SYLLABUS OF SEMESTER SYSTEM
FOR THE TRADE OF

Mechanic Motor Vehicle

Under

Craftsmen Training Scheme (CTS)
(Two years/Four Semesters)

Redesigned in
2014

By
Government of India
Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION

1.	Name of the Trade	:	**Mechanic Motor Vehicle**
2.	N.C.O. & NOS Code No.	:	**7231.10,** ASC/ Q 1401, ASC/ Q 1402
3.	Duration of Craftsmen Training	:	2 Year (Four Semester having duration of six months each)
4.	Power Norms	:	4.8 KW
5.	Space Norms	:	Space Area 210 Sq. Mt. (Including parking area)
6.	Entry Qualification	:	Passed 10th class examination with maths and Science.
7.	Unit strength	:	16 + 30% super Numeric
8.	Instructors Qualification	:	a) Degree in Automobile/ Mechanical Engg. (with specialization in Automobile) from recognised college/University with one year experience in the automobile industry and should possess valid LMV driving license. OR Diploma in Automobile/Mechanical (specialization in automobile) from recognized board of technical education with two years experience in the automobile industry and should posses valid LMV driving license. OR 10th Passed + NTC/NAC in the Trade of "**Mechanic Motor Vehicle)**" with 3 years post qualification experience in the relevant field and should possess valid LMV driving license. **and** b) With "**National Crafts Instructor Certificate".**

* **Note**:

1) At least one Instructor must have Degree/Diploma in Automobile/ Mechanical Engg. (with specialization in Automobile) when applied for 02 units.
2) Instructor Qualification for WCS & E.D, as per the Training Manual

9. For Employability Skills One Contract/Part Time/Guest Faculty for Generic Module .

i) MBA/ BBA with two years experience **OR** Graduate in Sociology / Social Welfare / Economics with Two years experience **OR** Graduate / Diploma with Two years experience and trained in Employability Skills from DGET institutes

AND

Must have studied English / Communication Skills and Basic Computer at 12^{th} / Diploma level and above

OR

Existing Social Study Instructors duly trained in Employability Skills from DGET institutes

Distribution of training on Hourly basis:

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extracurricular activity
42 Hours	27 Hours	5 Hours	3 Hours	3 Hours	2 Hours	2 Hours

COURSE INFORMATION (MECHANIC MOTOR VEHICLE)

1.Introduction :

- An intensive industrial survey was made to ascertain the requirements of skill-gap in the automobile sector; a scientifically designed survey covering labour-market survey web-survey was conducted. Based on the data obtained, the skills are identified and accordingly the syllabus has been drafted. Subsequently the Trade expert committee reviewed.

2. Terminal Competencies/Deliverables:

After successful completion of the above course, the trainee shall be able to perform the following skills with proper sequence.

- **Mechanic, Automobile** repairs overhauls and services motor vehicles to keep them in good running condition.

- Examines vehicle to ascertain nature and location of defects either by running engine or driving vehicle on road.

- Dismantles partially or completely defective unit or parts of vehicle such as engine, gear box, rear axle, front axle, steering assembly, radiator, etc. according to nature of repairs to be done, using hoist, jack, pullers, hand tools and other devices.

- Measures essential parts like cylinder, bores piston, sizes crank pins etc. using gauges, micrometer and other precision tools and gets cylinders rebored, liners filled, valve seats refaced, bearings replaced etc. as necessary.

- Repairs or overhauls and assembles engine such as replacing defective parts, scrapping bearings, setting timing, cleaning injectors, tuning carburettor etc. according to maker's specification.

- Replaces or repairs defective parts of gear box, rear axle, steering mechanism etc. and sets them right ensuring correct alignment, clearance, meshing of gears, specified movements and operations.

- Relines and builds brakes, sets wheel alignment, adjust, steering, clutch, hand brakes etc fits new or repaired accessories and body parts, makes electrical connection, and performs other tasks to effect repairs.

- Lubricates, joints, tightens loose parts, tests performance of vehicle by driving on road and makes necessary adjustments to attain desired standard.

3. Employment opportunities:

On successful completion of the course the candidates can either get employed, or become a self-employed Entrepreneur in any one of the following fields.

a) Wage Employment

1. Auto Mechanic
2. Vehicle Service Technician
3. Auto Fitter in Manufacturing Concern in Assembly Shop or Test Shop
4. Mechanic in Auto Manufacturing Industry
5. Dealers service mechanic
6. Driver/Vehicle Operator
7. Spare Parts Sales Assistant / Manufacturers' Representative
8. Laboratory Assistant
9. Auto Electrician

b) Self Employment

1. Automobile Mechanic
2.. Diesel Fuel System Service Mechanic
3. Vehicle Operator
4. Spare Parts Salesman
5. Spare Parts Dealer

4. **Further learning pathways:**

- On successful completion of the course trainee can get themselves enrolled in Apprenticeship training in reputed Industrial organisation.
- The qualified candidates have scope for lateral entry into the Diploma courses offered by some of the State Governments
- The qualified candidates can also get themselves upgraded by taking up the Second Semester at his own convenience in the CTS scheme, since the first semester is common to the following trades.

Craftsman Training Scheme

1.	Mechanic Motor Vehicle	- 2 Years (4 Sem)
2.	Mechanic Diesel	– 1 Year (2 Sem)
3.	Mechanic Motor Cycle	- 1 Year (2 Sem)
4.	Mechanic Auto Electrical and Electronics	- 1 Year (2 Sem)
5.	Mechanic Agricultural Machinery	- 2 Years (4 Sem)
6.	Mechanic Tractor	- 1 Year (2 Sem)
7.	Pump Operator cum Mechanic	- 1 Year (2 Sem)

Syllabus for the trade of Mechanic Motor Vehicle
First Semester (Semester code No.)
Duration: Six Months.
Syllabus for Trade practical and Trade Theory

Week No.	Trade Practical (27 Hrs/week)	Trade Theory (5 Hrs/week)
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.	**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
2	Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of Used engine oil. Energy saving Tips of ITI electricity Usage	**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**.**
3-5	Practice using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, Chisel etc., Layout a work piece- for line, circle, arcs and circles. Practice to measure a wheel base of a vehicle with measuring tape. Practice to measure valve spring tension using spring tension tester Practice to remove wheel lug nuts with use of an air impact wrench Practice on General workshop tools & power tools.	**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. Calipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch**,** center 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, Circlip pliers**,** external circlips pliers. Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing.

6&7	Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers. 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. Measuring practice on valve spring free length. Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges. Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges. Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator. Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge. Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge. Practice to check engine manifold vacuum with vacuum gauge. Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting.	**Systems of measurement**, Description, care & use of - Micrometers- Outside and depth mirometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.
8 & 9	Practice on General cleaning, checking and use of nut, bolts, & studs etc., Removal of stud/bolt from blind hole. Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding.	**Fasteners**- Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of **Gaskets,** Selection of materials for gaskets and packing, oil seals**.** **Cutting tools** :- Study of different type of cutting tools like Hacksaw, File- Definition, parts of a

	Practice on Hacksawing and filing to given dimensions.	file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding. **Limits, Fits & Tolerances**:-Definition of limits, fits & tolerances with examples used in auto components
10 & 11	Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor. 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.	**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 Die and Die stock. Screw extractors. **Hand Reamers** – Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.
12	Practice on making Rectangular Tray. Pipe bending, Fitting nipples unions in pipes. Soldering and Brazing of Pipes.	**Sheet metal** - State the various common metal Sheets used in Sheet Metal shop Sheet metal operations - Shearing, bending, Drawing, Squeezing Sheet metal joints - Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints. Sheet and wire-gauges. The blow lamp- its uses and pipe fittings.
13	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 & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings
14	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.

15	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.
16	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.
17& 18	Practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding. Setting of Gas welding flames, practice to make a straight beads and joints Oxy – Acetylene welding Film on Heat treatment process	**Introduction to welding and Heat Treatment** **Welding processes** – Principles of Arc welding, brief description, classification and applications. Manual Metal Arc welding -principles, power sources, electrodes, welding parameters, edge preparation & fit up and welding techniques; Oxy – Acetylene welding - principles, equipment, welding parameters, edge preparation & fit up and welding techniques;. Heat Treatment Process– Introduction, Definition of heat treatment, Definition of Annealing, Normalizing, Hardening and tempering. Case hardening, Nitriding, Induction hardening and Flame Hardening process used in auto components with examples.
19 & 20	Practice on Liquid penetrant testing method and Magnetic particle testing method. Identification of Hydraulic and pneumatic components used in vehicle. Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit.	**Non-destructive Testing Methods- Importance of Non-Destructive Testing In Automotive Industry, Definition of NDT,** Liquid penetrant and Magnetic particle testing method – Portable Yoke method **Introduction to Hydraulics & Pneumatics: -** Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External,

	Identification of components in Air brake systems.	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).
21	Identification of different type of Vehicle. Demonstration of vehicle specification data; Identification of vehicle information Number (VIN). Demonstration of Garage, Service station equipments.- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.	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.
22-23	In-plant Training	
24-25	Revision and Test	
26	NCVT Exam	

Workshop Calculation and Science

Syllabus for the trade of

1. Mechanic Motor Vehicle

Week No.	Workshop calculation and Science (3 Hrs/week) 1st Semester
1	Units, Derived and fundamental, types of system FPS, CGS, MKS and their conversion. Metric weights and measurements, units conversion factors
2	Fractions- Addition and subtraction, Fractions and whole numbers, Combined addition and subtraction, Multiplication and division of fractions. Operations in problems involving fractions.
3	Order of performing (BODMAS) Mathematical operators , Integers – Rules for dealing with integers, Addition, subtraction, Multiplication and division.
4 & 5	Ratio and proportion. Percentages, Examples of ratios in Automotive technology
6	profit and loss, Discount .
7	simple interest and compound interest
8	depreciation calculation
9-10	Time and work problem , Time and distance, clocks and calendar,
11	Brief description of manufacturing process of steel, and aluminum
12	Meaning of elasticity, malleability, brittleness, hardness, compressibility & ductility and their examples , 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.
13	Properties and uses in automobile industries- copper, zinc, lead, tin, aluminum, brass, bronze, solder bearing metals, timber and rubber. Nylon, P.V.C., PP (poly prop line, polymer).
14-15	**Materials – Stress, strain,-** Definition of Stress, Types of stress- Tensile, compressive, shear , Examples of the three basic stresses in automotive components , calculation of stress and strain in automotive application, Stress raisers, Strain-, Tensile, compressive, Shear strain, Tensile strength, Factor of safety, Torsional stress, Strain energy.
16	Definition of cold working and Hot working and its properties on sheet metal. Advantage of Deep drawing material. Importance of Iron- carbon diagram in heat treatment process.
17	Different Type of cutting fluids and their properties. Calculation of cutting speed, feed and drilling time.
18-19	**Forces** – Definition of Force, Types of force -examples,– Direct forces, Attractive forces, Explosive forces, Describing forces, Graphical representation of a force, Addition of forces, Parallelogram of forces ,Triangle of forces, Resolution of forces, Mass, Equilibrium, Pressure, Pressure in hydraulic systems, Hooke's law, Practical applications.
20-21	**Work energy, power**– Definition and calculation of Work, Power and Work done by a torque, Definition and calculation of Energy -Potential energy, Chemical energy, Conservation of energy, Energy equation, Kinetic energy, Energy of a falling body, Kinetic energy of rotation.

Syllabus for Engineering Drawing- Ist Semester

Syllabus for the trade of

1. **Mechanic Motor Vehicle**

Week No.	Engineering Drawing (3 Hrs/week) 1st Semester
1	Importance of engineering drawing as a communication medium, different types of drawing - Machine Drawing, Production Drawing, Part Drawing, Assembly Drawing, Drawing instruments, equipment and materials and their uses
2&3	Scales - Recommended scales, reduced & enlarged Drawing Sheet sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheet, sizes of title block and its contents. Using drawing instruments to draw straight lines, rectangles, squares, circles, polygons.
4&5	Lettering and Dimensioning - Types of Lettering, Guide Lines for lettering, Recommended sizes of letters and numbers, Single stroke letters, Dimensioning - rules and systems of dimensioning – dimensioning a given drawing.
6&7	Identify the alphabet of lines- Read and Interpret the meaning of various line types with examples- Object Lines, Hidden Lines, Center Lines, Phantom Lines, Dimension Lines, Extension Lines, Leaders, Break Lines -Long-break Line, Round, Solid, Hollow Cross Section, Section Lines – Common Manufacturing Materials, Cutting Plane Lines
8-11	Geometric Construction - Bisecting a line - perpendiculars - parallel lines - division of a line; Angles - bisection, trisection, Tangent lines touching circles internally and externally Polygons - Regular polygons - circumscribed and inscribed in circles. Conic sections - Definitions of focus, directrix, eccentricity, Construction of Ellipse by Concentric circles method, Construction of parabola by rectangular method.
12&13	Orthographic Projection - Definition - Planes of Projection - Four quadrants – Reference Line, First angle projection - Third angle projection.
14-17	Isometric Projection - Definition - Isometric axes, lines and planes, Isometric Scale - Isometric view. Drawing of isometric views of plane figures, Drawing of isometric views of prisms and pyramids, Drawing of isometric view of cylinders and cones
18-21	Development of Surfaces - Need for preparing development of surface, Concept of true length - Principal methods of development, Development of simple solids like cubes, prisms, cylinders, pyramids, cones.

SYLLABUS FOR EMPLOYABILITY SKILLS

SEMESTER-I

(Pl refer to www.dget.nic.in)

Syllabus for the trade of Mechanic Motor Vehicle
Second Semester (Semester code No.)
Duration: Six Months.

Syllabus for Trade practical and Trade Theory

Week No.	Trade Practical (27 Hrs/week)	Trade Theory (5 Hrs/week)
1 & 2	Identification of parts in a diesel engine of LMV/ HMV Practice on starting and stopping of diesel engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition. Practice on dismantling Diesel engine of LMV/HMV as per procedure.	**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 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..
3 & 4	Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters, Practice on removing rocker arm assembly manifolds. 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. Checking valve seats & valve guide – Replacing the valve if necessary. Testing leaks of valve seats for 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 adjustments.	**Diesel 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 **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**,** 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.

5	Overhauling piston and connecting rod Assembly. 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 between crank pin and the connecting rod big end bearing. Check connecting rod for bend and twist. Assemble the piston and connecting rod assembly.	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.
6	Overhauling of crankshaft, 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 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.
7	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 fix crank shaft on block-torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit.	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.
8	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	Description of **Cylinder block,** Cylinder block construction, and Different type of Cylinder sleeves (liner).

	Removing cylinder liners from scrap cylinder block, practice in measuring and refitting new liners as per maker's recommendations precautions while fitting new liners.	
9	Reassemble all parts of engine in correct Sequence and torque all bolts and nuts as per 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.
10-12	Practice on Checking &Top up coolant, Draining & refilling coolant, Checking / replacing a coolant hose, Testing cooling system pressure, Practice on Removing & replacing radiator/ thermostat. Inspect the radiator pressure cap, Testing of thermostat. Cleaning & reverse flushing. Overhauling water pump and refitting. Practice on Checking engine oil**,** Draining engine oil**,** Replacing oil filter**,** Refilling engine oil**.** 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.	**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. **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.
13.	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. Check Exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage; Practice on Exhaust manifold removal and	**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

	installation. Practice on Catalytic converter removal and installation.	and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers- Reactive, absorptive, Combination., Catalytic converters, Flexible connections, Ceramic coatings, Back-pressure, Electronic mufflers.
14 - 16	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. 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. General maintenance of Fuel Injection Pumps (FIP).	**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.
17	Practice on Start engine adjust idling speed and damping 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	**Marine & Stationary Engine**:- Types, double acting 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.
18	Monitoring emissions procedures by use of Engine gas analyser or Diesel smoke meter. Checking & cleaning a Positive crank case ventilation (PCV) valve. Obtaining & interpreting scan tool data. Inspection of EVAP canister purge system by use of scan Tool. EGR /SCR Valve Remove and installation for inspection.	**Emission Control:-** Vehicle emissions Standards- Euro and Bhart 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, Sulfur 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
19	Practice on removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles. Practice on removing starter motor Vehicle and overhauling the starter motor, testing of starter motor	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.
20 & 21	Practice on troubleshooting in LMV/HMV 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.
22-23	In-plant Training	
24-25	Revision and Test	
26	NCVT Exam	

Automobile Group – 2 years Trade

2nd Semester

Workshop Calculation and Science

Syllabus for the trade of

1. Mechanic Motor Vehicle

Week No.	Workshop calculation and Science (3 Hrs/week) 2nd Semester
1 & 2	**Factorisation and quadratics**: multiply expressions in brackets by a number, symbol or by another expression in a bracket; by extraction of a common factor eg ax + ay, a(x + 2) + b(x + 2) ; by grouping eg ax − ay + bx − by ; quadratic expressions eg a^2 + 2ab + b^2 ; roots of an equation eg quadratic equations with real roots by factorisation, and by the use of formula
3	**Geometry–** Use of scientific calculator,/logarithmic table Angles -Angular measurement, Angles and rotation, Examples of angles in automotive work, Adding and subtracting angles. Types of angle- Adjacent angles, Opposite angles, Corresponding angles, Alternate angle
4-6	**Trigonometry-** Types of triangle - Acute angled triangle, Obtuse angled triangle, Equilateral triangle, Isosceles triangle, Scalene triangle, Right angled triangle, Labelling sides and angles of a triangle, Sum of the three angles of a triangle. Pythagoras' theorem, Circles, Ratio of diameter and circumference, Length of arc, Timing marks, Wheel revolutions and distance travelled, Valve opening area. Trigonometry- Using sines, cosines and tangents to solve vehicle problems.
7 -10	Formulae for Perimeter and Area of Plane figure - Rectangle, Square, Parallelogram, Triangle, Hexagon, any regular polygon, Trapezium, Circle, sector, Fillet, Ellipse, segment of a circle; Formulae for Volume and surface area of solids- Rectangular solid, Prism, cylinder, pyramids and cones, Frustum of pyramid and cones, sphere, Hollow sphere, segment of sphere, circular ring, spherical sector, Calculation of volume and weight of simple solid bodies such as cubes, square and hexagonal prism-shop problem.
11-13	Statistics – Collecting and sorting raw data, Definition of Discrete variable, continuous variable with Shop examples. Constructing pictographs-pie chart, Bar chart. Frequency and tally Charts. Importance of the shape of a frequency distribution- histogram, frequency polygon, Cumulative frequency plot. Interpreting statistics- sampling, arithmetic mean, median, mode, Range. Graphs- variables, scales, coordinates, straight line graphs.
14 & 15	**Heat and temperature –**Temperature-Thermodynamic temperature scale (Kelvin), Cooling system temperature; Standard temperature and pressure (STP); Thermal expansion with calculation; Heat- Sensible heat, Latent heat, Specific latent heat, Specific heat capacity, Quantity of heat with calculation; Heat transfer – Conduction, Convection,
16 & 17	**Heating, expansion and compression of gases** - Absolute pressure, Absolute temperature; Laws relating to the compression and expansion of gases -Heating a gas at constant volume, Heating a gas at constant pressure, Charles' law. Expansion or compression at constant temperature – isothermal

18-20	**Internal combustion engines-** Engine power-Brake power, Horsepower, PS – the DIN, Indicated power, Mean effective pressure, Calculation of indicated power, Cylinder pressure vs. crank angle, Mechanical efficiency of an engine, Volumetric efficiency, Torque vs. engine speed, Specific fuel consumption vs. engine speed, Brake power, torque and sfc(Specific fuel consumption) compared, Brake mean effective pressure, Thermal efficiency, Indicated thermal efficiency, Brake thermal efficiency petrol vs. Diesel.
21	**Fuels and combustion-** Calorific value, Combustion-Products of combustion, Relevant combustion equations. Air–fuel ratio-Petrol engine combustion, Detonation, Pre-ignition, Octane rating, Diesel fuel, Flash point , Pour point, Cloud point, Biofuels, Liquefied petroleum gas (LPG) ,Hydrogen, Zero emissions vehicles (ZEVs)

Automobile Group – 2 years Trade

2nd Semester

Engineering Drawing

Syllabus for the trade of Mechanic Motor Vehicle

Week Nos.	**Engineering Drawing (3 Hrs/week)** **2nd Semester**
1-4	Read and interpret drawings- Determine information from the title block, Read and interpret industrial prints, Read and interpret detailed and assembly drawings, Identify casting drawings and machining drawings, Read and interpret diagrams, Distinguish between a monodetail and a multidetail drawing.
5-8	Identify different drawing projections - Interpret pictorial and multi-view drawings. Interpret auxiliary and section views, Determine views in a drawing and the significance of the view being shown. Identify missing lines and missing views.
9-12	Free hand sketching of key and screw threads. Read and interpret three Types of screw thread representation: pictorial, schematic and simplified presentation. Terms used in describing a threaded Part, Designation of Thread Specifications, Left-Hand Thread Notations, read and interpret the different type of Finish Symbols, Fillets and Rounds and Machine Slots.
13	Drawing of I .C engine – Diesel and their parts.
14	Sketching of otto cycle, Diesel cycle, valves and valve timing diagram.
15	Free hand sketch of piston assembly, Free hand sketching of piston gudgeon pins rings and connecting rod .
16	Free hand sketching of crank shaft and cam shaft showing all parts.
17	Free hand sketching of cylinder block and cylinder head, cylinder liners.
18	Free hand sketching of different cooling system -showing all necessary parts such as water pump, thermostatic valve, Radiator etc.
19	Free hand sketching of lubrication system, showing all necessary parts such as filters , oil pump, pressure release valve etc.
20	Freehand sketching of staring system.
21	Freehand sketching of charging system and solenoid switch circuit.

SYLLABUS FOR EMPLOYABILITY SKILLS

SEMESTER-II

(Pl ref to www.dget.nic.in)

Syllabus for the trade of <u>Mechanic Motor Vehicle</u>
Third Semester (Semester code No.)
Duration: Six Months.

Syllabus for Trade practical and Trade Theory

Week No.	Trade Practical (27 Hrs/week)	Trade Theory (5 Hrs/week)
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.	**Introduction**: 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 -4	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. 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.	**Clutches & Manual Transmissions**-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, Brief about Automated Manual Transmission (AMT) **Gearbox layout & operation-** Gearbox layouts, Transaxle designs, Gearbox operation, Baulk-ring synchromesh unit, Transaxle synchromesh unit. Gear shift mechanism.
5-7	Practice on Removing open type propeller shaft from vehicle, Practice on removing universal joints, cleaning replacing worn out parts, re-assembling & refitting to vehicle-and their alignment special precautions while removing torque tube drive shaft. Practice on FWD Driveshaft Removal and Replacement. Practice on overhauling & inspection of rear axle. Practice on overhauling & inspection of differential assembly. Trouble shooting – causes and remedy for clutch slip, clutch noise, clutch binding, hard clutch, gearbox noise, gear slip, rear axle noise, propeller shaft noise, universal joint noise, differential noise.	**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, Type of Universal joints, Type of Constant velocity 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 wheel final drives,

		All-wheel drive transfer case, Transfer case differential action.
8 & 9	Identification of Automatic transmission components Checking automatic transmission fluid, Changing transmission fluid & filter. Checking automatic transmission fluid, Changing transmission fluid & filter. Practice on oil pressure control cable play adjustments, Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler.	**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, 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.

10-12	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 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.	**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 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.
13-15	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**.** Trouble shooting for Suspension system defects : wheel hop, ride height (unequal and low), noises under operation, fluid leakage, excessive travel, bounce, worn dampers, worn joints/damaged linkages, vehicle "crabbing".	**Suspension Systems:-** Principles of suspension, Suspension force, Unsprung weight, Wheel unit location, Dampening. **Types of suspension**- Suspension systems, Solid axle, Dead axle, Description, function and advantages of non independent suspension Independent suspension, Rear independent suspension, Rear-wheel drive independent suspension, electronically controlled air suspension (ECAS), 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**,** 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
16	Practice on removing wheels from light & Heavy vehicle, dismantling tyres and tubes checking puncture. Assembling inflating to correct pressure. Checking & adjusting tire pressure by use of air or by Nitorgen Rotating the wheels in vehicle minor repairs to wheels and tyres, wheel balancing & alignment. Checking for tyre wear patterns**.** **Caution:** vehicle equipped with ABS while removing the wheel and using on vehicle balancing never ignition switch on (Follow the service manual procedure)	**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. Descriptions Tirewear Patterns and causes Nitrogen vs atmospheric air in tyres
17-19	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. Overhauling and inspection of disc brake. Adjusting Air brakes- repair to tank unit, air compressor, wheel brake adjuster- locating air leaks in the brake lines and rectifying – general maintenance and care. 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.	**Braking Systems :-** Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake pad, 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, 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, Back plate, Wheel cylinders **Disc brakes & components** -Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake calipprs, 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. The construction and operation of heavy vehicle Anti-Slip Regulation / Traction Control (ASR) system.

20 & 21.	**Trouble shooting Practice** with Heavy vehicle 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.	Study of Motor Vehicle act Rules & Regulation-Laws governing to use of motor vehicle & vehicle transport, Licensing of drivers & conductors, Registration of vehicle, Traffic rules, Signals & controls, Accidents, Causes & analysis, Responsibility of driver, Offences, penalties & procedures, Different types of forms, Government administration structure, Personnel, Authorities & duties, Rules regarding construction of motor vehicles, Tax exemption & tax renewal, Insurance types & significance -Comprehensive Third party insurance, Duty of driver in case of accident
22-23	In plant training	
24-25	Revision and Test	
26	NCVT Exam	

Automobile Group – 2 years Trade

3rd Semester

Workshop Calculation and Science

Syllabus for the trade of

1. Mechanic Motor Vehicle

Week No.	Workshop calculation and Science (3 Hrs/week) 3rd Semester
1& 2	Data interpretation
3 & 4	Allegations or Mixture
5 &6	**Levers and moments, torque and gears -** definition of Levers, Principles of leverage- The principle of moments. The bell crank lever, A practical application of the bell crank lever in vehicle. Axle loadings, A steering mechanism as a machine
7-9	**Friction** – Definition of friction, Coefficient of friction, Static friction, Sliding friction; Making use of friction – Clutch- Torque & power transmitted by a plate clutch and Example calculation, Belt drive- Torque & power transmitted by a belt drive and Example calculation, speed ratio of belt drive.
10-12	**Velocity and acceleration, speed -** Definition of Speed and velocity, Acceleration, Velocity–time graph- Uniform velocity, Uniform acceleration, Equations of motion and their application to vehicle technology. Problems on speed and velocity.
13-15	**Force, mass and acceleration**-Newton's laws of motion, Relation between mass and weight. Inertia, Motion under gravity, Angular (circular) motion, Equations of angular motion Relation between angular and linear velocity, Centripetal acceleration, Accelerating torque
16-18	**Vehicle dynamics** -Load transfer under acceleration, Static reactions, Vehicle under acceleration, , Definition of tractive effort, Tractive resistance-Rolling resistance, air resistance, gradiant resistance, Inertia. Power required to propel vehicle, Forces on a vehicle on a gradient – gradient resistance, Gradeability, Vehicle power on a gradient, Vehicle on a curved track, Overturning speed, Skidding speed
19-21	**Balancing and vibrations –** Balance of rotating masses acting in the same plane (coplanar). Engine balance, Simple harmonic motion (SHM), Applications of SHM- Vibration of a helical coil spring, Torsional vibration, Free vibrations, Example of free vibrations, Forced vibrations- Resonance, Driveline vibrations, Damping, Vibration dampers, Dual mass flywheel, Cams.

Automobile Group – 2 years Trade

3rd Semester Engineering Drawing

Syllabus for the trade of Mechanic Motor Vehicle

Week Nos.	**Engineering Drawing (3 Hrs/week)** **3rd Semester**
1&2	Lay out of synchromesh gear box unit, and showing the different gear engaged positions.
3&4	Free hand sketching of Front-wheel drive layout, Rear- wheel drive layout, Four-wheel drive layout, All-wheel drive layout, joints & Universal Joint.
5&6	Free hand sketch of Torque converter Selector positions, Planetary gear set, High range power flow, Low range power flow
7&8	Free hand **sketching** of propeller shaft, Universal Joint and Rear wheel final drive
9&10	Free hand sketching of different types of steering boxes. Layout of power steering system
11&12	Free hand sketching of caster, camber, king-pin angle. Ackerman's angle toe-in & toe-out.
13&14	Free hand sketching of Independent rear suspensions, Front suspension, Bushes/bushings, Arms & linkages and Rigid axle suspension (Leaf spring)
15&16	Free hand sketching of different type of shock absorrbes.
17&18	Free hand sketching of different type of wheels. Free hand sketching of different type of tyre treads design. Drawing constructional details of radial and conventional tyres.
19&21	Free hand sketching of wheel brake assembly sectioned views of master cylinder. Free hand sketching of wheel cylinders, brake shoe assembly and anchor pins. Freehand sketching – The layout of vacuum assisted hydraulic brake system Freehand sketching of the layout of Air brake system and sketching of slacke adjuster. Freehand sketching of the layout of Parking Brake, Air brake system and sketching of slacke adjuster. Circuit layout of ABS

Syllabus for the trade of Mechanic Motor Vehicle
Fourth Semester (Semester code No.)
Duration: Six Months.

Syllabus for Trade practical and Trade Theory

Week No.	Trade Practical (27 Hrs/week)	Trade Theory (5 Hrs/week)
1 & 2	Identification of petrol Engine components. Practice on starting and stopping of petrol engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition. Removing a petrol engine from a motor vehicle. Dismantling cylinder head for Inspection. Practice on Removing of piston and connecting rods from engine checking Cylinder bore wear for ovality and taper. Piston ring, Piston as per service manual. Checking valves - 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. **Spark-ignition engine components-** Basic engine components**,** Engine cams & camshaft**,** Engine power transfer**,** Scavenging**,** Counter weights**,** Piston components**.** **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**.** **Gasoline Fuel Systems** : Description of Gasoline fuel**,** Gasoline fuel characteristics**,** Controlling fuel burn**,** Stoichiometric ratio**,** Air density**,** Fuel supply system**,** Pressure & vacuum.
3	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,	**Carburetor operation**-Carburation**,** 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.
4&5	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**,** Inertia sensors.
6 & 7	Identification of Electronic control Unit. Set up for testing, Testing of Electronic	Introduction to **EFI Engine Management** - **EFI operation** Modes of EFI**,** Electronic fuel

	Control Circuit. Fault finding in Electronic circuit and remedies using scan tool. Identification of various sensors installed in engine & it's mounting. Checking instruments & Gauges on dash board. Rectify replace defective gauges. Testing of Temperature sensor, Pressure senor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor.	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. Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes. **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,
8	Diagnosis- Possible causes and remedy for Engine cranks, but will not or hard to start, Poor fuel economy or engine performance. Checking ignition timing, Checking & changing a spark plug, Identification and testing of Hall effect sensor, Optical sensor. Tracing and testing of sensor circuits.	**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, **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.
9 & 10	Checking a charging system for the cause of undercharge, No charge, and over charge conditions. Removing & replacing an alternator, Inspection of rotor for ground, open circuit – field coil resistance, slip ring surface, Fan, bearing. Inspection of stator for ground, open circuit, Inspection of Drive end bearing rotation, Rectifier, brush length compare with service manual. slip ring surface. Inspecting & adjusting an engine drive belt, Replacing an engine drive belt / pulleys / Tesnionsers and their alignments. Trouble shooting, possible causes and remedy for warning lamp does not glow when ignition switch is on, Warning lamp glows dim when ignition switch is on, warning lamp 'on' while the alternator is running, Warning lamp glows 'dim' while the alternator is running, warning lamp flickers considerably.	**Charging system**- The purpose of Charging system, charging system components, charging system circuit, 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.
11 & 12	Removing starter motor from vehicle, and Performance test for pull-in test, Hold-in test, pinion (plunger) return test, No-load	**Starting system**- purpose of starting system, Staring system components, Starter motor principles, study of starter control circuits.

	performance test. Solenoid test for Hold in coil open circuit, Armature test – Ground test, Open circuit test, pull-in coil open circuit test, field coil test. Inspections of brush length wear as per service manual. Trouble shooting , possible causes and remedy for starter motor not running, Starting motor running but too slow (small torque), staring motor running, but not cranking engine. Noise, starting motor does not stop running. -Growler testing for rotors. Checking a starting system**,** Jump-starting a vehicle	Starter motor construction**,** Starter magnet types**,** Starter motor engagement**,** Commutation**,** Switching**,** solenoid construction.
13 & 14	Trace the light circuit - test bulbs, align head lamps, Aiming headlights**.** Changing a headlight bulb, Checking of a head light switch and to replace if faulty. Trouble shooting and remedy for Headlight - headlight do not light up, only one headlight does not light up, Only one beam ("Hi" or "Lo") does not light**.** Trouble shooting and remedy for turn signal and hazard warning lights -Flash rate high or one side only flashes, No Flashing, flash rate low. Trouble shooting and remedy for clearance, tail and license plate lights - All lights do not light up, some lights do not light up. Trouble shooting and remedy for Back-up light - Back-up lights do not light up. Trouble shooting and remedy for Brake lights -Brake lights do not light up, Brake light stay on. Trouble shooting and remedy for fuel meter and fuel gauge unit - Fuel meter shows no operation or incorrect operation. Trouble shooting and remedy for Engine coolant Temp (ECT) meter and ECT Sensor – Engine coolant temp meter shows no operation or incorrect operation. Trouble shooting and remedy for oil pressure light – Oil pressure warning light does not light up when ignition switch is on at engine off. Trouble shooting and remedy for brake and parking brake warning light- Brake warning light does not light up when fluid flow level, Brake warning light does not light up when	**Lighting system**, Lamps/light bulbs**,** Lamp/light bulb information**,** LED lighting, Headlights-description of standard sealed beam, halogen sealed beam, composite and High intensity discharge (HID) headlights. Headlight & dimmer circuits, Park & tail light circuits**,** Brake light circuits, turn signal circuit, Cornering lights, Fog lights circuit**,** interior lights- courtesy, reading and instrument panel lights, Smart lighting , Reverse lights

	parking brake pull up, Brake warning lights stay on. Trouble shooting and remedy for interior light- Interior light do not light up. Trace the wiring circuit of traffic signal flashers light circuit-tracing defects in the flasher circuits, replacing fuse bulb.	
15 & 16	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. Checking a heating system, Compressor rotation test, air Gap check, Refrigerant recovery –evacuating –charging of A/c system. Replenishing compressor oil level. Troubles 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. Diagnosis test for High pressure gauge –pressure high and low, Low pressure gauge for pressure high and low.	**Heating Ventilation Air Conditioning (HVAC)** legislation, Vehicle heating, ventilation & cooling systems, Basic air-conditioning principles, Air-conditioning capacity, Air-conditioning refrigerant, Humidity 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 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.
17 & 18	Trouble shooting and remedy for Horn- No horn operation, poor sound quality, horn sounds continuously and to replace the horn if faulty. Remove and install wiper motors and wiper switches. Checking & replacing wiper blades. Trouble shooting and remedy for windshield wiper and washer - no operation, intermittent operation, continuous operation, and wipers will not park. Diagnose causes for improper operation of the windshield washer system and to replace the pump if faulty. Diagnose the power window system for – all power window motors do not operate, some switches do not operate. Diagnose the power door lock control for – All power door locks do not operate, only one power door lock not operate. Diagnose for remote keyless entry and immobilizer system. Familiarization of car radio wiring and	**Accessories:** Horn circuit, wiper circuit, power window components and circuit. Power door lock circuit, automatic door lock circuit, remote keyless entry system circuit, antitheft system, immobilizer system. Navigation system, Car radio and cassette player, car videos. Description and function of **Airbags,** Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pre-tensioners, Tire pressure monitoring systems Integrated communications, Proximity sensors, Reflective displays, Global positioning satellites, Triangulation/trilateration, Telematics. Networking & multiplexing .

	speaker circuits Diagnose automatic seat belt systems, Diagnose air bag system and service warnings.	
19-21	Driving Practice. Practice in straight driving on wide roads. Driving through lanes and curves. Practice in reversing. Practice overtaking another vehicle. Practice in driving through sand and wet surfaces. Practice in parking and Diagonal parking.	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 program**,** Using a service information program
22-23	Project work	
24-25	Revision and Test	
26	NCVT Exam	

Automobile Group – 2 years Trade

4th Semester

Workshop Calculation and Science

Syllabus for the trade of

1. Mechanic Motor Vehicle

Week No.	Workshop calculation and Science (3 Hrs/week) 4th Semester
1 & 2	The binary system- Most significant bit (MSB), Hexadecimal, Converting base 10 numbers to binary 10, Uses of binary numbers in vehicle
3 & 4	**Electrical principles**- Electric current, Atoms and electrons, Conductors and insulators, - Conductors, Semiconductors, Insulators, Electromotive force, Electrical power sources – producing electricity- Chemical power source, Magnetic power source, Thermal power source, Effects of electric current – using electricity,
5-7	Electrical circuits- Circuit principles, A simple circuit, Direction of current flow, Electrical units- Volt, Ampere, Ohm, Watt; Ohm's law, Resistors in series, Resistors in parallel, Alternative method of finding total current in a circuit, containing resistors in parallel, Measuring current and voltage, Ohmmeter, Open circuit, Short circuit.
8 &9	Temperature coefficient of resistance- Negative temperature coefficient; Electricity and magnetism- Permanent magnets, 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;
10 & 11	Solenoid and relay, Electromagnetic induction, The electric motor effect, Fleming's rule, Alternating current- Cycle, Period, Frequency; Applications of alternating current, Transformer,
12 & 13	Capacitors- Capacitance, Capacitors in circuits-Contact breaker ignition circuit, Capacitive discharge ignition system, Capacitors in parallel and series, Impedance.
14 &15	**Electronic principles**-Introduction, Semiconductors- Effect of dopants, Electrons and holes, The p–n junction, Bias, Behaviour of a p–n junction diode, Diode protection resistor, Negative temperature coefficient of resistance – semiconductor, The Zener diode.
16 &17	Light emitting diode (LED) - Voltage and current in an LED, Photodiode, Bipolar transistors-Basic operation of transistor, Current gain in transistor, Current flow in transistors; Transistor circuit used in automotive applications- Voltage amplifier, Darlington pair, Heat sink;
18 & 19	Filter circuits, Voltage divider, Integrated circuits, Sensors and actuators, Control unit (computer) inputs and outputs, Logic gates-The RTL NOR gate, Truth tables, Bits, bytes and baud.
20 & 21	Properties of refrigerants, refrigerant oil, Fluorinated refrigerants, Refrigeration process – pressure/enthalpy diagram

Automobile Group – 2 years Trade

4th Semester Engineering Drawing

Syllabus for the trade of Mechanic Motor Vehicle

Week Nos.	**Engineering Drawing (3 Hrs/week)** **4th Semester**
1&2	Introduction to AutoCAD, Starting AutoCAD, Exercises Using Draw commands as- Line, Polygon, Rectangle, Circle, Ellipse.
3-5	Exercises on using Edit Commands as Erase, Copy Mirror, Offset, Extend, Array, Move, Rotate, Scale, Trim Chamfer, Fillet
6&7	Exercises on using X,Y,Z, coordinate entry system for Angular measurement, Absolute Coordinate, Relative coordinate, Polar coordinate.
8	Exercises on using **Drawing Aids** -grid and snap, ortho and polar tracking, PolarSnap, running object snaps, the From snap, and object snap tracking.
9	Exercises on using Osnap commands as Endpoint, Intersection, Nearest, Midpoint, Tangent, Center.
10	Exercises on using Layers as Create new layer, Assign layer color, Assign layer linetype.
11	Exercises on using dimensions - Styling Dimensions, Adding Dimensions, Using Inquiry Commands, Adding Dimension Objects, Adding and Styling Multileaders, Editing Dimensions
12	Exercises on using Creating and Editing Text- Creating Text Styles, Writing Lines of Text, Creating Text to Fit, Justifying Text, Transforming and Creating Text, Editing Text.
13	Exercises on using Zoom Commands- Zoom realtime, Zoom window, Zoom previous, Zoom all, Pan realtime
14&15	Exercises on using Hatching and Gradients- Specifying Hatch Areas, Picking Points to Determine Boundaries, Selecting Objects to Define Boundaries, Associating Hatches with Boundaries , Hatching with Patterns, Specifying Properties, Separating Hatch Areas, Hatching with Gradients
16	Exercises on using Printing and Plotting - Configuring Output Devices, Setting Up a System Printer, Setting Up an AutoCAD Plotter, Plotting in Modelspace, Plotting Layouts in Paperspace, Exporting to an Electronic Format
17-19	Introduction to Modeling – type of modeling – 2D wire frame, 3D wire frame, surface modeling, solid modeling. Exercises on using 3D primitives, Extrude, Revolve command, subtract, union 3D drawing by using User co-ordinate systems
20-21	Working drawing of connecting rods (I.C. Engine) with the application of tolerances. Using CAD.

TRADE: Mechanic Motor Vehicle

LIST OF TOOLS & EQUIPMNT

A. TRAINEES TOOL KIT per 4 Trainees FOR 20 TRAINEES +1 ISTRUCTOR

Sl.No.	Item with specification	Qty (Nos.)
1.	Allen Key set of 12 pieces (2mm to 14mm)	(5+1)
2.	Caliper inside 15 cm Spring	6
3.	Calipers outside 15 cm spring	6
4.	Center Punch 10 mm. Dia. x 100 mm.	6
5.	Dividers 15 cm Spring	6
6.	Electrician Screw Driver 250mm	6
7.	Hammer ball peen 0.5 kg with handle	6
8.	Hands file 20 cm. Second cut flat	6
9.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	6
10.	Pliers combination 20 cm.	6
11.	Screw driver 20cm.X 9mm. Blade	6
12.	Screw driver 30 cm. X 9 mm. Blade	6
13.	Scriber 15 cm	6
14.	Spanner D.E. set of 12 pieces (6mm to 32mm)	6
15.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	6
16.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	6
17.	Steel rule 30 cm inch and metric	6
18.	Steel tool box with lock and key (folding type) 400x200x150 mm	6
19.	Wire cutter and stripper	6

B. Tools Instruments and General Shop outfits

Sl.No.	Item with specification	Qty. (Nos)
1.	AC alternator slip ring puller	1
2.	Adjustable spanner (pipe wrench 350 mm)	2
3.	Air blow gun with standard accessories	1
4.	Air Brake Assembly	1.
5.	Air impact wrench with standard accessories	4
6.	Air ratchet with standard accessories	4
7.	Allen Key set of 12 pieces (2mm to 14mm)	4
8.	Alternator assembly used for LMV	2
9.	Ammeter 300A/ 60A DC with external shunt	4
10.	Angle plate adjustable 250x150x175	1
11.	Angle plate size 200x100x200mm	2
12.	Anti theft device	1
13.	Anvil 50 Kgs with Stand	1
14.	Auto Electrical test bench	1
15.	Battery –charger	2
16.	Belt Tensioner gauge	1
17.	Blow Lamp 1 litre	2
18.	Caliper inside 15 cm Spring	4
19.	Calipers outside 15 cm spring	4
20.	Car Jet washer with standard accessories	1

21.	Carburetor – Solex, Mikuny for dismantling and assembling	1 each
22.	Carburetor repair tool kit	1
23.	Chain Pulley Block-3 ton capacity with tripod stand	1
24.	Chisel 10 cm flat	4
25.	Chisels cross cut 200 mm X 6mm	4
26.	Circlip pliers Expanding and contracting type 15cm and 20cm each	4
27.	Clamps C 100mm	2
28.	Clamps C 150mm	2
29.	Clamps C 200mm	2
30.	Cleaning tray 45x30 cm.	4
31.	Coil spring compressor for suspension spring	1
32.	Compression testing gauge suitable for diesel Engine with standard accessories	2
33.	Connecting rod alignment fixture	1
34.	Constant Mesh Gear box with stand for Dismantling and assembly.	1
35.	Copper bit soldering iron 0.25 Kg	4
36.	Cut section Model of Mock layout of a motor car –electrical system working model	1 set
37.	Cut section models of shock absorbers	1
38.	Cut section of cross ply and radial tyres	1
39.	Cut section working model of automatic transmission Gear box	1
40.	Cut section working model of centrifugal clutch assembly.	1
41.	Cut section working model of Diaphragm clutch assembly.	1
42.	Cut section working model of Single plate clutch assembly.	1
43.	Cylinder bore gauge capacity 20 to 160 mm	4
44.	Cylinder liner- Dry & wet liner, press fit & slidefit liner	1 each
45.	DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms	2
46.	Demonstration board of 2W Ignition system, ignition coil	1
47.	Demonstration board of electronic Ignition system, ignition coil	1
48.	Demonstration board of MPFI system	1
49.	Depth micrometer 0-25mm	4
50.	Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand)	4
51.	Different type of Engine Bearing model	1 set
52.	Different type of piston model	1each
53.	Disk brake with caliper assembly	2
54.	Distributor –Duel advance type, reluctance type	1 each
55.	Dividers 15 cm Spring	4
56.	Drift Punch Copper 15 Cm	4
57.	Drill point angle gauge	1
58.	Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm	4
59.	Drum brake assembly	1
60.	Electric Soldering Iron 230 V 60 watts 230 V 25 watts	2 each
61.	Electric testing screw driver	4
62.	Engineer's square 15 cm. Blade	4
63.	Engineers stethoscope	1
64.	Executive Auto Electrical tool kit	1
65.	Feeler gauge 20 blades (metric)	4

66.	File flat 20 cm bastard	4
67.	File, half round 20 cm second cut	4
68.	File, Square 20 cm second cut	4
69.	File, Square 30 cm round	4
70.	File, triangular 15 cm second cut	4
71.	Files assorted sizes and types including safe edge file (20 Nos)	2 set
72.	Flat File 25 cm second cut	4
73.	Flat File 35 cm bastard	4
74.	Front axle (Rzeeppa Joint) with stand for Dismantling and assembly	1
75.	Fuel feed pump for diesel	1
76.	Fuel injection pump (Diesel) inline	1
77.	Fuel injection pump dismantling tool kit /Universal Vice	1
78.	Fuel injection pump, VE pump / Distributor fuel rotary pump (DPC) pumps / along with special tools and accessories.	1 each
79.	Full floating axle and semi-floating axle assembly	1
80.	Functional/experiment model of different type of sensors.	1 set
81.	Garage stand	4
82.	Gloves for Welding (Leather and Asbestos)	5 sets
83.	Glow plug tester	2
84.	Granite surface plate 1600 x 1000 with stand and cover	1
85.	Grease Gun	2
86.	Grease Gun heavy duty trolley type 10 kg capciaty	1
87.	Growler	2
88.	Hacksaw frame adjustable 20-30 cm	10
89.	Hammer Ball Peen 0.75 Kg	4
90.	Hammer Chipping 0.25 Kg	5
91.	Hammer copper 1 Kg with handle	4
92.	Hammer Mallet	4
93.	Hammer Plastic	4
94.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2
95.	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	1 sets
96.	Hand Shear Universal 250mm	2
97.	Hand vice – 37 mm	2
98.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
99.	Horn and Horn relay	2
100.	Impact screw driver	2
101.	Injector – Multi hole type, Pintle type	4 each
102.	Injector cleaning unit	1
103.	Injector testing set (Hand tester)	1
104.	Insulated Screw driver 20 cm x 9mm blade	4
105.	Insulated Screw driver 30 cm x 9mm blade	4
106.	Left cut snips 250mm	4
107.	Lifting jack screw type 3 ton, 5ton & 20 Ton capacity	1 each
108.	Magneto spanner set with 8 spanners	1 set
109.	Magnifying glass 75mm	2

110.	Marking out table 90X60X90 cm.	1
111.	Multimeter digital	5
112.	Multi-point fuel injection pump	2
113.	Oil can 0.5/0.25 liter capacity	4
114.	Oil pump for dismantling and assembling.	2
115.	Oil Stone 15 cm x 5 cm x 2.5 cm	1
116.	Oscilloscope 20MHz	1
117.	Outside micrometer 0 to 25 mm	4
118.	Outside micrometer 25 to 50 mm	4
119.	Outside micrometer 50 to 75 mm	1
120.	Outside micrometer 75 to 100 mm	1
121.	Petrol nozzle	2
122.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	2
123.	Pipe cutting tool	2
124.	Pipe flaring tool	2
125.	Piston ring compressor	2
126.	Piston Ring expander and remover.	2
127.	Piston Ring groove cleaner.	2
128.	Pliers combination 20 cm.	2
129.	Pliers flat nose 15 cm	2
130.	Pliers round nose 15 cm	2
131.	Pliers side cutting 15 cm	2
132.	Portable electric drill Machine	1
133.	Prick Punch 15 cm	4
134.	Punch Letter 4mm (Number)	2 set
135.	Radiator cut section-cross flow	1
136.	Radiator cut section-down flow	1
137.	Radiator pressure cap	2
138.	Rear axle full floating type with stand for Dismantling and assembly	1
139.	Right cut snips 250mm	2
140.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm	2
141.	Scraper flat 25 cm	2
142.	Scraper half round 25 cm	2
143.	Scraper Triangular 25 cm	2
144.	Scriber 15 cm	2
145.	Scriber with scribing black universal	2
146.	Set of stock and dies – Metric	2 sets
147.	Shear Tin Man's 450 mm x 600mm	2
148.	Sheet Metal Gauge	2
149	Sher Tinmans 300mm	4
150	Soldering Copper Hatchet type 500gms	2
151	Solid Parallels in pairs (Different size) in Metric	2
152	Spanner Clyburn 15 cm	1
153	Spanner D.E. set of 12 pieces (6mm to 32mm)	4
154	Spanner T. flocks for screwing up and up-screwing inaccessible	2
155	Spanner, adjustable 15cm.	2
156	Spanner, ring set of 12 metric sizes 6 to 32 mm.	4
157	Spanners socket with speed handle, T-bar, ratchet and universal upto	2

158	Spark lighter	2
159	Spark plug spanner 14mm x 18mm x Size	2
160	Starter motor axial type, pre-engagement type & Co-axial type	1each
161	Steel measuring tape 10 meter in a case	4
162	Steel rule 15 cm inch and metric	4
163	Steel rule 30 cm inch and metric	4
164	Steering assembly - 1.Rack & pinion, 2.Worm & roller 3. Recirculating ball, 4.Power steering	1 each
165	Straight edge gauge 2 ft.	2
166	Straight edge gauge 4 ft.	2
167	Stud extractor set of 3	2 sets
168	Stud remover with socket handle	1
169	Surface gauge with dial test indicator plunger type i.e. 0.01 mm	4
170	Synchronous Gear box with stand for Dismantling and assembly.	1
171	Tachometer (Counting type)	1
172	Tandem master cylinder with booster	4
173	Taps and Dies complete sets BSF	1 set
174	Taps and wrenches - metric	2 sets
175	Telescope gauge	4
176	Temperature gauge with sensor 0-100 deg c	2
177	Tester sparking plug 'NEON' Type	1
178	Thermostat	2
179	Thread pitch gauge metric, BSW	2
180	Timing lighter	2
181	Toe-in, toe-out gauge	1set
182	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
183	Trammel 30 cm	2
184	Tread wear indicator	1
185	Tubed tyre of car, trucks & motorcycle	1
186	Tubeless tyre of cars & trucks	1
187	Tubeless tyre repair kit	
188	Turbocharger cut sectional view	1
189	Tyre & split rim wheel assembly	1
190	Tyre pressure gauge with holding nipple	2
191	Universal puller for removing pulleys, bearings	1
192	V' Block 75 x 38 mm pair with Clamps	2
193	Vacuum assisted hydraulics brake assembly with vacuum booster	1
194	Vacuum gauge to read 0 to 760 mm of Hg.	2
195	Valve Lifter	1
196	Valve spring compressor universal.	1
197	vernier caliper 0-300 mm with least count 0.02mm	4
198	Vice grip pliers	2
199	Water pump for dismantling and assembling	4
200	Wheel cylinder	4
201	Wiper motor assembly	2
202	Wire Gauge (metric)	2
203	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw	4

204	Working Model of power windows	1
205	Working model of torque converter	1
206	4 Point relays	2
207	5 Point relays	2

C. General Installation/ Machineries

Sl.No.	Item with specification	Qty (Nos.)
1.	Air bag simulator	1
2.	Air conditioned CRDI Vehicle in running condition -LMV	1
3.	Air conditioning service Unit (Car)	1
4.	Air conditioning trainer kit	1
5.	Arbor press hand operated 2 ton capacity	1
6.	Automotive exhaust 5 gas analyzer (petrol & Diesel) or Diesel Smoke Meter	1
7.	Bench lever shears 250mm Blade x 3mm Capacity	1
8.	Diesel Engine – CRDI - 4 stroke for Dismantling and assembling with swivelling stand	
9.	Diesel engine (Running condition) Stationary type	1
10.	Discrete Component Trainer / Basic Electronics Trainer	1
11.	Drilling machine bench to drill up to 12mm dia along with accessories	1
12.	Dual Magnetization Yoke : AC / HWDC, 230 VAC, 50Hz	1 set
13.	Four stroke petrol engine with CNG setup-working condition	1
14.	Gas Welding Table 1220mm x760mm	2
15.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia wheels rough and smooth	1
16.	Hand operated Hydraulic press	1
17.	Heavy Commercial vehicle type (without body on frame)	1
18.	Hydraulic jack HI-LIFT type -3 ton capacity, and 5 Ton capacity	1 each
19.	Liquid penetrant Inspection kit	1 set
20.	MPFI petrol engine with swiveling stand along with special tools for dismantling and assembling	1
21.	Multi Scan Tool with oscilloscope	1
22.	Petrol Engine(2-stroke) Motor Cycle/Scooter along with special tools and accessories	1
23.	Pipe Bending Machine (Hydraulic type) 12mm to 30mm	1
24.	Pneumatic rivet gun with standard accessories	2
25.	Spring tension tester	1
26.	Tin smiths bench folder 600 x 1.6mm	1
27.	Transfer case with stand for Dismantling and assembly.	1
28.	Trolley type portable air compressor single cylinder with 45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg/sq cm	1

29.	Tube/ tyre vulcanizing machine	1
30.	Two post car lift – capacity 4000 kg	1
31.	Tyer Changer Machine	1
32.	Ultrasonic Injection cleaning equipment	1
33.	Welding plant Oxy-Acetylene complete (high pressure)	1
34.	Welding Transformer (150-300 Amps)	1
35.	Wheel alignment Machine –computerised 3D	1
36.	Wheel balancing machine	1
37.	Working Condition of Diesel Engine – CRDI - 4 stroke Engine Assembly with fault simulation board	1
38.	Working Condition of Petrol MPFI Engine Assembly with fault simulation board	1

D. List of consumable:

Sl. No.	Description	Quantity
1.	Automatic Transmission oils	As required
2.	Battery- SMF	As required
3.	Brake fluids	As required
4.	Chalk, Prussian blue.	As required
5.	Chemical compound for fasteners	As required
6.	Diesel	As required
7.	Different type gasket material	As required
8.	Different type of oil seal	As required
9.	Drill Twist (assorted)	As required
10.	Emery paper - 36–60 grit , 80–120	As required
11.	Engine coolant	As required
12.	Engine oil	As required
13.	Gear oils	As required
14.	Gloves for Welding (Leather and Asbestos)	5 sets
15.	Hacksaw blade (consumable)	As required
16.	Hand rubber gloves tested for 5000 V	5 pair
17.	Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required	As required
18.	Hydrometer	4
19.	Lapping abrasives	As required
20.	Leather Apron	5
21.	Petrol	As required
22.	Power steering oil	As required
23.	Radiator Coolants	As required
24.	Safety goggles	As required
25.	Steel wire Brush 50mmx150mm	5

E. Workshop Furniture

Sl. No.	Description	Quantity
1.	Book shelf (glass panel) 6½ ‘ x 3’ x 1½’	As required
2.	Computer Chair	1+1
3.	Computer Table	1+1
4.	Desktop computer and related MS office software	1+1
5.	Discussion Table 8’ x 4’ x 2½ ‘	2
6.	Fire Extinguishers, first- aid box	As required
7.	Instructional Material – NIMI Books/Ref.books	As required
8.	Internet connection with all accessories	As required
9.	Laser printer	1
10.	LCD projector/ LED /LCD TV (42”)	1
11.	Multimedia DVD for Automotive application/subjects	As required
12.	Online UPS 2KVA	1
13.	Stools	21
14.	Storage Rack 6½ ‘ x 3’ x 1½’	As required
15.	Storage shelf 6½ ‘ x 3’ x 1½’	As required.
16.	Suitable class room furniture	As required
17.	Suitable Work Tables with vices	As required
18.	Tool Cabinet - 6½ ‘ x 3’ x 1½’	2
19.	Trainees locker 6½ ‘ x 3’ x 1½’	2 Nos. to accommodate 20 Lockers

List of tools & Equipment for the Trade of
Mechanic Motor Vehicle - Engineering Drawing
(Note : Facilities available in Draughtsman trade can be utilized)

TRAINEE’S TOOLS KIT

Sl. No.	Name of the items	Quantity
1.	Draughtsman drawing instrument box	20+1 set
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20+1 set
4.	Mini drafter	20+1 set
5.	Drawing board (700mm x500 mm) IS: 1444	20+1 set

GENERAL MACHINERY SHOP OUTFIT

Sl. No.	Name & Description of Machine	Quantity
1.	Draughtsman table	20 Nos.
2.	Draughtsman stool	20Nos.
3.	Computer Latest version compatible for running Auto CAD software, preloaded with windows and 20” colour Monitor.	10Nos
4.	Plotter (Max. A3 size) (Max. A0 size)	1 No.
5.	Laser Jet printer latest model	1 No.
6.	UPS - 5 KVA	2 Nos.
7.	Computer table	10 Nos.
8.	Computer chairs	10 Nos.