

1

10

SYLLABUS FOR
MECHANIC MOTOR VEHICLE
UNDER
CRAFTSMEN TRAINING SCHEME
&
APPRENTICESHIP TRAINING SCHEME

2004 (Revised)

GOVT. OF INDIA
MINISTRY OF LABOUR (DGE&T)
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN BLOCK, SECTOR - V
SALT LAKE CITY, KOLKATA - 700 091.

GENERAL INFORMATION

1. Name of the Trade : MECHANIC
Motor Vehicle
2. N.C.O. Code No. : 753.27
3. Duration of Craftsman Training : Two Years
4. Duration of Apprenticeship Training : Three years including ~~one~~ year
Basic Training
5. Entry Qualification : Passed 10 th. Standard under 10 + 2
system with Science and Maths.
6. Rebate of Ex-ITI Trainees : Two years for Ex-ITI
Mechanic (Motor Vehicle) Trainees.
7. Ratio of Apprentice to Workers : 1 : 4

LIST OF TRADE COMMITTEE MEMBERS

CHAIRMAN

Shri S.R. Majumdar

: Director
CSTARI, Salt Lake, Kolkata-91

MEMBERS

(S/Shri)

- | | |
|--|--|
| 1. M.K.Nandi
Asst. Manager Service | : M/S Ashok Leyland Ltd.
Kolkata |
| ✓ 2. S.S.Choudhury
Sr. Service Engineer | : M/S Ashok Leyland Ltd.
Kolkata |
| ✓ 3. K.S.Majumdar
Sales & Service Executive | : M/S Lucas Indian Service Ltd.
Kolkata |
| 4. Ashmin Banerjee | : M/S A.N.Motor Ltd.
Kolkata |
| 5. Lakshmana Gowda
Joint Director | : Directorate of Employment &
Training, Bangalore. |
| 6. S.K.Maity
Asst. Director of Training | : Directorate of Employment &
Training, West Bengal. |
| ✓ 7. K.N.Karmakar | : Directorate of Employment &
Training, West Bengal. |
| 8. A.K.Pal
Dy. Director of Training | : Regional Directorate of App.
Training (E.R.), Kolkata-64. |
| 9. M.K.Majumdar
Asst. Director of Training | : Advanced Training Institute
Kolkata; Dasnagar, Howrah-5. |
| 10. R.M.Sinha
Jt. Director of Training | : CSTARI, Salt Lake, Kolkata-91. |
| 11. K.P.Chattopadhyaya
Jt. Director of Training | : CSTARI, Salt Lake, Kolkata-91. |
| 12. T.Mukhopadhyay
Dy. Director of Training | : CSTARI, Salt Lake, Kolkata-91. |
| 13. N.S.Garbyal
Dy. Director of Training | : CSTARI, Salt Lake, Kolkata-91. |
| 14. Sanjay Kant
Dy. Director of Training | : CSTARI, Salt Lake, Kolkata-91. |

4

BREAK UP OF TRAINING PERIOD OF 2 YEARS FOR THE TRADE OF MECHANIC MOTOR VEHICLE UNDER CTS

Period of Training : 2 Years (104 Weeks)

(A) The syllabus for the 1st year of 52 weeks :
Break up of 52 weeks of training :

1. Admission formalities	2 week
2. Induction and safety training	2 week
3. Allied trade fitting	3 week
4. Allied trade sheet metal work	2 week
5. Identification of vehicles units, use of fasteners & locking device	2 week
6. Preliminary Engine work	10 week
7. Transmission work	10 week
8. Suspension and steering work	7 week
9. Brake work	6 week
10. Basic Electrical and Electronics work	5 week
11. Revision	3 week
Total	<u>52 week</u>

(B) The syllabus for the 2nd year of 52 weeks :
Break up of 52 weeks training :

1. Further practice on Petrol Engine Repair work	8 week
2. Trouble shooting in cooling lubrication fuel feed and ignition systems.	2 week
3. Diesel Engine Repair work	10 week
4. Industrial visit	1 week
5. Electrical/Electronics accessories repair work	7 week
6. Driving practice	7 week
7. Synchromesh Gear box and transfer case 4 wheel drive repair work, power drive.	4 week
8. Engine fault diagnosis including Engine scanning	4 week
9. Service station equipment and wheel balancing and servicing & lubrication work	3 week
10. Car A/C system repair and maintenance	3 week
11. Revision and All Indian Trade Test	3 week
Total	<u>52 weeks</u>

DRAFT SYLLABUS FOR THE TRADE OF "MECHANIC MOTOR VEHICLE" UNDER C.T.S.
SYLLABUS FOR 1ST YEAR OF TRAINING (52 WEEKS) - TRADE PRACTICAL AND RELATED INSTRUCTIONS

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
1 & 2	1. Admission formalities			
3 & 4	<p>2. Induction and safety Training Familiarisation with Institute. Importance of the Trade Machinery used in Trade. Types of work done by the students in the shop floor.</p> <p>Description of safety equipment, their use, safety rules to be observed in Automobile repair shop. Accident their causes. Up keep of fire extinguishers. Familiarisation of the tools and machinery available in the shop - their use and up-keep. Importance of cleanliness of work spot, tools, jacks, trays and horses etc.</p>	<p>General Introduction to the Course - Duration of the Course and Course contents. Study of the syllabus. General rules pertaining to the Institute. Facilities available - Hostel, Recreation, Medical & Library - Working Hours - Time Table.</p> <p>Importance of safety & general precautions to be observed in the shop. Fire extinguishers used for different types of fire. Storing and handling of inflammable materials. Elementary First Aid.</p>		

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
5	<p>3. Allied Trade - fitting</p> <p>Demonstration and use of fitters, hand tools - marking off with steel rule, callipers, scriber, divider, dot & centre punch. Chipping in marked lines. Sharpening of Chisels, centre punch, dot punch for correct angle.</p> <p>Hacksawing and filing to given dimensions. Filing true and square. Different types of filing operations.</p>	<p>Systems of measurement, conversion of English into metric measurements. & vice-versa. Marking material - Chalk, mechanic's Blue or Red lead. Tools used in marking steel rule, try square, callipers, dividers, scriber, prick and centre punch, hammer and chisel. Their uses and maintenance, safety precautions in handling grinding machines.</p> <p>Types of hacksaw frames & blades - their selection and uses. Types of files and their uses. care & maintenance of files.</p>	<p>Introduction to the subject of engineering drawing and blue print reading. Freehand sketching of lines, rectangles, squares and circles.</p> <p>Freehand sketching with dimensions and proportionate sketching of circles, rectangles, squares, parallelograms Rhombus & polygons.</p>	<p>Importance of workshop calculation & science. Addition, subtraction and multiplication and division of whole numbers.</p> <p>Common fractions. addition, subtraction, multiplication & division of common fractions. Vulgar fractions. Simple problems involving fractions.</p>
6	<p>Marking and drilling clear & blind holes, safety precautions to be observed while drilling. Tapping a clear and blind hole. Adjustment of Two-piece Die-reaming a bush to suit the given pin/shaft. Scraping a given machine surface.</p>	<p>Types & sizes of Drills. Cutting angles and speed and feed of drills. calculation of Tap drill sizes. Taps & dies - Description and use of different types of taps & dies. Use of 'V' threads. Precautions while using taps & dies. Description and use of different type of scrapers, reamers & emery papers.</p>	<p>Reading of simple Blue prints - sketching of simple solids such as cubes, prisms, cylinders, cones etc.</p>	<p>Applied workshop problems involving fractions & Vulgar fractions.</p>

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
7	Measurement by Micrometer (Out side and inside), vernier calliper and protractor head.	Construction and method of reading Micrometers (Internal & External) & vernier callipers. Correct handling of Micro meters and vernier callipers. Reading of vernier scale. Description and use of combination set vernier bevel protector. care and maintenance of Micrometers, vernier callipers, combination set etc.	---do---	Properties of ferrous metals - cast iron, wrought iron, plain and high carbon steel - high speed steel and alloy steel etc. and their uses.
8 & 9	4. Allied trade - Sheet Metal Work Joining of metal parts by soil soldering. Simple marking out on sheet metal, cutting, bending and folding. Practice of silver soldering, Pipe bending. Annealing of pipes. Fitting nipples and unions in pipes. Soldering and Brazing of Pipes.	Sheet metal worker's hand tools - their description & uses. description of simple soldering and brazing. Fluxes used for common joints. Types of sheet metal joints - their uses. Sheet and wire gauges. The blow lamp and its uses. Pipe fitting. Explanation of various common metal sheets used in sheet metal shop.	Free hand sketching of nuts, bolts, studs, with dimensions from samples. Sketching of solid bodies-such as square and Rectangular block, hollow cylinders, rings, cones etc.	Properties of ferrous metals copper, zinc, lead, tin, brass, aluminium, bronze solder & bearing metals and their uses.

Achievement after 7 weeks of Training

Trainees should be able to :

- (i) be familiar with shop tools, equipment etc.
- (ii) be aware of safety precautions and use of safety equipment and use of first aid
- (iii) do marking, simple hacksawing, filing, drilling, tapping, reaming, scraping, measuring operations
- (iv) do simple sheet metal joints, soldering, brazing, pipe bending, operations and use of sheet metal tools.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
10 & 11	5. Identification of vehicles, units, use of fasteners and locking devices Identify different types of vehicles, units on vehicles. Tighten all the loose nuts & bolts on vehicle. Practice and use of common locking devices such as lock nuts, cotter and split pins, rivets, keys, circlips, lock rings, lock washers, wire locking and locating where these are used. Use of modern locking device such as engineering adhesive and chemicals.	General description of motor vehicles. Major assemblies their location and function of each. Details of diesel, petrol, CNG & battery operated vehicle. Different locking methods and devices used in vehicles. Different fasteners used in vehicles.	Free hand sketching of rivets, screws, washers from samples. Sketching of riveted joints.	Brief description of manufacturing process of steel, copper and aluminium.
12 & 13	6. Preliminary Engine Work Dismantling unserviceable engine. Cleaning & studying parts. Measuring cylinder bore, crank pins, main journals, pistons, studying valve operating mechanism. Practice in the use of correct tools & right procedure.	Description of internal and external combustion engines, different types of I.C. Engines, important working parts in the engine - the 4 stroke cycle. Two stroke cycle, difference between 4 stroke and 2 stroke cycle engines. Description of valve operating mechanism and valve timing. Description and function of valve spring, guide, tappets, valve seals and locks.	Free hand sketching of 4 stroke cycles and 2 stroke cycles. ---do---	Calculation of volumes and weight of cubes, hexagonal prisms - shop problems. ---do---

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
14	Checking compression pressure in a running engine, dismantling the cylinder head from the engine, decarbonising the cylinder head, removing the valves, cleaning, reassembling.	Description and function of cylinder block, cylinder head, cylinder liners. reconditioning of cylinder heads.	Drawing of 3 views stepped and taper blocks in 3 rd . angle projection.	Calculation of cylinder wear-ovality-taper compression ratios-problems on compression ratios.
15	Removing piston and connecting rod assembly from engine - dismantling, cleaning, inspecting, checking clearances, installing rings and piston pins. Removing crank shaft from engine.	Description and functions of different types of pistons, piston rings and piston pins - common troubles and remedy.	---do---	centre of gravity - examples - problems involving centre of gravity in vehicles.
16	Removing connecting rod assembly - cleaning, checking bearing clearances, and bearing crush/spread, replacing bearing shells, setting correct clearances, measuring wear in crank pins and main journals in crank shaft.	Description and functions of connecting rod, materials used for connecting rods - Big end and main bearings shells - piston pins and locking methods of piston pins. Crank Shaft - description, function and types. Common troubles and remedies.	Drawing of plan, elevation and side views of tapered hollow objects.	Heat Temperature Thermometers Centigrade and Fahrenheit scales - use of temperature measuring instruments - their description and uses.
17	Assembling crankshaft, main bearings, connecting rods and piston assembly in the engine. Fitting cylinder head on engine block and setting ignition timing.	Firing order of the engine. Crank Shaft balancing. Description of the fly wheel and its function, Crank case and oil sump.	---do---	---do---

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
18	Checking cooling system for overheating, cleaning radiators, dismantling, cleaning, assembling and testing water pumps, reverse flushing the system and adjusting the fan belt tension. Check thermostat valve.	Engine cooling methods, Air and water cooling - radiators, pump thermo stats and fans - their description, care and maintenance. Reasons for engine overheating. Types of coolants.	Drawing the 3 views in 3 rd angle projection of a curved object.	Geometry - Properties of angles, triangles and circles.
19	Trace the lubrication oil flow system in engine. Overhauling oil filters, oil pump and setting the pressure release valve for correct oil pressure. maintenance and repairs in the lubrication system in engine.	Need for lubrication of engine parts - friction, lubricant and its properties, lubrication system, types - full flow and by-pass flow system, components in lubrication system, oil filters and pumps - types, their special features and uses. Types of lubricants and their properties.	Free hand sketching of oil filters - oil flow circuits - oil pumps.	---do---
20	Simple repairs in fuel feed system - overhauling of petrol pump, carburettors, fuel filters and air cleaners. Repair to a car carburettors - adjusting float level and slow speed adjustments - studying the fuel flow circuit in carburettor.	Fuel feed system in motor vehicles - description and layout of the system. Types, description, operation, maintenance of petrol pump, petrol filters and carburettors. Types of fuels and their properties. Types of carburettors, special features - advantages, different adjustments and their purpose.	---do--- Reading of simple blue prints.	---do--- Reading of simple graphs.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
21	Practice in engine tune up in a vehicle - testing, vacuum and compression of engine, adjusting tappets setting ignition timing and adjusting carburettor for slow speeds.	Explanation of engine tune up, job description of compression and vacuum testing - description of ignition timing setting and slow speed adjustment. function of different sensors on engine.	Exercises in Blue print reading.	Plotting and reading of graphs.

Achievements for 10 weeks of training from 12th to 21st week :

- (i) dismantling and assembling of different components of the engine
- (ii) repair operations of engine, valve refacing, valve seat cutting, decarbonising, fitting of bearings, piston rings, gudgeon pins
- (iii) overhauling of water pump, oil pump and petrol pump
- (iv) follow safety precautions while doing the above repairs
- (v) locate troubles and rectify in cooling, lubrication and fuel feed system of the engine.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
22	7. Transmission work : Adjusting clutch pedal play - removing gear box and clutch assembly from vehicle. Dismantling clutch assembly cleaning and inspecting parts. Servicing clutch master cylinder.	Layout of transmission system, description of single plate clutch and multiple plate clutches - functions - different types of clutches used in vehicles - their description, special features and advantages. different types of clutch actuation mechanism.	Isometric drawing of simple objects such as square, and rectangular blocks, with grooves and key ways.	Shop problems on force work - done, energy and power.
23	Removing and fitting of new pilot bearing. Removing and fitting of ring gear in fly wheel. Relining a clutch plate-checking condition of flywheel and pressure plate surface for refacing.	Clutch linings - types - materials used - bonded and riveted lining clutch plate construction, purpose of damper spring - precautions while relining a clutch plate.	Isometric view of clutch pedal - clutch release bearing - fork and clutch plate - free hand sketching of clutch assembly.	logarithm - definition - characteristic and Mantissa. Reading of Logarithm and Anti logarithm tables. Calculation of multiplication, division, powers etc. by using Log.
24	Assembling of pressure plate - adjusting the fingers - checking run out of flywheel and aligning clutch assembly with flywheel.	Fluid coupling - description operation and advantages o using fluid coupling - common troubles and remedy.	---do---	Applied problems on work, energy and power.
25	Dismantling a four speed sliding Mesh gear box. Cleaning, inspection of parts for wear damage. Assembling the gear box and filling in oil.	The purpose of gear box in vehicle - description and functions of a sliding mesh gear box - common troubles in gear box and their remedies.	Free hand sketching of the arrangements of gears inside the sliding mesh gear box in different gear positions.	Explanation of horse-power brake horse power and indicated power horse electrical equivalent of horse power.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
26	Dismantling, cleaning and assembling of gear shift mechanism - changing oil in gear box, studying gear ratios in the gear box.	Lubrication of gear box, constant mesh gear box - description and advantages.	Free hand sketching of shifter mechanism and gear shift lever.	Applied problems in horse power. calculation of speed ratios in 4 speed gear box.
27	Removing open type propeller shaft from vehicle. removing universal joints - cleaning, inspecting - replacing of wornout parts, reassembling and fitting to vehicle. Special precautions while removing torque tube drive shaft.	Universal joints and propeller shaft - open and closed type propeller shaft. Types of universal joints - care and maintenance, constant velocity joints - special features and advantages.	Use of drawing instruments, T - squares and drawing board. construction of simple figures.	Ratios and proportions - simple problems. Gear ratios in gear box and rear axles.
28	Removing rear brake drums and adjusting the wheel bearings in full floating rear axles and semi-floating axles - replacing oil seals in rear axles.	Description and purpose of different types of rear axles - special features and advantages of each type, lubrications of rear axles - reasons for oil in brake drums.	Construction of simple figures with dimensions - and titles - use of different types of scales.	---do---
29	Removing rear axles assembly from vehicle, dismantling, cleaning, inspecting parts for wear and damage, cutting packings/gaskets, removing tail pinion and bearings - cleaning and inspection of oil seals and bearings.	Description and functions of final drive assembly - crown wheel and tail pinion - hypoid gear and its lubrication. description of differential and its principle of operation.	Free hand sketching of different types of rear axles.	Calculation of areas of square rectangles, triangles, circles and regular polygons.
30	Checking tooth contact in crown and pinion and adjusting backlash, adjusting pre load of crown and pinion. Assembling the rear axle and fitting rear axle assembly on vehicles and testing.	Description and function of differential gear types - Tooth contact and backlash, pre loading adjustment. common troubles and their remedy in rear axle assembly.	Free hand sketching of universal joints, silencer brackets and spring shackles.	---do---

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
31	Trouble shooting in the transmission system of vehicles - detecting noises from clutch, gear box, universal joints. and rear axles assembly.	Description and purpose of optional fittings such as transfer case - free wheel - power take off - common troubles in these units and their remedy - care and maintenance.	---do---	Calculation of volume of square rectangular and conical blocks, volume of cylinders - solid and hollow.

Achievements for 10 week of training from 22nd to 31st week :

Trainees should be able to :

- (i) do relining the clutch plate and adjust clutch paddle free play
- (ii) repair defects in clutch assembly, gear box, universal joint and rear axle
- (iii) identify defects and noises in the transmission system and rectify
- (iv) overhaul differential and able to adjust and check backlash and do pre load bearings
- (v) observe safety precautions.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
32	8. Suspension & Steering Work Removing wheels from vehicle, dismantling tyres and tubes. - Checking and repairing punctures in tubes, assembling inflating to correct pressure, rotating the wheel in a vehicle. Minor repairing of wheels and tyres.	Description of Wheels and Tyres - Types - Section of Tyres, Ply rating, inflation pressure and carrying capacity, storage of tyres. Different types of rims.	Explanation of simple orthographic projection - 1st angle & 3rd angle. Free hand sketching of tyres and wheels.	Metric system, metric weight measurement, units used - conversion from FPS to metric system and vice-versa.
33	Inspecting the Frame-checking alignment of Frame-Servicing of spring - replacing new bushes for shackle pins - changing bushes in shock absorbers - cleaning and lubrication of wheel bearing, adjusting wheel bearings.	Frames - description and function - common trouble in conventional suspension system. Types of leaf springs. Different types of shock absorbers - their description, operation and maintenance.	Exercises in simple orthographic projection - 1st angle, free hand sketching of front spring assembly and shock absorber.	Exercises involving Metric and FPS Units.
34	Removing king pins and bushes, replacing new bushes and pins after reaming and lubrication of king pin bushes; changing rubber bushes in the front, independent suspension system.	Description of different types of independent suspension system - special features in each system. Maintenance and lubrication of front suspension system and air suspension system.	Exercises in simple orthographic projection - 3rd angle - free hand sketching of front axle assembly.	Shop problems in metric system.
35	Inspect and overhaul front and rear suspension - rear springs, coil springs - torsion bars. Check-up of dead axle for alignment.	The front axle - description and functions; types of steering knuckles, arrangement of steering knuckle joint, general lay out of steering linkages.	Views of simple hollow and solid bodies with dimensions, sketching of steering linkages.	Meaning of tenacity, elasticity, hardness, compressibility and ductility - examples of each.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
36 & 37	Inspect and overhaul steering boxes - adjusting steering. Gear back-lash and end play. Check and adjust Toe-in, camber angles. Checking king-pin inclination and Caster angle with special gauges.	Description of Ackerman's angle, caster, camber, Toe-in and Toe-out on turn, purpose and effect of these angles.	Free hand sketching of caster, camber, king-pin inclination Ackerman's angle, toe-out.	Problems in steering geometry, calculation of caster & camber.
38	Inspect and adjust steering linkages, after replacement of worn parts. Alignment of steering wheels with respect to front wheel.	Description of different types of steering boxes - special features of each, adjustments repair and maintenance of steering boxes. Power steering - description and its advantages.	Free hand sketching of different types of steering boxes.	Effect of alloying elements and properties of cast iron and steel alloys.
39	9. Brake Work Adjusting brake pedal play checking brake binding. Dismantling wheel brake assembly - cleaning and inspecting - adjusting brake shoes for proper clearances. Bleeding Hydraulic Brakes.	Arrangement of brakes in cars and trucks - description of hand brake and its purpose. Layout of mechanical and hydraulic braking system in cars.	Free hand sketching of brake linkages, brake assembly sectional views of master cylinder.	square root - square root of whole numbers and decimals. Problem relating to braking.
40	Removing master cylinder - dismantling cleaning and inspection of parts - assembling and testing - bleeding the braking system after cleaning the pipe lines.	Master cylinders - types including the Tandem master cylinder, special features of each - functions - common troubles and remedy.	---do---	Simple levers, problem related to levers as applied to motor vehicles.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
41	Dismantling wheel brake assembly - removing old lining and fitting new lining on the brake shoe. Removing & cleaning of brake drums. Inspecting wheel cylinders and brake drums - fitting new cups and brake hose pipes - re-assembling adjusting wheel bearings and testing & adjusting all 4 wheel brakes.	Brake linings - types, uses - relining the brake shoes - precautions to be observed. Wheel cylinders - description, function and types. Brakes fluids - description and use, types of fluids used.	Free hand sketching of brake wheel cylinders - cam adjuster, brake shoe assembly and anchor pins.	Meaning of friction - examples of useful and wasteful friction in vehicles - coefficient of friction, simple problem on friction.
42	Removing and refitting of vacuum boosters - repairs to pipelines - adjusting the brakes in vacuum assisted hydraulic brakes.	Description and advantages of vacuum assisted hydraulic brakes - special features - common troubles in vacuum assisted hydraulic brakes.	Free hand sketching of vacuum boosters - sketching the layout of vacuum assisted braking hydraulic system.	Properties of matter, molecules and atoms - atomic symbols and atomic number - simple chemical formulae.
43	Adjusting air brakes - repairs to tank unit, air-compressor, brake valve assemblies. Wheel brake adjusters - locating air leaks in the brake lines and rectifying general maintenance and care.	Description of air brake system - major components in system, description and purpose of each part, their care and maintenance - troubles in air brake assembly and their remedy.	Free hand sketching of the layout of the air brake system and sketching of slack adjuster.	Definition of mass, unit of force-weight of a body-energy and power.
44	Trouble tracing in braking system of a vehicle - adjusting brakes, precautions to be observed while testing brakes. Points to remember while preparing the vehicle for brake certificate.	Brake testing - efficiency of brakes - braking distance, weight transference during braking a vehicle - common troubles in brakes and their remedy.	---do---	Applied problem in forces - work done energy and power.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
45	10. Basic Electrical & Electronic Work Practice in joining wires & soldering. Forming simple electrical circuit. Measuring of current, voltage and resistance.	Simple electrical circuits and parallel circuits. Identification of A.C. & D.C. meters. Insulators, conductors, types of resistance Ohm's law and its application. Common electrical terms & symbols.	Free hand sketching of electrical symbols and drawing of simple electrical circuits.	Electricity and its effects of static & dynamic electricity. AC & DC differences.
46	Cleaning and topping up of a lead acid battery. Testing battery with a hydrometer cell tester, charging battery.	Primary & secondary cells, lead acid battery - description - construction - common troubles and remedies. Care while handling battery. Effects of mishandling batteries on environment.	---do---	Magnets - natural and artificial types, poles of magnets - magnetic field.
47	Identification of electronic control unit. Testing of electronic control circuit. Fault finding in electronic circuit and remedies.	Introduction to electronics. Definition of resistor, capacitor and inductor and their principles of working. Different types of diodes, transistors, power supply for electronic circuit.	Sketching of various electronic devices used in motor vehicle.	Calculation based on Ohm's law.
48	Checking instruments & gauges on dash board. Rectify/replace defective gauges.	Different gauges used in automobiles, their function.	Free hand sketch of gauges and their circuit.	Definition of ampere, volt and ohms - units of current, voltage and resistance, Ohm's law.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
49	Check and replace ignition coil, overhauling distributor assembly checking and setting ignition timing, cleaning and checking spark plug.	Ignition coil function - distributor types, function, spark plugs - function.	Free hand plotting of ignition circuit of a vehicle, sketching the circuit line diagram of magnetic ignition.	Advanced calculations relating to electric circuits.
50,51 & 52	Revision & Test			

Achievement control

Trainees should be able to do :

- (i) practice in making wire connections and soldering
- (ii) forming series and parallel circuits in the motor vehicle
- (iii) maintaining and testing battery
- (iv) trace & rectify defects in wiring circuits
- (v) overhaul distributor
- (vi) identify basic electronic components such as diodes, capacitors, resistors etc. and locate & rectify faults
- (vii) follow safety precautions while doing the above repairs.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & Science
53	<p>1. Further Practice on Petrol Engines Repair Work :</p> <p>Removing a petrol engine from a motor vehicle - dismantling cylinder head, decarbonising - checking valves - cutting valves' seats, replacing worn guides and weaksprings, assembling valves and cylinder head and adjusting tappet clearance in an engine.</p>	<p>Method of engine repair, fitting new liners - types and advantages of liners, procedure of decarbonising and valve reconditioning in an engine - common defects in valves - valves reface and seat angles. Reasons for valve bouncing - Importance of correct tappet clearances.</p>	<p>Drawing of riveted joints - lap and Butt joints. A free hand sketching valve operating mechanism.</p>	<p>Problems on straight and bell crank levers.</p>
54	<p>Removing piston and connecting rods from engine checking cylinder bore wear for ovality and taper. Checking piston ring grooves and cleaning - measuring piston size - removing gudgeon pin and bushes - checking wear - refitting new bushes and pins.</p>	<p>Reasons for cylinder wear - methods of reconditioning worn out cylinders. Precautions to be observed while removing and fitting piston and connecting rod assembly in cylinder bore.</p>	<p>Drawing of locking devices of different types with dimensions. Freehand sketching of piston and connecting rod.</p>	<p>Meaning of stress, strain, modulus of elasticity, ultimate strength examples.</p>
55	<p>Checking main and connecting rod bearing. Checking connecting rod alignment, fitting new bearing shells and setting correct oil clearances. Checking and cleaning oil passages in crank shaft and engine block, Overhauling and testing oil pumps, changing oil filters and oil pump.</p>	<p>Bearing types - their special advantages and special features - bearing metals, their composition, bearing spread - nip and crush -their purpose. Lubricating pumps; types and their special features. By pass and full flow oil filters.</p>	<p>Drawing of different types of couplings. Freehand sketching of oil pumps.</p>	<p>Problems involving stress, strain. Modulus of elasticity and ultimate strength.</p>

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
56 & 57	Cleaning fuel tank, checking for leaks in fuel tank. Circuit checking of multipoint fuel injection pump and petrol nozzle. Replacement if necessary, check delivery from fuel pump.	Layout of petrol injection system, its advantages, construction and working of multi point fuel injection pump and petrol injector their maintenance and care.	Drawing of different types of coupling.	Factor of safety, examples of different types of stress. Problems involving factor of safety and different types of stress.
58	Removing valve timing - cover - checking and correct setting of valve timing- replacing timing chains. Checking cam-shaft, end play and correcting it.	Valve timing gears - Timing marks, timing chains and chain tensioners - effect of stretched chains - checking backlash in timing gears.	Drawing of bearing pulleys with dimensions. Free hand sketches of valve timing diagram.	Elementary Hydraulics.
59	Assembling piston and connecting rod assembly, crank shaft, camshaft and timing gears. Fitting cylinder head checking valve tappet clearance, starting and adjusting engine speed.	Engine Assembly procedure as recommended by makers - precautions to be observed while assembling engine components, checking and adjusting engine idle speed with vacuum gauge.	---do---	Problems on various Trigonometric ratios. Reading of trigonometric tables. Problems on height and distance.
60	Removing inlet and exhaust manifold - cleaning carbon and checking for warpage and crack - checking heat control valve on exhaust manifold for proper working. Removing and replacing new manifold gaskets and checking leakage of exhaust gases. Removing and cleaning silencers and tail pipe and refitting.	Inlet and exhaust manifold description and purpose of manifolds, exhaust pipes and silencer box. Constructional details and purpose and types of silencers. Common troubles in exhaust system and their remedy. Catalytic converter, its function and advantages.	Free hand sketching of sectional view of silencer box - exhaust pipes and tail pipe.	---do---

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
61	2. Trouble Shooting In Cooling Lubrication Fuel Feed And Ignition Systems Trouble shooting in cooling and lubrication systems. Checking up and correcting oil and water leaks - changing defective packings and gaskets. Testing radiator for leaks - testing thermostat.	Step by step method of locating troubles in the lubrication and cooling systems. Reasons for engine overheating flow test rate recommended for radiator. Crank case dilution and crank case ventilation.	Free hand sketching of piston and connecting rod.	Properties of gases and composition of gases. Compression pressure.
62	Trouble shooting in fuel feed and ignition system - starting engine - checking air leaks. Repairing of silencer and tail pipes. Adjusting the slow speed of the engine with vacuum gauge.	Systematic procedure of trouble tracing in fuel feed and ignition system in automobile engine - Reasons for excessive fuel and oil consumption.	---do---	Applied problems on gas pressures, compression ratios and horse power.

Achievement for 10 weeks from 53rd to 62nd week.

Trainees should be able to :

- (i) remove petrol engine from vehicle, dismantle cylinder head, piston connecting rod, crank shaft, cam shaft etc.
- (ii) decarbonise cylinder head, to cut, repair and grid valve seat.
- (iii) check main and connecting rod bearing. Fit new shell bearing in main and big end, set oil clearance.
- (iv) clean ring grooves, set piston rings and assemble.
- (v) Check and replace oil pumps, oil filters, fuel filter
- (vi) Test & adjust MPFI pump and petrol nozzle.
- (vii) set ignition timing and valve timing
- (viii) locate troubles and rectify them cooling, lubrication, fuel feed and ignition system
- (ix) follow safety precautions.

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & Calculation
63	3. Diesel Engine Repair Work Practice on unserviceable diesel engine - removing jammed nuts, broken studs and reconditioning damaged threaded holes - removing cylinder head, connecting rods and pistons, cleaning, inspecting and refitting them.	History and development of compression ignition engines. Classification of C.I. Engines. Advantages and disadvantages over petrol engines - constructional details of single and multi cylinder engines. Turbo charger and its advantages.	Free hand sketching of combustion chambers of different types.	Lubricants - types special purpose, viscosity, effects of temperature on viscosity, high detergent oil and its applications.
64	Practice in starting and stopping of stationary and a transport vehicle engine. General maintenance of engines - checking oil, fuel, water levels and accessories of diesel engines.	The four stroke and two stroke diesel engine - unilflow and loop scavenging constant pressure and constant volume cycles. Diesel cycle indicator diagrams.	Free hand sketching of four stroke cycles and two stroke cycle engines.	Lubricants - types - viscosity and effect of temperature on viscosity. High detergent oils and their application.
65 & 66	Removing cylinder head, piston connecting rods, cleaning, decarbonising and cylinder head checking, piston clearance, dismantling valve assembly, cleaning checking and reconditioning valves, assembling valves and adjusting tappet clearances, assembling engine parts and starting the engine after repairs and adjusting slow speeds.	Specifications of diesel engines, materials used for different engine parts, working clearances, compression ratios -valve timing of diesel engines crank shaft, connecting rods, pistons valves and valve operation. The combustion chambers - types; advantages and disadvantages. Heater plugs types and their uses.	Free hand sketching of fuel feed system in diesel engines and diesel fuel filters.	Gear and belt drives - problems on gear and belt drives.
67	Bleeding fuel lines for Air locks. Repairing fuel leaks in the pipe-lines and unions, cleaning of air filters in diesel engines.	Fuels used in diesel engines, specification of diesel fuels, importance of clean fuel, general layout of the fuel feed system in the stationary and transport diesel engines.	Free hand sketching of diesel fuel feed system and fuel filters.	---do---

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & Calculation
68	Cleaning and servicing of primary fuel filters and pressure stage filters - removing feed pump - dismantling, cleaning, reassembling refitting and testing the feed pump.	Types of fuel injection systems - air injection and airless injection. Fuel feed pumps - description operation - common troubles and remedies.	Free hand sketching of diesel fuel feed system and fuel filters.	Gear and belt drives, problems on gear and belt. Torque - definition, its relation with forces on engine mounting, steering gear box and torque wrench.
69	Dismantling an unserviceable fuel injection pump clearing, inspecting, parts and reassembling. Removing F.I. pump from running engine changing oil in it - fitting back to engine - testing the governor and setting injection timing.	Need for governors - types - pneumatic and mechanical governors. The pumps - phasing and calibration of pumps. Checking and fixing injection timings. Governors - types, their description and operation.	Free hand sketching of components from assemblies.	Inclined, plane, its uses - example and applied problems.
70	Testing injectors for missing on the vehicle - removing, dismantling, cleaning, inspecting - replacing defective parts - reassembling the injectors and testing them.	Injector nozzles - types, description, operation testing of injectors. Special features of pintle nozzles.	Free hand sketching of fuel injectors of different types.	Screws and screw jack, problems on a screw jack.
71	Servicing & testing rotary fuel injection pump, adjusting tappet & setting injection timing.	Rotary fuel injection pump, flange type pump and their special features. Care and maintenance of single cylinder pump.	Free hand sketching of single element flange mounted pump.	Area of circle, ellipse, volume and weight of regular solid and sphere.

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
72	Trouble shooting with special references to adjustments in the fuel feed systems - checking exhaust gases - and adjusting the governor - slow speed adjustment and venture control adjustments. Checking oil, fuel, water and exhaust gas leaks and correcting them. Checking exhaust gas by free acceleration method.	Need for governors - types - pneumatic and mechanical governors, maintenance of governors, reasons for black, white and blue smoke in exhaust.	Freehand sketching of fuel injectors of different types.	Area of circles, ellipses, volume and weight of regular solids and spheres.
73	4. Visit to local garages and industries - demonstration of service station equipments :			

Achievements for 11 weeks from 63rd to 73rd weeks :

Trainees should be able to :

- (i) Bleed air in the diesel fuel system, check and correct fuel leak and service diesel fuel filters.
- (ii) Remove clean and test fuel injector and find out the defective/missing injector.
- (iii) Overhaul fuel feed pump.
- (iv) Check and correct injection timing in single and multi-cylinder engine and know service station equipments
- (v) Follow necessary safety precautions.

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
74	5. Electrical/Electronics Accessories Repair Work Trace the light circuit - test bulbs, align head lamps, find out short and open circuits in the light wiring - replacing fuses testing the tail and brake lights in vehicle. Check function of malfunctioning indicating lamp.	Description of light circuits -different components in light circuits - description and function of each. Pre focused bulbs and sealed beams. Fuses and their importance. Layout of different sensors and malfunctioning indicating lamp in a vehicle.	Freehand sketching of light circuit of a vehicle with electrical symbols.	Measurement of electrical power watt and kilowatt with relationship with Horse power.
75	Removing an electrical horn from vehicle - dismantling, cleaning point, testing wires, assembling the horn and adjusting the horn for correct sound, tuning double horn, repairing of horn relay and horn switches.	Electrical horn circuit -m description of electric horn - operation of relay and horn - operation of relay and horn switches. Common troubles and their remedies.	Free hand sketching of horn circuit, drawing the sectional view of horn.	Applied problems involving watt, kilowatt, volt ampere and horse power.
76	Removing a wiper motor - dismantling, cleaning, inspecting, repairing electrical wiper motors, assembling and fitting, setting blades for correct functioning.	Description and operation of an electric wiper motor, care and maintenance. Common troubles and remedies.	Free hand sketching of wiper motor circuit.	Applied problems on resistance in the series and parallel circuits.
77	Trace the wiring circuit of traffic signal flashers light circuit - tracing defects in the flasher circuits, replacing fuse bulb. Removing, dismantling, cleaning and assembling magnetos adjusting gap in points - testing magnetos.	Flasher circuit, its description and operation, common troubles in the circuit and remedies. Magneto ignition system - description and operation, advantages - rotating armature and flywheel magnetos - special features.	Sketching the flasher light circuit with symbols. Freehand sketching of magneto ignition circuit.	Problems on resistance in series, parallel circuits. Conductors and insulators examples and uses.

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
78	Removing and rectifying alternator/dynamo in a vehicle, precautions while connecting battery in alternator circuit. General maintenance, adjusting fan belt play tension.	Description of charging circuit. Difference between dynamo & alternator, their operation common trouble and remedies. Regulator unit ignition warning lamp.	Free hand sketching of light circuit of vehicle with electrical symbols. Free hand sketching of charging unit.	Measurement of electrical power watt and kilowatt relationship with horse power and conductors and insulator types and uses.
79	Removing starter motor from vehicle, overhauling and testing of starter motor.	Description of starter motor circuit. Constructional details of starter motor. Solenoid switch common troubles and remedies in starter circuit. Positive and negative earthing of battery.	Sketching starter motor circuit and solenoid switch circuit. Free hand sketching of tracer plate assembly and advance and retard plate.	Explanation of open and short circuits - locating short circuits with the help of motors.
80	Trouble tracing in electrical wiring of the vehicle. Use of resistance meter voltmeter and ammeter. Attending mechanical repairs to electric accessories such as fuel gauge, temperature gauge, brake light switch, solenoids switch. Tracing fault in different electronic ignition systems and rectification.	Luças - colour code for wiring in the motor vehicles. Binary numbers logic gates, amplifiers and multi vibrators. Principle of electronic ignition, advantages, types of electronic ignition system as capacitor discharge ignition system, thyristor based ignition system and microprocessor based contactless ignition system.	Freehand sketching of the complete wiring of the vehicle.	---do---

Achievements for 7 weeks from 74th to 80th week :

Trainees should be able to :

- (i) trace fault in electrical wiring and accessories and rectify them.
- (ii) trace faults in electronic circuits and accessories and rectify them.
- (iii) follow necessary safety precautions.

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
81 to 87	6. 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. Practice in driving over slopes and down hill. Practice in driving over narrow bridges.	Motor vehicle Act - Driving road rules - road traffic signals - hand signals. Precautions to be taken while over taking, reversing driving through narrow lanes, curves and slopes.	Freehand sketching of different traffic signals.	Applied workshop problems calculating fuel average, gear ratios.

Achievement for 7 weeks from 81 to 87 week :

Trainees should be able to :

- (i) Drive and road test a motor vehicle
- (ii) Follow necessary safety precautions.

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
88	7. Synchronmesh Gear Box And Transfer case 4 Wheel Drive Repair Work Dismantling a synchronmesh gear box, cleaning, inspecting parts replacing worn out defective parts - assembling and testing for correct performance, identifying noises from gear boxes and rectifying.	Synchronmesh gear boxes - advantages - description, operation in different gear positions. Common troubles and remedies types of synchronmesh gear boxes - their special features.	Free hand sketching of synchronmesh units.	Calculating of area, volume and weight of hollow and solid bodies.
89	Removing transfer case from the vehicle - dismantling, cleaning inspected parts, replacing worn/damaged parts, reassembling, testing and fitting. Repairing of four wheel drive shifter mechanism. Overhauling of front wheel drive propeller shaft unit. Overhaul over drive mechanism.	Description and operation of four wheel drive - the purpose of transfer case and the arrangements of shifting mechanism. Common troubles and remedies. Over drive mechanism its advantages, maintenance & care.	Free hand sketching of intermediate shaft and shifter arrangement.	Revision of ratio and proportion, applied problems in 4 wheel drive.
90 & 91	Trouble shooting in the transmission system identifying the noises from clutch, assembly, gear box, universal joints - rear axle drive and the differential unit. Checking oil leaks and correcting.	Systematic procedure of locating noises from the transmission units - common troubles in the system and their remedies.	Freehand sketching of intermediate shift and shifter arrangement.	---do---

Achievement for 4 weeks from 88th to 91st week :

Trainees should be able to :

- (i) Overhaul a synchronmesh gear box
- (ii) Overhaul a transfer case
- (iii) Follow necessary safety precautions:

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
92 & 93	8. Engine Fault Diagnosis Including Engine Scanning Diagnosing noises and faults in engine and rectifying them checking under carriage noises and rectifying them. Road testing vehicles.	Different types of noises coming from engine - bearing knock, gudgeon pin knock, pinging, tappet noise, chipping noise.	General Engineering Drawing's codes.	Revision of calculation of fuel average, gear ratio.
94 to 95	Test Dual angle, Engine Tuning and exhaust gases analysis. Check engine efficiency with the help of Dynamometer. Rectify the causes for improper smoke in Petrol & Diesel engine.	Introduction to engine turning. Study engine torque, fuel consumption. Dual angle, exhaust gases etc. Reasons for improper exhaust and their remedies.	---do---	---do---

Achievements for 4 weeks from 92nd to 95th week

Trainees should be able to :

- (i) Diagnose noises and faults in engine and rectify them.
- (ii) Diagnose faults in engine with the help of computerised machines
- (iii) Follow necessary safety precautions.

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
96 & 97	9. Service Station Equipments and Wheel Balancing Repairs of jacks, grease guns, oil spray guns, other spray gun and other shop floor equipment. Care, maintenance and lubrication of air compressor, valve refacer, drilling machine, injector tester, spare part washing of a vehicle.	Garage equipment construction and operation of all mentioned equipment, plug tester, valve refacer, injector tester, drilling machine, care and maintenance. Care to be observed while servicing & washing of a vehicle.	Sketching of screw - jacks, grease guns and oil spray guns.	Description and operation of an alternator.
98	Wheel balancing and use of equipment	Importance of wheel balancing. Details of equipment and method.	---do---	---do---

Achievement for 3 weeks from 96th to 98th week :

Trainees should be able to :

- (i) Repair jacks, grease guns oil spray guns and other shopfloor equipment.
- (ii) Operate the wheel balancer.
- (iii) Follow necessary safety precautions.

Week No.	Practical	Theory	Engineering Drawing	Workshop Science & calculation
99 to 101	10. Car Air Conditioning System Repair and Maintenance Fitting and repairing air conditioning unit in Motor vehicle. Tuning engine with respect to the air conditioning. Installation of car music system and its wiring. Maintenance of power windows.	Introduction to air conditioning system in motor vehicle. Compatibility of air conditioning system with vehicle engine. Power window & its advantages.	Free hand sketching of layout of air conditioner in vehicle, wiring of car music system power window.	Simple calculation in air conditioning.

Achievements for weeks from 99th to 101st week :

Trainees should be able to :

- (i) Undertake servicing, rectification and installation of air conditioning system in Motor vehicles
- (ii) Follow necessary safety precautions.

Week No.	Theory	Practical	Engineering Drawing	Workshop Science & calculation
102 to 104	REVISION AND ALL INDIA TRADE TEST			

LIST OF TOOLS AND EQUIPMENTS

THE LIST INDICATES THE REQUIREMENT OF TWO YEARS
PROGRAMME

For a batch of unit of 16 trainees

Sl.No.	Description	Quantity
1	2	3
1. TOOL KIT		
1✓	Hammer ball Peen 0.75 Kg.	16
2.	Chisel Cold Flat 19 mm.	16
3.	Centre Punch 10 mm. Dia. x 100 mm.	16
4.	Steel Rule 15 cm English and Metric	16
5.	Screw Driver 30 cm x 9 mm. Blade	16
6✓	Screw Driver 20 cm x 9 mm. Blade	16
7.	Spanner DE Set of 12 pieces (10 mm. - 32 mm.)	16
8.	Plier Combination 15 cm	16
9.	Hand File 20 cm second cut	16
10✓	Feeler gauge 20 blades (Metric)	16
11✓	Ring spanner set of 12 pieces (10 mm. - 32 mm.)	16
12.	Steel tool box with Lock and Key (folding type) size 400 x 200 x 150 mm.	16
13.	Allen Key set of 12 pieces (2 mm. - 14 mm.)	4 sets
14✓	Circlip Plier (Ext. and Int.) 150 mm. And 200 (two each)	8 sets
15✓	Philips screw driver type set of 5 pieces 100 mm. -300 mm.	4 sets
Tools Measuring Instruments and General Shop Out fit		
1✓	Rule Steel 300 mm.	2
2✓	Divider Spring Joint 150 mm.	2
3✓	Prick Punch 15 cm	2
4✓	Chisel cross cut 200 mm. X 6 mm.	1
5✓	Hammer Ball Peen 0.5 Kg.	2
6✓	Hammer Copper 1 Kg. With handle	1
7✓	Engineering Square 15 cm Blade	2
8✓	Scriber 15 cm	2
9✓	Scriber Block Universal	1
10✓	Marking out tables 90x 60 x 90 cm(high)	1
11✓	Surface Plate 60 x 60 cm	1
12✓	Hacksaw frame for 30 cm blade	4
13.	'V'-Block 75 x 38 mm pair with clamps	2
14✓	Punch Hollow 6,7,8,9, 10.5 and 12 mm set	1 set
15.	Punch figure set 3 mm	1 set
16✓	Punch letter set 3 mm	1 set
17✓	Hand Vice 37 mm	2
18✓	Screw Driver, Electrician type 15 cm size	2
19✓	File, Flat 35 cm bastard	2
20✓	File, flat 25 cm second cut	2

21✓	File, Flat 20 cm Smooth	2
22✓	File, Flt safe edge 25 cm smooth	2
23✓	File, triangular 15 cm second cut	2
24✓	File, half round 20 cm second cut	2
25✓	File, Square 30 cm rough	2
26✓	File, square 20 cm second cut	2
27✓	Twist Drill, Metric 3mm to 12 mm(1 mm step)	1 set
28✓	Taps and dies complete set in box B.A, BSW, BSF, American and metric with handles	2 sets
29✓	Hand reamer adjustable 10.5 mm to 11.25, 11.25 mm to 12.75 mm, 12.75mm to 14.25 mm and 14.25 mm to 15.75 mm.	1 set
30✓	Scraper flat 25 cm	1
31✓	Scraper Triangular 25 cm	1
32✓	Scraper half round 25 cm	1
33.	Sets of Morse socket MT-O-1, 1-2 and 2-3	1
34✓	Micrometer outside 25-50 mm	1
35✓	Micrometer outside 0-25 mm	1
36✓	Micrometer Outside 50 - 75 mm	1
37✓	Micrometer Outside 75-100 mm	1
38✓	Micrometer Inside 50 to 75 mm and 150 mm and 25 mm to 50 mm	1 each
39.	Vernier Caliper set 250 or 200 mm inside, outside and depth	1
40.	Safety goggles	2 pairs
41.	Hammer, Planishing	1
42.	Setting Hammer	1
43.	Mallet(Wooden)	1
44.	Trammel 30 cm	1
45✓	Blow lamp 0.5 litre	1
46.	Soldering iron 120 watts	2
47.	Soldering iron copper 225 gms(fire heated)150 mm &200 mm	2
48.	Pliers Nose(round and straight)150 mm and 200 mm	2 each
49.	Snip Straight 250 mm	1
50.	Spanners double ended set of 12 metric sizes 6 to 32 mm	1 set
51.	Spanner off-set double ended set of 7 pds.(6 mm to 17 mm)	1 set
52.	Double Open-ended Ignition spanner set of 5(0 to 9 mm)	4 sets
53.	Spanners adjustable 20 cm	1
54.	Spanner Ring Off-set sett of 6 SAE	1 set
55.	Spanner for sparking plug 14 mm	1 set
56.	Magneto Spanner set of 8 spanners	1 set
57.	Spanner socket set(6-32 mm sockets) - complete set	2
58.	Spanner T*Flex for screwing up and unscrewing in inaccessible position.	1
59.	Double open-ended Tappet spanner	1 set
60.	Drift copper 10 mm dia x 150 mm	2
61.	Spray Gun Kerosene	1
62.	Pressure Grease Gun	1
63.	Chain Pulley Block - 3 ton capacity	1
64.	Tray cleaning 45 x 30 cm	16
65.	Drilling Machine(Bench) 12 mm dia	1
66.	Oil Can 0.5 litre	1
67.	Lifter, Valve Spring	1

68.	Tool, Valve grinding, suction type (consumable tool)	6
69.	Valve set cutting tools complete with Guides and Pilot bar(all angles) in a Box.	1 set
70.	Extractor, Stud 'EzgOut' type	1
71.	Compression gauge to read 17.6 kg./Sq.cm	1
72.	Vacuum Gauge 0 to 75 cm	1
73.	Stone Carborandum 15 x 5 3.75 cm rough and smooth	2
74.	Cylinder dial gauge	1 set
75.	Torque wrench (0 to 67.5 kg./meter) set of 3	1
76.	Work Bench 240 x 120 x 75 cm with 4 vices 12.5 cm jaw	4
77.	Lockers with 8 drawers (standard size)	2
78.	Metal rack 180 x 150 x 45 cm	1
79.	Fuel Pump - old for practice	2
80.	Distributor - old for practice	2
81.	Carbauretor(two different types)	2 each
82.	Water Pump and Oil Pump	2(1 each)
83.	Filing jig for adjusting the piston ring gap	1
84.	Steel almirah 180 x 90 x 50 cm	1
85.	Black Board 180 x 90 cm	1
86.	Desk or table 90 x 60 cm(for instructor)	1
87.	Fire extinguisher	2
88.	Fire buckets with stand	4
89.	Tachometer	1
90.	Jack, hydraulic Hi-Lift type(Trolley type)	2
91.	Tester sparking plug 'NEON' Type	1
92.	Compressor air piston type(vehicular)	1
93.	Wheel alignment gauge - magnetic type with turn tables	1
94.	Sectionised engine gear box and differential mounted on chassis	1
95.	Brake assembly, master cylinder, wheel cylinder and servo	1
96.	Vacuum assisted hydraulics brake assembly with vacuum booster	1
97.	Air Brake Assembly	1
98.	Brake Lining riveting machine(foot operated)	1
99.	Clutches, different types such as Cone type disc type diaphragm type etc.	1
100.	Axle, Gear boxes, steering boxes front axle, axle assembly Independent front wheel spring assembly. Synchromesh gear box assembly, live front axle assembly transfer case	1
101.	Full floating axle and semi-floating axle assembly	1 each
102.	Steering assembly - rack and pinion type	1
103.	Steering assembly - power steering	1
104.	Spring Tension scale - 0-4.5 kg.	1
105.	Valve spring compressor	1
106.	Carburettor repair tool kit	1
107.	Puller set steering wheel universal 1set	1
108.	Puller set universal bearing and bushes	1 set
109.	Lifting jack, screw type	4
110.	Coil spring compressor for suspension spring	1
111.	Hot patch clamp	2
112.	Piston Ring Compressor	2

113.	Valve Key inserter	1
114.	Wall Charts(Driving instructions)	1
115.✓	Connecting rod alignment fixture	1
116.	Valve refacer	1
117.	Piston ring expander	1
118.	High rate discharge tester	1
119.	A.V.O. Meter	1 set
120.✓	Pneumatic tools	1 set
121.	Impact screw driver	1 set
122.	General purpose puller	1 set
123.	Stud extractor	1 set
124.	Spring Plier 150,200 mm	1 set
125.✓	Torque Wrench(set of 3 numbers)	1 set
126.	Growler	1
127.	Battery charger	1
128.	Timing light	1
129.	Hydrometer	1
130.✓	Continuity meter	1
131.✓	Tyre changer	1
132.	Fuel injection pump(Diesel) inline	1
133.	Fuel Injection Pump(Diesel) rotary	1
134.	Multi-point fuel injection pump	2 nos.
135.	Petrol nozzle	2 sets
136.	A/C Unit(Car)	2 Nos.

GENERAL MACHINERY

1.✓	Grinder with two 7" wheels with twist drill grinding attachment	1
2.✓	Arbor press hand operated ½ ton	1
3.✓	Motor vehicle in running condition(Diesel heavy)	1
4.✓	Motor car in running condition(Petrol)	1
5.✓	Light commercial vehicle - 3 ton	1
* 6.✓	Heavy Commercial vehicle	1 (optional)
7.✓	Petrol Engine running condition MPFI type	2
* 8.	Petrol engine running condition carburettor type	2
* 9.✓	Diesel Engine running condition (Vehicle type)	2
10.✓	Petrol Engine(2-stroke) Motor Cycle/Scooter	2
11.✓	Spark Plug cleaning and testing equipment	1
12.✓	Air compressor - 2 stage - 500 litre with 5 HP motor & air receiver	1
13.✓	Mechanical Hoist/Plate Form Type	1
14.	Exhaust gas analyser	1
15.	Smoke tester	1

* Ref. DGET 2 (1) 2001 - CD, dated 2nd June 2004.

LIST OF OPTIONAL TOOLS AND EQUIPMENT, SHOULD BE PROCURED IF POSSIBLE.

1. Car Washer with detergent and steam mixed facility
2. VCR/VCP along with the Video Cassettes in the field of Mechanic Motor Vehicle
3. Engine Tuning Equipment, such as Dual Angle Tester etc.
4. Car Air Conditioning Model
5. Disc Brake Model
6. Engine Model with Petrol Injection
7. Engine Model equipped with Electronic Ignition System
8. Car Scanner
9. Illuminated Magnifier 10 x.

SYLLABUS UNDER A.T.S.

First and Second Year

Syllabus for the First and Second year should be the same as that for the Trade of Mechanic(Motor Vehicle) under Craftsman Training Scheme.

Third Year - Shopfloor Training

SYLLABUS FOR PRACTICAL TRAINING

I. Revision Further practice on front axle, suspension, steering and brake work

II. ENGINE REPAIR WORK

1. Removing engine from vehicle, observing all safety precautions.
2. Dismantling cylinder head and decarbonising
3. Re-conditioning valves and valve seats
4. Removing piston and connecting rod assembly
5. Dismantling Gudgeon Pins and bushes, Piston rings, cleaning, checking and refitting them.
6. Checking main bearings and crank shaft
7. Checking connecting rod bearings
8. Checking and cleaning of oil passages in the crank shaft and engine block
9. Overhauling oil pump
10. Checking timing chain tension and replacing worn chain
11. Checking and adjusting valve timing
12. Checking alignment of connecting rods for twist and bend
13. Checking warping in the cylinder head
14. Measuring cylinder bores and crank pins.
15. Fitting new bearing shells and adjusting main bearings
16. Re-assembling piston and connecting rod assembly in engine block
17. Fitting cylinder head and torquing to correct specifications

18. Assembling overhead valve assembly and adjusting tappets
19. Removing exhaust manifold, silencer pipe, silencer box, cleaning and refitting.
20. Overhauling petrol pump and testing
21. Cleaning and testing petrol tank for leaks
22. Overhauling carburettors
23. Checking and correcting air/fuel leaks in petrol lines
24. Reverse flushing radiator and cooling system
25. Adjusting fan belt tension
26. Testing Thermostats
27. Overhauling Water pump
28. Replacing hose pipes and checking leaks
29. Maintenance of lead acid battery
30. Charging a battery from a battery charger
31. Overhauling a distributor assembly
32. Testing induction coil and condenser
33. Cleaning and Testing spark plugs
34. Testing engine compression with compression gauge
35. Starting engine and adjusting slow speed of engine
36. Trouble shooting in engine
37. Trouble shooting in cooling system, lubrication system and fuel feed system
38. Checking circuits and delivery of multi-point fuel injection pump
39. Testing Petrol nozzles
40. Checking exhaust gases and rectifying defects for improper exhaust gas.

III. DIESEL ENGINE WORK

41. Practice starting and stopping a diesel engine
42. General maintenance of diesel engine
43. Bleeding air from diesel Fuel system
44. Repairing leaks in Diesel Fuel pipelines
45. Servicing Diesel fuel filters and air cleaners.
46. Servicing of oil filters
47. Overhauling Transfer Pumps(feed pumps)
48. Removing fuel injection pump from running engine, cleaning changing Lubrication oil, refitting and setting injection timing
49. Testing fuel injectors on the vehicle for missing
50. Overhauling an injector and testing on test-bench
51. Troubling shooting in Diesel fuel feed system.
52. Trouble shooting in Diesel Engine
53. Maintenance of Log Book
54. Checking exhaust gases and rectifying defects for improper exhaust gas.

IV. ELECTRICAL WORK

55. Repairing of components in lighting circuit
56. Testing bulbs and replacing fuses
57. Overhauling starter motor

- 58. Overhauling a dynamo in the vehicle
- 59. Repairing and adjusting electrical horns
- 60. Repairing of wiper motors
- 61. Tracing trouble in the wiper motor circuit and rectifying them.
- 62. Studying wiring circuit of traffic signal flasher circuit and rectifying defects in the circuit
- 63. Removing and fitting of alternators in vehicles
- 64. Trouble tracing in electrical circuits using AVO meter.
- 65. Check electronic control unit and its circuit in a vehicle and replace.

V. TRANSMISSION WORK

- 66. Overhauling a synchromesh gear box
- 67. Overhauling transfer case assembly
- 68. Replacing universal joint cups and cross in propeller shaft assembly
- 69. Identifying noise and rectifying in transmission system
- 70. Overhauling rear axle assembly, adjusting tooth contact in final drive assembly
- 71. Checking undercarriage noise in a vehicle
- 72. Overhaul over drive mechanism
- 73. Overhaul front wheel drive front axle

VI. SERVICE STATION/GARAGE EQUIPMENT

- 74. Repairing Jacks(Mechanical and Hydraulic type)
- 75. Repairing of Grease Guns and Oil spray guns
- 76. Care and maintenance of Air compressor and Hydraulic hoist
- 77. Care and maintenance of valve refacer, injector, tester, spark plug, tester and car washer.
- 78. Care and maintenance of exhaust gas analyzer/smoke tester.
- 79. Practice in use of special tools

VII. TROUBLE SHOOTING

- 80. Diagnosis of faults in engine, steering, brakes and transmission system and rectifying them.
- 81. Diagnosis of fault in engine for improper smoke and rectify them.
- 82. Towing a sick vehicle.
- 83. Use, care and maintenance of vacuum/pressure gauges in diagnosis engine troubles.
- 84. Preventive maintenance.

SYLLABUS FOR RELATED INSTRUCTION

Related Instruction should be imparted to all the apprentices during the entire period of training including basic training. The syllabus given for Related Instruction should be considered as a guide.

The subjects to be taught to the apprentices in Related Instructions are :

1. Trade Theory
2. Workshop Calculation and Science
3. Engineering Drawing
4. Social Studies

FIRST AND SECOND YEAR

The content of the syllabus for the apprentices during first and second year of the trade Mechanic(Motor Vehicle) under Craftsman Training Scheme.

THIRD YEAR

1. Trade Theory (3 hours per week or 150 hours per year approximately). The no. of hours to be spent on the different topics in the trade theory has been indicated. The hours indicated are flexible and are only intended as a guide.
1. Safety at work - accidents do not happen they are caused.
2. Revision of the work of previous two years.
3. Heat treatment of metals and alloys - its necessity definition of terms - hardening, tempering, annealing, normalising and case hardening. Brief description and process employed. Equipment used for heat treatment temper colour charts.
4. Scrapping, lapping and honing operations their applications.
5. Inter changeability, fits, limits, tolerance and allowances.
6. Battery charging - fault finding and service station test including road tests
7. Machinery and equipment - Air compressor hydraulic hoist, cylinder boring machine, crank shaft grinding machine, main bearing, link bearing, bar honing machine, wheel alignment gauge etc. their description, operation and use. Care and maintenance.
8. Further description of tyres and tubes - selection of tyres carrying capacities, inflation pressures - tubeless tyres emergency repairs. Vulcanising - re-treading.
9. **Power Unit** - Reasons for use of multi-cylinder engines, cylinder arrangements and construction, combustion chamber, shapes. Cams and Cam shafts. Piston materials and construction. Procedure in de-carbonising and valve maintenance

including determination of cylinder wear, valve guide wear spring strength . Crank shaft - main bearing alignment - construction crank position in relation to firing order. Effect of altitude and power output. Fault finding - use of vacuum pressure gauges in diagnosing engine faults.

10. **Oil film wedge theory. Viscosity** - SAE numbers Factors governing selection of correct grade of oil. Manufacturer's specification, Types of lubricant. Oil additives. Forced and splash lubrication. Crank, case dilution and crank case ventilation - By pass flow and full flow system - service procedure in relation to lubrication system.
11. **COOLING SYSTEM** - Thermo syphon system and pump circulation. Thermostats - Pressurised radiators. Anti freeze and anti-corrosive compounds.
12. **COMPRESSION IGNITION ENGINES** - Types of combustion chamber, effects of turplenance. Direct and indirect combustion. The injector pump - methods of calibrating and phasing, spill timing - Types of Governors for compression ignition engines. Methods of metric fuel. Injectors - arrangements of sprayers to suit direct and indirect injection - glow plugs and manifold heaters.
13. **FUEL/AIR SUPPLY SYSTEM** - Fuels - specification details - calorific values and air fuel ratios for typical fuels. Air filtration system - Air cleaners.

Typical fuels and characteristics for spark ignition and compression ignition engines. Functions of jets, chokes, float and plot chamber. Starting, slow running and accelerating devices. Causes of faulty running with simple adjustments. Exhaust gas, composition and characteristics. Intake and exhaust manifolds, turbo charger.
14. **SILENCERS** - Essential features in arrangement, construction. and mounting procedures for cleaning and re-assembly, catalytic converter.
15. **ELECTRICAL EQUIPMENT** - Ignition timing, advance and retard by manual and automatic control. Contact breaker cleaning and adjustments. Construction of coil and distributor. Lubrication of electrical equipment cleaning/dressing of commutator. Alternators in vehicles transisterised ignition.
16. Purpose of clutch, limits of clutch adjustments. Lubrication in gear box - description and operation of special type gear box metal and rubber types of universal joints, constant velocity joints, assembly details. Front axle drives, rear engine drives. Over drive mechanism.
17. **FRONT AXLE, FRONT SUSPENSION AND STEERING GEAR** - Ball joint suspension, causes of steering faults and vibration - methods of correction, Dynamic wheel balancing.
18. **WHEELS, TYRES AND BRAKES** - Construction of tyre, rims and split rims - their sizes and fitting, cover and tube repair , inflation pressures. Wheel brake assembly. Types of brakes and braking systems including air brakes. Servo assisted brakes and air brakes effect of brake action and operating forces.

Relining brakes, cause of noise in operation. Location and rectification of troubles, use of special tools.

19. **FRAMES** - Loads to be carried by frame, distortion under normal and abnormal road conditions, drive and brake reaction. Constructional details - including methods of ensuring strength and rigidity, reinforcement, testing of frame alignment mounting of body. Typical methods of construction for separate and integral body. Chassis combinations, jacks and jacking systems.
20. **SUSPENSION** - Springs, shock absorbers, stabiliser rod - different types of independent systems.
21. **GENERAL SERVICING AND ROAD TESTING** - Typical service station equipment for routine servicing including Air compressor - Car washer - greasing equipment. Lubrication service - Assembly of components after routine overhaul. Importance of cleanliness in relation to chassis details and body fittings. Road testing after routine servicing and overhaul, location and detection of faults, simple testing on fuel consumption. Care and use of tools, equipment and measuring instruments.
22. Use of reference tables and manufacturer hand book
23. Modern development in the trade-new technique etc.
24. Estimation of time and materials.
25. Quality and finish of work, importance of quality and finish of jobs at all stages protection of finished surface etc.
26. Trouble shooting sequence.
27. Revision and test

II. WORKSHOP CALCULATION AND SCIENCE(1 hour per week or 50 hours per year approximately)

1. Revision of the previous two year's work.
2. Further problems on mensuration , work, power and energy.
3. Elementary principles of parallelogram and triangle of forces application to lifting tackles.
4. Graphs - Plotting of points, plotting of graphs of simple equations, reading of graphs.
5. Torque and its relation to forces on engine mounting, steering gear transmission.
6. Friction - co-efficient of friction, braking, lubrication, ball and roller bearings.

7. Properties of water and lubrication in relation to heat. Specific gravity - Archimedes principle - laws of floatation. Viscosity. Change of viscosity with temperatures, importance of this relation to selection of lubricants for various purposes.
8. Properties of gases.
9. Electricity and its various effects - Electric current positive and negative terminals. Use of switches and fuses. Units of current, resistance and voltages, Ohm's Law, Conductors and Insulators. Units of power watt and Kilo-watt relationship with horse power, board of trade unit. Electrical circuits - caused of open or short circuits. Measuring instruments - volt meter - ammeter, ohmmeter, megger and wattmeter. Types of circuits, batteries, magnets and electro-magnets - working of DC and AC motors.
10. Hydraulic elementary principles, incompressibility of liquids, properties of liquids, Pascal's Law.

III. ENGINEERING DRAWING (2 HOURS PER WEEK OR 100 HOURS POWER YEAR(APPROX.))

1. Revision of the previous two years work.
2. Free hand sketching and production of working drawings of actual machine parts or engine parts such as pistons, connecting rods, crank shafts, diesel injectors, engineer's vice drill posts, ratchet braces etc.
3. Freehand sketching of detailed component from assemblies.
4. Freehand sketching of simple electrical circuits and reading of automotive electrical circuits (IS: 732-1962)
5. Advance blue print reading.
6. Code of practice for general engineering drawing according ISI (IS-696-1960)

IV. SOCIAL STUDIES (1 HOUR PER WEEK OR 50 HOURS PER YEAR APPROX.)

The syllabus has already been approved and is same for all the trades.