-cranked levers.

3	Practice on Diesel engine cleaning, dismantling as per procedure.	Principle of Spark Ignition engine, Differentiate between C.I engine and S.I Engine, 4-stroke and 2 strokes, Otto cycle and Diesel cycle. Different type of starting and stopping method of Diesel Engine. Engine output**,** Power range.	Explanation of simple Orthographic projection- 1st angle Views of simple hollow and solid bodies with dimensions.	Calculation of volume and weight of simple solid bodies such as cubes, square and hexagonal prism-shop problem.
4	Overhauling of cylinder head assembly with use of service manual for clearance and other parameters:- Practice on removing rocker arm assembly manifolds, cylinder head from the engine.	Engine Components Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence.	Explanation of simple orthographic projection 3rd angle. Simple isometric drawings, isometric views of simple objects, such as square, rectangles, cubes , rectangular blocks etc	Heat and temperature thermometric scale Fahrenheit and centigrade scales & their conversion. Name & use of temperature measuring instruments normally used in Workshop.
5	Practice on removing the valves and its parts from the cylinder head, cleaning & decarbonising. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. checking valve seats & valve guide – reconditioning valve seats and re-facing valves- lapping valves on its seat- testing leaks of valve seats for	**Valves & Valve Trains** Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats**,** Valve seats inserts in cylinder heads**,** importance of Valve rotation**,** Valve stem oil seals**,** size of Intake valves**,**	Sketching valve timing diagram. Free hand sketch of Different types of cams and followers Free hand sketching of crank shaft showing all parts.	Calculation of Engine displacement. Calculation of spring stiffness Shop problems on determination of volume & weight of simple bodies.

	leakage – Dismantle rocker shaft assembly -clean & check rocker shaft-and levers, for wear and cracks and reassemble. Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after decarbonising.	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**.**		
6 & 7	Overhauling piston and connecting rod assembly with use of service manual for clearance and other parameters:- Practice on removing oil sump and oil pump – clean the sump Practice on removing the big end bearing, connecting rod with the piston. 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. Measure -the piston ring close gap in the cylinder, clearance between the piston and the liner, clearance	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.	Free hand sketch of piston assembly, valve assembly. Free hand isometric sketching of simple objects with dimensions. Free hand sketching of piston gudgeon pins rings and connecting rod with dimensions from samples	Calculation of volume, compression ratio, force on the piston due to combustion pressure, average piston velocity, internal power of engine respecting two or four stroke,

	between crank pin and the connecting rod big end bearing. Check connecting rod for bend and twist. Assemble the piston and connecting rod assembly.			
8	Overhauling of crankshaft with use of service manual for clearance and other parameters:- Practice on removing damper pulley, timing gear/timing chain, flywheel, main bearing caps, bearing shells and crankshaft t from engine checking oil retainer and thrust surfaces for wear, Measure crank shaft journal for wear, taper and ovality, Checking crankshaft for fillet radii, bend & twist.	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.	Free hand sketching of crankshaft and flywheels with dimensions from samples Drafting of - Bush bearing - Split bearing - Thrust bearing, - Ball bearing - Roller bearing – straight and needle.	calculation of effective power on crank shaft by using mechanical efficiency Centre of gravity of bodies-stable & unstable, Neutrals & equilibrium-Examples & Problems on Centre of gravity.
9	Checking of flywheel and mounting flanges, spigot, bearing. Check vibration damper for defects, Practice on removing cam shaft from engine block, Check for bend & twist of camshaft. Inspection of cam lobe, camshaft journals and bearings and measure cam lobe lift. Fixing bearing inserts in cylinder block & cap check nip and spread clearance & oil holes & locating lugs	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.	Free hand sketching of gears timing mark.	Simple levers with examples i. e. bell - crank lever & other used in engine – Advantage in using them. Problems on lever.

	fix crank shaft on block-torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit.			
10	Cleaning and Checking of cylinder blocks surface for any crack, flatness, Measure cylinder bore for taper & ovality, clean oil gallery passage and oil pipe line, Bore - descale water passages and examine Removing cylinder liners from scrap cylinder block, practice in measuring and refitting new liners as per maker's recommendations precautions while fitting new liners.	Description of Cylinder block, Cylinder block construction, Different type of Cylinder sleeves (liner).	Free hand sketching of cylinder block and cylinder head Free hand sketching of cylinder liners with dimensions form sample	Definition of stress, strain and modulus of elasticity ultimate strength types of stresses- factor of safety examples.
11	Reassemble all parts of engine in correct sequence and torque all bolts and nuts as workshop manual of the engine. Engine component procedures- Testing cylinder compression**,** Checking idle speed**,** Removing & replacing a cam belt**,** Inspecting & adjusting an engine drive belt**,** Replacing an engine drive belt.	Engine assembly procedure with aid of special tools and gauges used for engine assembling. Introduction to Gas Turbine, Comparison of single and two stage turbine engine, Different between gas turbine and Diesel Engine.	Free hand sketching of plain and elevation of simple objects like hexagonal bar, square bar, circular bar, tapered bar, hollow bar etc.	Simple calculation of stress, compressive Strain, compressive stress (E), Shear stress (G), Tensile strength, Factor of safety, and The allowable working stress.

12&13	Practice on Checking & adjusting coolant, Draining & refilling coolant, Checking & replacing a coolant hose, Testing cooling system pressure, Practice on Removing & replacing a radiator, thermostat. Inspect the radiator pressure cap, Testing of thermostat. Cleaning & reverse flushing. Overhauling water pump and refitting.	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, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch.	Free hand sketching of different cooling system showing all necessary parts. Freehand sketching of water pump thermostatic valve & water jackets in the cylinder block.	Calculation of Volumetric efficiency, Torque Vs Engine speed, Specific fuel consumption vs. engine speed.
14 & 15	Practice on Checking engine oil**,** Draining engine oil**,** Replacing oil filter**,** Refilling engine oil**.** Overhauling of oil pump, oil filters, oil coolers, air cleaners and air filters and adjust oil pressure relief valves, repairs to oil flow pipe lines and unions if necessary.	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.	Free hand sketching of lubrication system, filters and different types of oil pump, pressure release valve.	Properties of Diesel engine cylinder lubricating oil. Definition of emulsion, viscosity index.

16	Practice on Dismantling air compressor and exhauster and cleaning all parts - measuring wear in the cylinder, reassembling all parts and fitting them in the engine. Dismantling & assembling of turbocharger, check for axial clearance as per service manual.	Intake & exhaust systems – Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger, variable turbo charger mechanism. 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**,** Catalytic converters**,** Flexible connections**,** Ceramic coatings**,** Back-pressure, Electronic mufflers**.**	Free hand sketching of air cleaner & Turbocharger system.	Machines- basic principles, determination of velocity ratio, mechanical advantage and efficiency.

17 & 18	Practice on removing & Cleaning fuel tanks, checking leaks in the fuel lines, soldering & repairing pipe lines and Unions, brazing nipples to high pressure line studying the fuel feed system in diesel engines, draining of water separators. Bleeding of air from the fuel lines, Servicing primary & secondary filters. Dismantling fuel injection pump, feed pump governor studying the parts and reassemble general maintenance of Fuel Injection Pumps (FIP). 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. Practice on overhauling of injectors and testing of injector.	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, Mechanical or pneumatic governors, 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.	Free hand sketching of fuel feed system in diesel engines and fuel filters. Free hand sketching of different types of injectors. Free hand sketching of single element plunger of fuel injection pump Freehand sketching of water separators and fuel tanks with dimension from sample. Freehand sketching of Distributor fuel injection pump with dimension from samples. Freehand sketching of a pneumatic governor with dimensions from samples Freehand sketching of mechanical governor with dimensions from sample.	Alternate Fuel Systems:- Bio-diesel fuel, Importance of Alternative fuels- Ethanol, Methanol, Liquefied Petroleum Gas Compressed Natural Gas, Liquefied Natural Gas, Fuel cells, solar, Hybrid system.
19 & 20	Practice on Start engine adjust idling speed and damping	Marine & Stationary Engine:- Types, double acting	-do-	Problems on Equations of motion

	device in pneumatic governor and venture control unit checking performance of engine with off load adjusting timings. Start engine- adjusting idle speed of the engine fitted with mechanical governor checking- high speed operation of the engine. Checking performance for missing cylinder by isolating defective injectors and test-dismantle and replace defective parts and reassemble and refit back to the engine Visit to marine engine service station.	engines, opposed piston engines, starting systems, cooling systems, lubricating systems, supplying fuel oil, hydraulic coupling, reduction gear drive, electromagnetic coupling, electrical drive, generators and motors, supercharging.		(v = u+at s = (u+v)t /2 $v^2 = u^2+2as$ s = ut+ (at^2) /2 u = initial velocity in m/s; v = final velocity in m/s; a = acceleration in m/s^2; t = time in seconds; s = distance.) and their application to vehicle technology
21	On-board diagnostics-OBD systems**,** Diagnostic trouble codes**,** Monitoring emissions Emissions procedures Checking & cleaning a Positive crank case ventilation (PCV) valve**.** Obtaining & interpreting scan tool data.	Emission Control:- Vehicle emissions standards. 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**,** Sulfur content in fuels Description of Evaporation emission control**,** Catalytic conversion**,** Closed loop**,** Crankcase emission control**,** Exhaust gas	Views of simple solid and hollow bodies cut by section plane.	Determination of efficiency of simple machines like winch, pulley locks, wheel and compound axles.

		recirculation **(**EGR) valve**,** Controlling air-fuel ratios**,** Charcoal storage devices, Diesel particulate filter (DPF).		
22	Practice on removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles.	Description of charging circuit operation of alternators, regulator unit, ignition warning lamp-troubles and remedy in charging system.	Freehand sketching of charging system.	Magnets-natural and artificial types-poles of magnets-magnetic fields.
23	Practice on removing starter motor vehicle and overhauling the starter motor, testing of starter motor.	Description of starter motor circuit, comparison of wire thickness in starter motor circuit, constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit.	Sketching starter motor circuit and solenoid switch circuit.	Principle of Solenoid and relay, Electromagnetic induction. Fleming's rule.
24	Practice on troubleshooting for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.	Troubleshooting : Causes and remedy for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.	Reading of simple blue print.	Study of Engine specification.
25	**i) Project Work** **ii) Industrial Visit (Optional)**			
26	**Examination**			

TRADE: "MECHANIC MOTOR VEHICLE"

THIRD SEMESTER

Semester Code: MMV;SEM-III

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Workshop calculation and science
1	Identification of different major components of Heavy vehicle and their function & placement study of different make lorry/bus/tractor in Institute with different dealers or organizations.	Study of different major components & assemblies of heavy vehicle, and different make (indigenous). Name plate-constructional differences and their merits. leading manufacturers in Heavy vehicle Industry		
2	Trouble shooting Practice with Heavy vehicle.	Review of Trouble shooting: Causes and remedy for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.	Simple Blue Print Reading and I.S.I. symbols of different materials	Materials used in the construction of different parts of Heavy vehicle.
3-5	Practice on adjusting clutch pedal play-removing gearbox and clutch assembly from Light & Heavy Vehicle. Dismantling clutch assembly, cleaning inspecting parts. Removing & fitting of new pilot bearing, removing & fitting of ring gear in fly wheel relining a clutch plate checking condition of flywheel and pressure plate surface for reconditioning.	Clutches & Manual Transmissions-Clutches Clutch principles**,** Single-plate clutches**,** Multi-plate clutches**,** Dual mass flywheels**,** Operating mechanisms Clutch components-Pressure plate**,** Driven/center plate**,** Throw-out bearing Manual transmissions-Gear ratios**,** Compound gear trains**,** Gear selection**,** Bearings**,** Oil seals & gaskets Gearbox layout & operation	Isometric drawing of simple objects such as squire and rectangular blocks with grooves-keyways. Isometric view of clutch pedal-clutch release bearing-fork and clutch plate-free hand sketching of clutch assembly. Free hand sketching of shifter	Study of Gear nomenclature. Applied problems in force, work-done, energy & power. Applied problems in horsepower calculation of speed ratios in 4-speed gearbox & 5-speed gearbox.

	Assembling of pressure plate adjusting the fingers checking run out of fly wheel and aligning clutch assembly with flywheel. Dismantling cleaning and assembling of gearshift mechanism changing oil in gear box Dismantling a synchromesh gear box, cleaning, inspecting parts replacing worn out defective parts assembling & testing for correct performance identifying noises from gear boxes and rectifying.	Gearbox layouts**,** Transaxle designs**,** Gearbox operation**,** Baulk-ring synchromesh unit **,** Transaxle synchromesh unit	mechanism and hear shift lever. Free hand sketching of the arrangement of gears inside the sliding mesh gear box in different gear positions.	
6-8	Practice on Removing open type propeller shaft from vehicle, Practice on removing universal joints cleaning replacing worn out parts, re-assembling & refitting to vehicle-special precautions while removing torque tube drive shaft. Practice on Removing and refitting rear axle assembly. Practice on overhauling & inspection of rear axle. Practice on overhauling & inspection of differential assembly. Trouble shooting – causes and remedy for clutch slip, clutch	Final Drive & Drive Shafts - Basic layouts Front-wheel drive layout**,** Rear-wheel drive layout**,** Four-wheel drive layout**,** All-wheel drive layout**,** 4WD v/s AWD **Front-wheel drive** Front-wheel drive shafts**,** Front-wheel final drives**,** Front-wheel differentials **Rear-wheel drive-** Propeller shaft**,** Universal joints**,** Rear-wheel final drives**,** Salisbury axles**,** Rear-wheel drive differentials**,** Limited slip differentials**.** **Four-wheel drive-** Four-wheel drive shafts**,** Four-wheel final drive**,** Four-wheel drive transfer case**,** Freewheeling hubs**,** Four-wheel drive differentials **All-wheel drive-** four	Free hand sketching of Front-wheel drive layout**,** Rear-wheel drive layout**,** Four-wheel drive layout**,** All-wheel drive layout, joints & Universal Joint.	Study of Gear terminology, Belt drives, Problems on gear and belt drives. Gear ratio calculation,

	noise, clutch binding, hard clutch, gearbox noise, gear slip, rear axle noise, propeller shaft noise, universal joint noise, differential noise.	wheel final drives, All-wheel drive transfer case, Transfer case differential action.		
9-11	Identification of Automatic transmission components Checking automatic transmission fluid, Changing transmission fluid & filter.	Automatic Transmissions-Torque converters Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches Planetary gearing-Planetary gears, Simple planetary gear sets, Compound planetary gear sets, Automatic transmission brake bands, Multi-disc clutches, Electronic control transmission -Electronic control Unit, Fully hydraulically controlled transmission, Electronic shift programs, Manual selection Layout & operation for P,R,N&D (1^{st} & 2^{nd}) Selector positions, Planetary gear set, High range power flow, Low range power flow Servos & clutches-Rear servo, Front servo, One way clutch, Multi-plate front clutch, Clutch pack, Rear clutch. Hydraulic system & controls-Hydraulic system components, Spool valves, Regulating or flow control valves, Control valves, Orifices Valve types & functions Basic valve action,	Free hand sketch of Torque converter Lay out for gearbox, Selector positions, Planetary gear set, High range power flow, Low range power flow	Properties of transmission fluid. Gear ratio calculation for Automatic transmission.

		Regulator & control valves, Shift & governor valves Pressure regulation-The primary regulating valve, Line pressure variation, Modulator valve pressure, The governor, Governor pressure, Kickdown pressure. Flow control-Gear position 1, 1-2 shift valve, 2-3 shift valve assembly, The servo orifice control valve, 3-2 kick down Continuously variable transmission (C.V.T.) Continuously variable transmission, Drive or reverse, The steel belt, Secondary pulley shaft.		
12-14	Following practical to be Practiced On Light & Heavy Vehicle. 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. Practice on removing steering wheel, steering gearbox. 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. Checking & adjusting power steering fluid, Pressure testing a power	**Steering Systems:-** Description and function of Steering systems, Principles of steering, Rack-and-pinion steering system, Recirculation ball & nut steering system, Four-wheel steering systems, collapsible steering system. Steering boxes & columns Description and function of Steering columns, Rack-and-pinion gearbox, Helix, Variable ratio steering, Worm gearbox, Power Assisted steering, Steering process, Flow-control valve, Electric power assisted steering, Basic electric power steering operation Steering arms & components Forward control vehicle steering, Steering linkages, Joints, Bushes/bushings **Wheel alignment**	Free hand sketching of different types of steering boxes Free hand sketching of caster, camber, king-pin angle. Ackerman's angle toe-in & toe-out.	Problems in steering geometry-calculation of caster, camber.

	steering system, Flushing a power steering system, Inspecting & adjusting an engine drive belt, Servicing a steering system, Servicing wheel bearings. Troubleshooting- Causes and remedy for abnormal wear of tyre, wheel wobbling, poor self centering, hard steering, and vehicle pulling to one side.	**fundamentals:-** Basic principles of wheel alignment, wheel base, wheel track, king pin inclination, Caster, Camber, Scrub radius, Toe-in & toe out, Toe-out on turns, Turning radius, Thrust angle & centerlines.		
15-17	Following practical to be Practiced On Light & Heavy Vehicle Practice on visual Inspection of chassis frame for crack, bent and twists. Overhauling and Inspection of shackle, leaf spring, front & rear suspension. Practice on removing, inspection and assembling of shock absorber Lubricating a suspension system.	**Suspension Systems:-** Principles of suspension, Suspension force, Unsprung weight, Wheel unit location, Dampening Types of suspension- Suspension systems, Solid axle, Dead axle, Independent suspension, Rear independent suspension, Rear-wheel drive independent suspension, Adaptive air suspension operation Types of springs- Description and function of Coil springs, Leaf springs, Torsion bars, Rubber springs Shock absorber types- Description and function of Hydraulic shock absorbers, Gas-pressurized shock absorbers, Load-adjustable shock absorbers, Manual adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load-adjustable shock absorbers Front suspension types & components-Mc person Strut suspension,	Free hand sketching of Suspension system layouts. Driven rear suspension layouts, Non-driven rear suspension layouts, Independent rear suspension layouts, Front suspension layouts, Bushes/bushings, Arms & linkages	Definition of longitudinal vibration, Transverse vibration and torsional vibrations. Simple problem on frequency of Transverse vibration and torsional vibrations.

		Short/long arm suspension, Torsion bar suspension Rear suspension types & components-Rigid axle leaf spring suspension, Rigid axle coil spring suspension, Independent type suspension, Rigid non-drive suspension		
18-19	Practice on removing wheels from light & Heavy vehicle, dismantling tyres and tubes checking puncture. Assembling inflating to correct pressure. Rotating the wheels in vehicle minor repairs to wheels and tyres, wheel balancing & alignment. Checking for tyre wear patterns.	Wheels & Tyres-Wheel types & sizes Wheels, Rim sizes & designations, Types of wheels Tyre types & characteristics Tyres, Radial ply tyres, Radial ply tyre sidewalls, Tyre pressure monitoring systems, Run flat tyres, Space-saver tyres, Tyre distortion, Center of gravity Tyre construction-Tyre construction, Types of tyre construction, Tyre materials, Hysteresis, Tyre sizes & designations, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction.	Free hand sketching of different type of tyre thread design.	Rounding of Numbers, Power & roots – General rule for indices, Multiplying and dividing numbers in standard form.
20-22	Practice on Adjusting brake pedal play, Overhauling and inspection of tandem master cylinder assembly, Overhauling and inspection of front and rear brake assembly, overhauling and inspection of wheel cylinder assembly Bleeding hydraulic brakes & Disk brakes. Overhauling and inspection of vacuum assisted brake assembly.	**Braking Systems :-** Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake fade, Regenerative braking. Braking systems - Brake type - principles, Air brakes, Exhaust brakes, Electric brakes, Parking brakes, Engine brakes, **Regenerative braking Braking system components**-Park brake system, Brake pedal, Brake lines, Brake fluid, Bleeding, Master cylinder,	Free hand sketching of brake linings wheel brake assembly sectioned views of master cylinder. Free hand sketching of brake wheel cylinders cam adjuster, brake shoe assembly and anchor pins. Freehand sketching – the	Square root of perfect square, square root of whole numbers and decimals relating to braking distance. Simple levers, problems related to as applied to motor vehicles Meaning of friction examples of useful and wasteful friction

	Overhauling and inspection of disc brake. Adjusting Air brake s-repair to tank unit, air compressor, wheel brake adjuster-locating air leaks in the brake lines and rectifying – general maintenance and care. Brakes procedures-Checking & adjusting brake fluid, Replacing brake fluid, Checking brake pads, Replacing brake pads, Removing & replacing a rotor, Replacing brake linings, Adjusting a parking brake cable. Trouble tracing in braking system of a heavy vehicle adjusting brakes and balancing all four wheel brakes, precautions to be observed while testing brakes points to be remember while preparing the vehicle for brake certificate. Practice of maintaining of ABS system.	Divided systems, Tandem master cylinder, Power booster or brake unit, Hydraulic brake booster, Electro hydraulic braking (EHB), Applying brakes, Brake force, Brake light switch Drum brakes & components -Drum brake system, Drum brake operation, Brake linings & shoes, Backing plate, Wheel cylinders Disc brakes & components -Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake calipers, Proportioning valves, Proportioning valve operation, Brake friction materials Antilock braking system & components-ABS brake system, Antilock braking system operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with EBD electronic control unit.	layout of vacuum assisted. Hydraulic brake system Freehand sketching of the lay out of Air brake system and sketching of slacken adjuster.	in vehicles co efficient of friction-simple problems on frication. Definition of mass, unit of force-weight of a body- energy and power. Applied problems in force, work done energy and power.
23-24		Study of Motor Vehicle act Rules & Regulation.		Exercise in driving a Lorry/Bus with different implements
25	**i) Project Word** **ii) Industrial Visit(Optional)**			
26	**Examination**			

TRADE: "MECHANIC MOTOR VEHICLE"

FOURTH SEMESTER

Semester Code: MMV;SEM-IV

Week No	**Practical**	**Trade Theory**	**Engineering Drawing**	**Workshop Calculation and Science**
1	Identification of petrol Engine components.	Auto Industry in India - History, leading manufacturers, development in automobile industry, trends, new product.		Statistics- definition, collecting and sorting raw data- tally chart.
2	Removing a petrol engine from a motor vehicle - dismantling cylinder head, decorbonising, checking valves - cutting valves seats, replacing worn guides and weak springs, assembling valves and cylinder head and adjusting tappet clearance in engine.	**Petrol Engine Basics:** 4-stroke spark-ignition engines- Basic 4-stroke principles, 4-stroke engine cycle. 2-stroke principles, 2-stroke engine cycle, Spark-ignition engine components- Basic engine components**,** 4 & 2-stroke engine differences**,** Engine cams & camshaft**,** Engine power transfer**,** Scavenging**,** Counter weights**,** Piston components**.**	Make a simple sketch in plan view of a front engine FWD vehicle. Label the main components: engine, clutch, gearbox, drive shafts, driving, wheels, radiator, fuel tank. .	Constructing pictograph –pie chart, bar chart, arithmetic mean, the median, and the mode.
3	Practice on Removing assembling of piston and connecting rods from engine checking cylinder bore wear for ovality and taper and finding next oversize- Piston ring, Piston as per service manual. Checking & changing an air filter	**Intake & exhaust systems -**Carbureted systems**,** Electronic fuel injection systems**,** Exhaust systems**.** Intake system components**,** Air cleaners**,** Carburetor air cleaners**,** EFI air cleaners**,** Intake manifolds**,** Intake air heating**.**	A free hand sketching of 2 stroke and 4 stroke engines. Free hand sketching of Intake system and exhaust system, Air cleaners.	Circle, length of arc, Timing marks, wheel revolutions and distance travelled, calculation of valve opening area.

4 & 5	Simple repairs in fuel feed system – overhauling of fuel pump, carburetors, fuel Filters and air cleaners. Repair to a car carburetors – adjusting float level and slow speed adjustments – studying the fuel flow circuit in carburetor Practice in engine tune up in a vehicle – testing vacuum and compression of engine, adjusting tappets setting ignition timing and adjusting carburetor For slow speeds.	**Gasoline Fuel Systems** : Description of Gasoline fuel**,** Gasoline fuel characteristics**,** Controlling fuel burn**,** Stoichiometric ratio**,** Air density**,** Fuel supply system**,** Pressure & vacuum Carburetor operation-Carburation**,** Carburetor system components**,** Carburetor systems**,** Metering jets**,** Accelerating**,** Carburetor barrels Carbureted system components The carburetor**,** Mechanical fuel pumps**,** Electric fuel pumps**,** Tanks & lines**,** Fuel lines**,** Charcoal canister**,** Carburetor filters	Free hand sketching of valve Operating mechanisms, Free hand sketching of Carburetor, Block diagram of Petrol fuel feed system	Calculation of piston, Engine displacement. Swept volume, clearance volume, total volume, Compression ratio Check your results by looking in the manufacturers manual. Units of Heat, Temp, Pressure and its conversion. Basic of calorific value calculation. Comparison of various fuel w.r.to calorific values. Relevant combustion equation, Detonation.
6 & 7	Practice on Cleaning fuel tank, checking for leaks in Fuel tank. Identification of various components of MPFI system. Testing of MPFI components and replacement if necessary. Check delivery from fuel Pump. Replacing a fuel filter**.**	Introduction to Electronic fuel injection (EFI) fuel supply system , Basic EFI principles**,** Air supply**,** Air volume**,** Multi-point injection systems **(MPI/MPFI),** Simultaneous injection**,** Efficient combustion **EFI fuel supply system - components** Fuel pumps**,** Fuel filters**,** Tanks & lines**,** Fuel lines**,** Fuel rail**,** Fuel pressure regulator**,** Injectors**,** Tachometric relay**,** Thermotime switch**,** EFI sensors**,** Potentiometer**,** Auxiliary air valves**,** Idle speed control devices**,**	Block diagram of MPFI system. International standard and norms for testing of MPFI. Free hand sketching of wiring diagram of MPFI system Free hand sketching of symbols used in vehicle electrical systems.	Angels & rotation Type of angels, adding and subtracting angle, Examples of angles in automotive work Type of triangle, Pythagoras's theorem Trignometery-Using scientific calculator to find the value of sin, cos, tangent with examples in automotive application,

		Inertia sensors.		
8 & 9	Identification of Electronic control Unit. Set up for testing, Testing of Electronic Control Circuit. Fault finding in Electronic circuit and remedies	Introduction to EFI Engine Management - EFI operation Modes of EFI, Electronic fuel injection, Idle speed control systems, Feedback & looping, Cold start systems, Air measurement, Air-flow monitoring, Variable intake manifold system, Electrical functions, EFI wiring diagram Electronic control unit - ECU EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp.	Sketching of various Electronic devices used in motor vehicle. Free hand sketching of wiring diagram of EFI system	Binary system, Most significant Bit (MSB), Least significant Bit (LSB), hexadecimal, converting base 10 numbers to binary, uses of binary numbers in vehicle systems . Binary codes- ASCII
10	Identification of various sensors installed in engine & its mounting. Checking instruments & Gauges on dash board. Rectify replace defective gauges.	EFI sensors- Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor	Free hand sketching of sensors. Free hand cut sectional view of petrol nozzle.	Directed numbers- Addition, subtraction, multiplication and Division. Active sensors, Passive sensors.
11	Check and replace ignition coil, overhauling Distributor Assembly. Diagnosis- Possible causes and remedy for Engine cranks, but will not or hard to start, Poor fuel economy or engine performance.	Ignition principles and Faraday's laws, Primary and secondary winding of transformer, Ignition components, Spark plugs, Spark plug components, Vacuum & centrifugal units, Plug firing voltage, Contact breaker system, ballast resistor coil, Dwell angle, Spark timing.	Free hand sketching of Transformer windings, Ignition circuit of a vehicle, Sketching various type of spark plugs.	Algebra- Multiplying two binomial expressions in brackets, Algebraic expressions and simplification, finding the value of the unknown quantity.

12	Checking ignition timing, Checking & changing a spark plug, Removing & replacing contact points.	Battery power source, Description and function of Capacitor/condenser, Distributors, Distributor types, High-tension leads, Advance & retard mechanisms.	Sketching of battery and assorted capacitor/condenser.	Calculation of time constant for capacitance circuit. Calculation relating to capacitor in series and parallel.
13	Identification and testing of Hall effect sensor, Optical sensor. Tracing and testing of sensor circuits.	Induction , Inductive system operation, Induction wiring, Hall effect sensors, Hall effect operation, Optical type sensors Distributor less ignition systems, Insulated coils, Distributor less ignition system timing .	Sketching of sensors symbols, sketching of Hall effect sensor, Optical sensor.	Calculation of time constant for inductive circuit.
14	Checking a charging system for the cause of undercharge, No charge, and over charge conditions. Removing & replacing an alternator, Inspecting & adjusting an engine drive belt, Replacing an engine drive belt / pulleys / Tesnionsers and their alignments.	Charging system, Alternator principles , Alternating current , Alternator components , Rectification , Phase winding connections , Rotor circuit , Voltage regulation , System operating voltage, High voltage charging systems Rotor, Stator, Alternator end frames, Slip ring & brush assembly. , Rectifier assembly, Alternator cooling fan.	Sketching of Exploded view of alternator. Sketching of Charging circuit along with symbols in it.	Lenz's law, simple calculation of back emf.
15	Perform starter motor current draw test, Perform starter voltage drop test, test starter motor relay, solenoid switch, connectors and wires. Removing starter motor from vehicle , overhauling and testing Of starter motor. Differentiate	Starting system, Starter motor principles, Starter motor construction, Starter magnet types, Starter motor engagement, Commutation, Switching, solenoid construction. Checking a starting system, Jump-starting a vehicle	Sketching of Exploded view of starter motor. Sketching of starter motor circuit along with symbols in it.	Permanent magnet, The magnetic effect of an electric current, Direction of the magnetic field due to an electric current in a straight conductor, Magnetic field caused by a coil of wire.

	between electrical and mechanical problems that cause slow crank and no crank. Growler testing for rotors.			
16 & 17	Trace the light circuit - test bulbs align head lamps, replacing fuses testing the tail and brake lights in vehicle. Checking & changing an exterior light bulb**,** Checking incorrect turn signal or hazard light operation. Checking & changing a headlight bulb**,** Aiming headlights**.** Identify system voltage and safety precaution associated with high intensity discharge light. Removing an electrical horn from vehicle - assembling the horn and adjusting the horn for correct sound, tuning double horn, repairing of horn relay and horn switches. Removing a wiper motor dismantling, cleaning, inspecting, and repairing	Lighting system**,** Lamps/light bulbs**,** Lamp/light bulb information**,** LED lighting Stop lights**,** Reverse lights**,** Indicators**,** Headlights**,** High intensity discharge (HID) lights**,** Driving lights**,** Fog lights**,** Cornering lights**,** Smart lighting Park & tail light circuits**,** Headlight & dip circuits**,** Circuit diagrams**,** Networking & multiplexing	Sketching of 1. Head lamp, Park & Tail light circuit. 2. Interior lighting circuit 3. Hazard light and turn light 4. Horn & Wiper circuit	Graph-scales, variables coordinates, straight line graphs Geometry and trigonometry:- Angles- angular measurements, the radian.

	electrical wiper motors, assembling and fitting, Diagnose wiper speed control and park problem. setting blades for correct functioning. Trace the wiring circuit of traffic signal flashers light circuit-tracing defects in the flasher circuits, replacing fuse bulb. Removing, dismantling magnetos adjusting gap in points-testing magnetos.			
18	Identification of Air conditioning components, Performance test on A/c unit, Checking Charged state of refrigerant, Inspecting & adjusting an engine drive belt, Replacing an engine drive belt.	Heating Ventilation Air Conditioning (HVAC) legislation, Vehicle heating, ventilation & cooling systems, Basic air-conditioning principles, Air-conditioning capacity, Air-conditioning refrigerant, Humidity	Sketching of Air conditioning system using an expansion valve and orifice tube.	Definition – Absolute humidity, Boiling point, Heat transfer, convection, conduction, radiation, Latent heat of vaporization, super heat, the effect of pressure on boiling or condensation.
19 & 20	Checking a heating system, Compressor rotation test, air Gap check, Refrigerant recovery – evacuating – charging of A/c system.	Description and function of Fixed orifice, Control devices, Thermostatic expansion valve system, Thermal expansion valves, Air-conditioning compressors, Condensers & evaporators, Receiver drier, Lines & hoses, TX	Drawing of A/c wiring circuit motor vehicle. Sketching of TX valve construction. Sketching of block diagram of AC	Properties of refrigerants, refrigerant oil, Fluorinated refrigerants, Refrigeration process – pressure/enthalpy diagram.

	Replenishing compressor oil level Trouble diagnose and remedy for No cooling or warm air, Cool air comes out only intermittently, Insufficient cooling, Abnormal noise from compressor, Magnetic clutch, condenser, evaporator, Blower motor.	valve construction, Temperature monitoring thermostat, Refrigerants, Pressure switches, Heating elements Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Electric servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation systems.	compressor.	
21	Carrying out a visual inspection, Inspecting under body components, Measuring a wheelbase, Checking windshield washer liquid, Checking & replacing wiper blades, Checking a security system, Checking door hinges, Diagnose automatic seat belt systems, Checking interior trim, Checking driver's seat fabric, Vehicle valet service, Routine vehicle checks	Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pre-tensioners, Tire pressure monitoring systems Air bag safety and service warnings. Security systems, Remote control keys, Theft deterrent systems Integrated communications, Body controlled lighting systems, Proximity sensors, Reflective displays Global positioning satellites, Triangulation/trilateration, Satellite navigation, Telematics.	Drawing of Automatic door lock system circuit. Drawing of power window system circuit.	
22-24	Driving Practice Practice in straight driving on wide roads. Driving through lanes and curves. Practice in	Locating vehicle information, Obtaining & interpreting scan tool data, Using a repair manual, Using a shop manual, Using an owner's manual, Using a labor guide, Using a parts	Free hand sketching of different traffic Signals.	Applied workshop Problems calculation Fuel average, gear ratios.

	reversing. Practice overtaking another vehicle. Practice in driving through sand and wet surfaces. Practice in parking and Diagonal parking.	program**,** Using a service information program		
25	**Revision**			
26	**Examination**			

Trade: Mechanic Motor Vehicle
LIST OF TOOLS & EQUIPMNT

A. TRAINEES TOOL KIT FOR 16 TRAINEES +1 INSTRUCTOR

Sl.No.	Item with specification	Qty.
1.	Steel rule 15 cm inch and metric	17 nos.
2.	Steel rule 30 cm inch and metric	17 nos.
3.	Steel measuring tape 10 meter in a case	17 nos.
4.	Try Square 10 cm Blade	17 nos.
5.	Calipers outside 15 cm spring	17 nos.
6.	Caliper inside 15 cm Spring	17 nos.
7.	Dividers 15 cm Spring	17 nos.
8.	Safety glasses	17 nos.
9.	Scriber 15 cm	17 nos.
10.	Knife double Blade Electrician	17 nos.
11.	Wire insulation Stripper for shinning conductors from 0.4mm to 4mm	17 nos.
12.	Electrician testing Pencil (Line / Neon tester)	17 nos.
13.	Electrician Screw Driver 250mm	17 nos.
14.	Centre punch 10 cm.	17 nos.
15.	Chisel cold flat 20 mm x 150 mm	17 nos.
16.	Hammer ball peen 0.5 kg with handle	17 nos.
17.	Screw driver 20cm.X 9mm. Blade	17 nos.
18.	Screw driver 30 cm. X 9 mm. Blade	17 nos.
19.	Spanner D.E. set of 12 pieces (6mm to 32mm)	17 nos.
20.	Pliers combination 20 cm.	17 nos.
21.	Pliers side cutting 15 cm	17 nos.
22.	Pliers round nose 15 cm	17 nos.
23.	Pliers flat nose 15 cm	17 nos.
24.	Hands file 20 cm. Second cut flat	17 nos.
25.	Hand file 20 cm. Second cut half-round	17 nos.
26.	Hand file 20 cm. smooth triangular	17 nos.
27.	Hand file 30 cm. bastard	17 nos.
28.	Hand file 30 cm. round bastard	17 nos.
29.	File card or cleaner	17 nos.
30.	Wire cutter and stripper	17 nos.
31.	Steel tool box with lock and key (folding type) 400x200x150 mm	17 nos.

B. Tools Instruments and General Shop outfits

Sl. No.	Item with specification	Qty.
1.	Outside micrometer 0 to 25 mm	1no.
2.	Outside micrometer 25 to 50 mm	1no.
3.	Outside micrometer 50 to 75 mm	1no.
4.	Outside micrometer 75 to 100 mm	1no.
5.	Internal micrometer 5 to 30 mm	1no.
6.	Depth micrometer 0-25mm	1no.
7.	Thread Micrometer 0-25mm	1no.
8.	Drift Punch Copper 15 Cm	4 nos.
9.	Prick Punch 15 cm	4 nos.
10.	Adjustable micrometer sprit level to measure flatness, indication and taper with prismatic measuring base	1no.
11.	Vernier caliper A 200 with inside and depth measurement	1no.
12.	Direct reading vernier caliper B 300 (direct reading with dial)	1no.
13.	Vernier depth Gauge 0-150 mm	1no.
14.	Vernier height gauge 500 mm	1no.
15.	Telescope gauge	1no.
16.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)	4 nos.
17.	Surface gauge with dial test indicator plunger type i.e. 0.01 mm	2 nos.
18.	Cylinder bore gauge capacity 20 to 160 mm	2 nos.
19.	Compression testing gauge suitable for petrol engine.	2 nos.
20.	Vacuum gauge to read 0 to 760 mm of Hg.	2 nos.
21.	Tyre pressure gauge with holding nipple	2 nos.
22.	Marking Material (Consumable)	As required
23.	Marking out table 90X60X90 cm.	1no.
24.	CI surface plate 400 x 400 mm with stand and cover	1no.
25.	Granite surface plate 1600 x 1000 with stand and cover	1no.
26.	Steel rule 15 cm inch and metric	2 nos.
27.	Steel rule 30 cm inch and metric	2 nos.
28.	Steel measuring tape 10 meter in a case	2 nos.
29.	Try Square 10 cm Blade	2 nos.
30.	Engineer's square 15 cm. Blade	2 nos.
31.	Calipers outside 15 cm spring	2 nos.
32.	Caliper inside 15 cm Spring	2 nos.
33.	Calipers 15 cm Hermaphrodite	2 nos.
34.	Dividers 15 cm Spring	2 nos.
35.	Scriber 15 cm	2 nos.
36.	Scriber with scribing black universal	2 nos.
37.	Punch Letter 4mm	2 set
38.	Chisels cross cut 200 mm X 6mm	2 nos.
39.	Chisel 10 cm flat	2 nos.
40.	Safety Goggles	2 nos.
41.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
42.	Ball Peen Hammer 0.75 Kg	2 nos.

43.	Hammer copper 1 Kg with handle	2 nos.
44.	Hammer Mallet	2 nos.
45.	Hammer Plastic	2 nos.
46.	Hammer ball peen 0.25 kg with handle	2 nos.
47.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	2 sets
48.	Insulated Screw driver 30 cm x 9mm blade	2 nos.
49.	Insulated Screw driver 20 cm x 9mm blade	2 nos.
50.	Electric testing screw driver	2 nos.
51.	Allen Key set of 12 pieces (2mm to 14mm)	2 nos.
52.	Hand vice – 37 mm	2 nos.
53.	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw	1no.
54.	Magnifying glass 75mm	2 nos.
55.	'V' Block 75 x 38 mm pair with Clamps	2 nos.
56.	Clamps C 100mm	2 nos.
57.	Clamps C 150mm	2 nos.
58.	Clamps C 200mm	2 nos.
59.	Spanner D.E. set of 12 pieces (6mm to 32mm)	4 nos.
60.	Spanner, adjustable 15cm.	2 nos.
61.	Spark plug spanner 14mm x 18mm x Size	2 nos.
62.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	2 nos.
63.	Adjustable spanner (pipe wrench 350 mm)	2 nos.
64.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	2 nos.
65.	Spanner T. flocks for screwing up and up-screwing inaccessible positions	2 nos.
66.	Spanner Clyburn 15 cm	1no.
67.	Magneto spanner set with 8 spanners	1 set
68.	Spirit level 2V 250, 05 metre	2 nos.
69.	Angle plate size 200x100x200mm	2 nos.
70.	Angle plate adjustable 250x150x175	1no.
71.	Solid Parallels in pairs (Different size) in Metric	2 nos.
72.	Pliers combination 20 cm.	2 nos.
73.	Pliers side cutting 15 cm	2 nos.
74.	Pliers round nose 15 cm	2 nos.
75.	Pliers flat nose 15 cm	2 nos.
76.	Vice grip pliers	2 nos.
77.	Circlip pliers Expanding and contracting type 15cm and 20cm each	2 nos.
78.	Grip Wrench 200mm	2 nos.
79.	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
80.	Workshop plain goggles	17 nos.
81.	Air impact wrench	1no.
82.	Air ratchet	1no.
83.	Air chisel	1no.
84.	Air blow gun	1no.
85.	Car Jet washer	1no.
86.	Pipe flaring tool	1no.

87.	Pipe cutting tool	1no.
88.	Universal puller for removing pulleys, bearings	1no.
89.	Cleaning tray 45x30 cm.	4 nos.
90.	Cleaning tray- Aluminum 45 x 30 cm	4 nos.
91.	Stud extractor set of 3	2 sets
92.	Stud remover with socket handle	1no.
93.	Rivets sets snap and dolly combined 3mm, 4mm, 6mm	2 each
94.	Chemical compound for fasteners (Consumable)	As required
95.	Paraffin pressure Gun	2 nos.
96.	Grease Gun	2 nos.
97.	Hacksaw frame adjustable 20-30 cm	2 nos.
98.	Hacksaw blade (consumable)	As required
99.	Flat File 35 cm bastard	4 nos.
100.	Flat File 25 cm second cut	4 nos.
101.	File flat 20 cm bastard	4 nos.
102.	Files assorted sizes and types including safe edge file (20 Nos)	2 set
103.	Drill Twist (assorted) (Consumables)	10 Nos
104.	Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm	4 nos.
105.	Drill point angle gauge	1no.
106.	Set of stock and dies - UNC, UNF and metric	2 sets
107.	Taps and wrenches - UNC, UNF and metric	2 sets
108.	Taps and Dies complete sets (5 types)	1 set
109.	Hand reamers adjustable 10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm	2sets
110.	Lapping abrasives (consumable)	As required
111.	Oil can 0.5/0.25 liter capacity	2 nos.
112.	Oil Stone 15 cm x 5 cm x 2.5 cm	1no.
113.	Different type gasket material (consumable)	As required
114.	Different type of oil seal (consumable)	As required
115.	Sheet Metal Gauge	2 nos.
116.	Feeler gauge 20 blades (metric)	2 nos.
117.	Straight edge gauge 2 ft.	1no.
118.	Straight edge gauge 4 ft.	1no.
119.	Thread pitch gauge metric, BSX, BSF, MC, MF & SAE	1no.
120.	Valve Lifter	1no.
121.	Ladle 150mm Dia	1no.
122.	Blow Lamp 1 litre	2 nos.
123.	Crow bar 910 x25mm	2 nos.
124.	Voltmeter 50V/DC	5 nos.
125.	Ammeter 300A/ 60A DC with external shunt	5nos.
126.	DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms	1no.
127.	Electric Soldering Iron 230 V 60 watts 230 V 25 watts	2 each
128.	Copper bit soldering iron 0.25 Kg	5 nos.

129.	Thimbles of different sizes	2 nos.
130.	Wire Gauge (metric)	5 nos.
131.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2 nos.
132.	Hand rubber gloves tested for 5000 V	5 pair
133.	Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required	As required
134.	Multimeter digital	5 nos.
135.	Growler	1no.
136.	Scientific Calculator	1no.
137.	Hydrometer	2 nos.
138.	High rate discharge tester (cell tester)	1no.
139.	Spray Gun (Painting) 500ml	1no.
140.	Techometer	1no.
141.	Valve Timing Diagram	1no.
142.	Belt Tensioner Gauge	1no.
143.	Portable electric drill Machine	1no.
144.	Spring tension tester	1no.
145.	Carburetor repair kit	1no.
146.	Hot patch clamp	1no.
C. General Installation/ Machineries		
1.	Lathe general purpose all geared height of center 150 mm to below, Gap bed between centers 1000mm with all accessories with all attachment	1no.
2.	Drilling machine bench to drill up to 12mm dia along with accessories	1no.
3.	Cut section working model of Single plate clutch assembly.	1no.
4.	Cut section working model of Diaphragm clutch assembly.	1no.
5.	Cut section working model of centrifugal clutch assembly.	1no.
6.	Front axle (Rzeeppa Joint) with stand for Dismantling and assembly	1no.
7.	Rear axle with stand for Dismantling and assembly	1no.
8.	Constant Mesh Gear box with stand for Dismantling and assembly.	1no.
9.	Sliding mesh Gear box with stand for Dismantling and assembly.	1no.
10.	Synchronous Gear box with stand for Dismantling and assembly.	1no.
11.	Transfer case with stand for Dismantling and assembly.	1no.
12.	Cut section model of synchronous gear box working	1no.
13.	Cut section model of sliding mesh gearbox working	1no.
14.	Cut section model of constant mesh gearbox working	1no.
15.	Full floating axle and semi-floating axle assembly	1no.
16.	Cut section working model of automatic transmission Gear box	1no.
17.	Working model of fluid fly wheel	1no.
18.	Working model of torque converter	1no.
19.	Steering assembly - 1.Rack & pinion	1 each

	2.Worm & roller 3. Recirculating ball 4.Power steering	
20.	Suspension and steering system trainer	1no.
21.	Cut section models of shock absorbers	1no.
22.	Stock absorber testing bench	1no.
23.	Spring Tension scale – 0-4.5 kg.	1no.
24.	Coil spring compressor for suspension spring	1no.
25.	Turbo charger , variable Turbo charger	1 each
26.	Wheel alignment gauge – magnetic type with turn tables	1no.
27.	Wheel alignment setup instrument	1no.
28.	Tyre changer	1no.
29.	Nitrogen Tyre Inflation system	1no.
30.	Tube vulcanizing machine	1no.
31.	Tyre vulcanizing machine	1no.
32.	Camber angle gauge	1set
33.	Toe-in, toe-out gauge	1set
34.	Wheel balancing machine with accessory	1no.
35.	Tubed tyre of cars	2 each
36.	Tread wear indicator	1no.
37.	Tyre & split rim wheel assembly	1no.
38.	Solid tyre	1no.
39.	Tubed tyre of car, trucks & motorcycle	1no.
40.	Tubeless tyre of cars & trucks	1no.
41.	Cut section of cross ply and radial tyres	1no.
42.	Disk brake with caliper assembly	2 nos.
43.	Drum brake assembly	1no.
44.	Tandem master cylinder with booster	4 nos.
45.	Wheel cylinder	4 nos.
46.	Vacuum assisted hydraulics brake assembly with vacuum booster	1no.
47.	Air Brake Assembly	1no.
48.	Brake Lining riveting machine (foot operated)	1no.
49.	Brake testing equipment (to test efficiency of vehicle where motion after braking is plotted)	1no.
50.	Motor vehicle in running condition (Diesel heavy)	1no.
51.	Light Motor Vehicle	1no.
52.	Mechanical Hoist/Plate Form Type	1no.
53.	Trolley type portable air compressor single cylinder with 45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg/sq cm	1no.
54.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia wheels rough and smooth	1no.
55.	A.C welding transformer 300 Amps with complete accessories	2 set
56.	Oxy-acetylene welding equipment with complete accessories (Low & high pressure)	2 nos.
57.	Spot welding machine with complete accessories	1no.
58.	Guillotine shearing Machine foot operation	1no.

	(1mt x 18G Capacity)	
59.	Fly press / Ball press No.4 single body	1no.
60.	Pipe Bending Machine (Hydraulic type) 12mm to 30mm	1no.
61.	Spring tension tester	1no.
62.	Bench lever shears 250mm Blade x 3mm Capacity	1no.
63.	Gas Welding Table 1220mm x760mm	1no.
64.	Hydraulic Trainer Kit –Basic along with accessories	1no.
65.	Pneumatic Trainer Kit- Basic along with accessories	1no.
66.	Electronic component trainer kit	1no.
67.	Cylinder Block, CI Engine, Overhead camshaft & camshaft in block, air cooled	1each
68.	Carburetor – Solex, Mikuny for dismantling and assembling	1 each
69.	Carburetor repair tool kit	1no.
70.	Demonstration board of 2W Ignition system, ignition coil	1no.
71.	Demonstration board of electronic Ignition system, ignition coil	1no.
72.	Spark Plug cleaning and testing equipment	1no.
73.	Starter motor axial type, pre-engagement type & Co-axial type	1each
74.	Distributor –Duel advance type, reluctance type	1 each
75.	Tester sparking plug 'NEON' Type	1no.
76.	Alternator assembly used for LMV	2 nos.
77.	Starter motor assembly used for LMV	2 nos.
78.	Electronic engine control module	1no.
79.	Working Condition of Petrol MPFI Engine Assembly with fault simulation board	1no.
80.	MPFI petrol engine with swiveling stand along with special tools for dismantling and assembling	1no.
81.	Demonstration board of MPFI system	1no.
82.	Ultrasonic Injection cleaning equipment	1no.
83.	Fuel feed pump	1no.
84.	Multi-point fuel injection pump	1no.
85.	Petrol nozzle	4 nos.
86.	Air conditioning trainer kit	1no.
87.	Air conditioning service Unit (Car)	1no.
88.	Working Model of power windows	1no.
89.	Petrol Engine(2-stroke) Motor Cycle/Scooter along with special tools and accessories	1no.
90.	Cut model of 4 stroke Petrol engine on stand	1no.
91.	Cut model of 2 stroke Petrol engine on stand	1no.
92.	Mechanical Hoist/Plate Form Type	1no.
93.	Multi scan tool /ECU diagnostics kit	1no.
94.	Four stroke petrol engine with CNG setup-working condition	1no.
95.	AC alternator slip ring puller	1no.
96.	Functional/experiment model of different type of sensors.	1 set
97.	Executive Auto Electrical tool kit	1no.
98.	Auto Electrical test bench	1no.
99.	Cut section Model of Mock layout of a motor car –electrical	1 set

	system – working model	
100.	Car stereo	1no.
101.	Battery 12V (Lead acid & Alkaline)	2 nos.
102.	Battery charger 6V – 24 V	1no.
103.	Electrical horn (different types)	2 nos.
104.	Wiper motor assembly	2 nos.
105.	Anti theft device	2 nos.
106.	Horn and Horn relay	2 nos.
107.	Air conditioned MPFI vehicle with accessories	1no.
108.	5 Point relays	2 nos.
109.	4 Point relays	2 nos.
110.	Air bag simulator	1no.
111.	Driving Simulator	1no.
112.	Trolley type portable air compressor single cylinder with 45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg/sq cm	1no.
113.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia wheels rough and smooth	1no.
114.	Tyer Changer Machine	1no.

C. Workshop Furniture

Sl. No.	Description	Quantity
1.	Suitable class room furniture	As required
2.	Suitable Work Tables with vices	As required
3.	Stools	17 nos.
4.	Discussion Table	1 no.
5.	Tool Cabinet	2 nos.
6.	Trainees locker	2 Nos. to accommodate 16 lockers
7.	Fire Extinguishers, first- aid box	As required
8.	Book shelf (glass panel)	1 no.
9.	Storage Rack	As required
10	Storage shelf	As required.
11	LCD projector/ LED /LCD TV (big size)	1 no.
12	Multimedia CD for Automotive application	As required
13	Desktop computer and related MS office software	5+1 no.
14	Online UPS 2KVA	1 no.
15	Laser printer	1 no.
16	Computer Table	1 no.
17	Computer Chair	2 no.