

**MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI - 51**

1	Name of Course	Certificate Course in Automobiles Engineering (306204)																																																													
2	Max. Nos. of Student	25 Students																																																													
3	Duration	1 Year																																																													
4	Type	Full Time																																																													
5	Nos. of Days / Week	6 Days																																																													
6	Nos. of Hours /Days	7 Hrs																																																													
7	Space Required	Theory Class Room – 200 sqft    Practical – 1500 sqft Total - 1700 sqft																																																													
8	Entry Qualification	S.S.C. Passed																																																													
9	Objective Of Syllabus/ introduction	Awareness of Safety precautions Knowledge of Fitting & Measurement, use of tools in assembly. Knowledge of Engineering Tools Knowledge of Sheet metal & Welding. Awareness of Basic Electrical & Electronics and computer Skill Awareness of Basic Microprocessor & Computer Operation. Awareness of Basic Petrol & Diesel Engines. Awareness of Basic of Transmission, Suspension, Steering System & Brakes.																																																													
10	Employment Opportunity	The trainee will either to be able to take up jobs with agencies which maintain and repair Automobiles or with working experience will be in a position to start his own independent Business.																																																													
11	Teacher’s Qualification	Diploma in Mechanical /Automobile Engg. With 3 year Teaching experience in Electronics Field.																																																													
12	Training System	<table><tr><th colspan="7">Training System Per Week</th></tr><tr><td colspan="2">Theory</td><td colspan="2">Practical</td><td colspan="3">Total</td></tr><tr><td colspan="2">12 Hours</td><td colspan="2">30 Hours</td><td colspan="3">42 Hours</td></tr></table>						Training System Per Week							Theory		Practical		Total			12 Hours		30 Hours		42 Hours																																					
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# SYLLABUS

## Theory - I

### Basic Electricity and Electronics, Microprocessor & Computer Skill

#### Part - I

#### Basic Electricity and Electronics

Theory	Practical
Safety precautions and first aid. Care and maintenance of tools. Signs and symbols used in Electrical Technology. Voltage, Current and Resistance and its units. Effects of resistance on the length and cross sectional area of a conductor, conductors and insulators.	Familiarization with shop layout, hand tools and machines, safety precautions and first aid. Insulation stripping and cutting of wire. Making joints on simple strapped conductors, sieving or taping with insulation tape, Measurement of conductor using wire gauge.
Cumulative resistance of parallel and series connected circuits, Exercises on series and parallel circuits. The parts of a simple electrical circuit Ohm's law - Exercises on Ohm's law. Method of using Ohmmeter. The use and method of connecting a D.C. moving coil voltmeter and ammeter. Use of voltmeter to detect loose connections. Type of solder and flux required for soldering aluminum and copper conductor. Introduction to equipment used for soldering.	Soldering practice on wire joints, Soldering and crimping of lugs with wire ends Measurement of resistance of wire would resistors using ohmmeter. Connect two or three resistors in parallel and in series and measure total circuit resistance, Build a simple electrical circuit using a battery and resistors, Connect voltmeter to measure battery voltage and voltage drop across resistors, Connect ammeter to measure current, reconcile Ohm's law.
Description of an automobile electrical circuit Earth return wiring, Polarity of earth connection, Description of switch, fuse, rating of use and their location on the circuit. Description of various automobile electrical equipment and their function in brief, Description of starter motor, Description of changing circuit -details of connections and cables sizes.	Build a simple earth return lamp circuit using battery, lamp, switch, a fuse, connecting wires and frames for return current, Practice of connecting voltmeter and ammeter. Checking blowing of fuse with wires short-circuited. Identify various electrical equipments on the mock up wiring board i.e. starter motor, dynamo control box etc., Follow up starting system wiring, Identify marking on terminal joints, Remove and repeat connections, Similar practice on charging system wiring.
Lead acid battery connections, Working principles, Terminal polarity, voltage and ampere-hour capacity of battery, Care and maintenance of batteries, Method of checking of batteries and recharging on a bench charger	Practice in removing and fitting the batteries, Cleaning and maintenance of batteries, Testing the batteries with Hydrometer and cell tester, Topping of battery with distilled water, Connect batteries for charging

<p>Triac, Diac, etc. Simple electronics circuits such as oscillators, amplifiers, rectifier circuits, power supplies, etc.</p> <p>Use of simple instruments for electronic measurements such as multimeters-Digital and Analog, Application of electronics in modern automobiles such as Automatic voltage regulators, Electronic charging circuits.</p>	<p>Demonstration and use of simple devices such as transistors, Thyristors, Triac, Diac, etc.</p> <p>Assembling and study of rectifier circuits and power supplies, use of measuring instruments, study of electronic system in modern automobiles</p> <p>Basic electronics devices such as transistors, Integrated circuit, Thyristors,</p>
<p>Principles of Digital electronics. Number systems and Truth table concept and application, logic gates and their applications, Simple digital circuits.</p>	<p>Demonstration of digital kits, Development of simple digital circuits using logic gates, Study of input and output relationships in logic circuits.</p>

## Part - II

### Microprocessor & Computer Skill

Theory	Practical
<p>Study of basics of micro processor</p> <p>Application of micro processor in automobile system. Approach to trouble shooting in micro processor controlled systems.</p>	<p>Demonstration on micro processor kits and familiarization with different related devices</p> <p>Demonstration and familiarization with automobile micro processor system</p>
<p>Introduction to computer fundamentals and its parts, familiarizing with Disk Drives, Booting of a computer system, using the mouse, right click, left click and use of operating systems like windows XP, Linux, menu system, tool bars, file structures, directories, moving and copying a file from floppy to hard disk, Hard disk to floppy disk, creating directories. Formatting floppy disk.</p>	<p>Booting the computer, opening windows menus, using the mouse, refresh computer desktop using right click of the mouse, create a directory in xp and linux, format a floppy, create a file using notepad, save the file in floppy, copy the file into hard disk, copy a file from hard disk to floppy, create a directory in floppy, create a directory in hard disk, use my documents, use start menu for opening an application, to open a document recently written, change control panel settings for display, change the volume name of the hard disks using system properties., familiarise with keyboard and keys.</p>
<p>Use of desktop, control panel settings, Explorer, regional settings, creating shortcuts, use of simple applications like Paint, Notepad.</p>	<p>Techniques of changing desktop wall paper, changing desktop screen properties, control panel, user accounts, customizing icons, writing a simple text using Notepad. Using paint for drawing figures to get accustomed with mouse. Saving a file. Using Windows Explorer, Install</p>

	a software, Remove a Software, Add new hardware to the system ( like a Printer, Change the system date and Time, changing the regional settings of the system like country, currency, date format, using start menu, creating Desktop short cuts
Study of Internet Explorer, Modem, Settings in the IE and Modem, Dial up and Broadband connections, Outlook Express, Viewing E mail from the web site and Outlook Express, Creating e mail Accounts, using search engines, Video conferencing, MS Chat.	Open internet explorer, change the settings in IE , customize Internet Explorer for default applications, enable cookies, change the security settings, setup an internet connection, user ID and password saving in the computer for future usage, set up outlook express for an e-mail account, set up server authentication settings, receive and send e-mails from the account. Search using Yahoo and Google for certain topics, download a file from the internet, save the downloaded file. Set up the net meeting using MSN or Yahoo Messenger.
Creating sample documents using MS WORD. Text wrapping, Text formatting, changing letters to different case, drawing table, mail merging, page formatting, using different font types, printing a document Using Excel as spread sheet, familiarizing with cells, formulae, text numbers and date, using shortcuts for entering date and numbers in progressive cells, copying formulae, text and numbers, using borders, merging cells, unmerging, changing cell width, row height, printing an area of the sheet, options of printing like fit to paper, shrinking, etc, using different sheets in a work book, changing colour of cells, fonts, text.	Open MS WORD, create a new file, save a file, open an existing file, save as a text file, type a paragraph, set for left and right margins, change the letters from upper to low case, vice versa, cut a paragraph, copy a paragraph, set up tab positions, set hanging indents, draw a simple table, insert rows, insert columns, erase rows, erase columns, search the document for spelling corrections, print the letter in a printer attached, in portrait and landscape. Open Excel, and work out the following to understand the theory commands: Prepare a salary bill for ABC organisation with Column A for names, Column B for Basic Salary, Column C for DA, Column D for addition of B & C to get the full
Internet and e-mail Computer networking and types of networks	Opening a web page, search command and downloading, creating and using e-mail

## List of Tools

Sl. No.	Item	Quantity
1.	Plier insulated 150mm	10 Nos.
2.	Nose Plier insulated 150mm	10 Nos.
3.	Screw drives 100mm insulated handle and thin steel	10 Nos.
4.	Screw drivers 150mm	10 Nos.
5.	Knife double Blade Electrician	10 Nos.
6.	Wire insulation Stripper for shinning conductors from 0.4mm to 4mm	10 Nos.
7.	Electrician testing Pencil (Line / Neon tester)	10 Nos.
8.	Scriber 150mm x 4mm	10 Nos.
9.	Rule Steel 300mm	10 Nos.
10.	Punch Centre 150mm x 9mm	10 Nos.
11.	Heavy duty screw driver 200mm	10 Nos.
12.	Hammer Ball Peen 0.50Kg with handle	10 Nos.
13.	Hammer Cross Peen 100gms. With handle	10 Nos.
14.	Pliers Side Cutting insulated 150mm	10 Nos.
15.	Pincers 150mm	10 Nos.
16.	Electrician Screw Driver 250mm	10 Nos.

Sl. No.	Item	Quantity
1.	PENTIUM V COMPUTER or latest WITH 512 MB RAM WITH FOLLOWING ACCESSORIES DVD COMBO DRIVE WITH THE LATEST X VERSION, HARD DISK WITH 80 GB OR ABOVE, 17" MONITOR, AGP GRAPHICS CARD WITH 64 MB	9 Nos.
2.	CENTRALIZED UPS WITH 5KVA CAPACITY	1 No.
3.	LASER PRINTER	1 No.
4.	DOT MATRIX PRINTER	1 No.
5.	Inkjet Printer ( colour)	1 No.
6.	WINDOWS XP OPERATING SYSTEM	09 Nos.
7.	MS- OFFICE 2000	09Nos.
8.	Scanner	1 No.
9.	Internet connection	As required
10.	External Modem	1 No.

Sl. No.	Furniture-Computer Lab	Quantity
1.	Suitable Computer Tables	As required
2.	Computer Chairs	10Nos.
3.	Tool Cabinet	2 Nos.
4.	Trainees locker	2 Nos.
5.	Book shelf (glass panel)	1 No.
6.	Shoe Rack	As required
7.	Vacuum cleaner	1 No.

## Theory & Practical - II

### Basic Fitting, Measurements Sheet Metal & Welding

Theory	Practical
<p>Safety precautions to be observed in the Workshop.</p> <p>Importance of sheet metal work &amp; welding in Industry</p> <p>Safety in Gas welding &amp; manual metal Arc welding</p> <p>Metals and their characteristics Sheet metal - Classification and uses Measuring &amp; Marking Tools - Try square, dividers, trammels, marking block, Scriber, Steel rules, Calipers, SWG etc. Types of Snips, shears and their uses Sheet metal work Tools - Mallet, Nylon Hammers, etc. Bench vice C clamps, Pliers, Bench stokes or sheet formers, Types and uses.</p>	<p>Use of protective safety devices on shop floor</p> <p>Identification of Tools &amp; Equipments</p> <p>Practice in Scribing of straight line, Bisection of straight lines with marking tools.</p> <p>Practice in cutting sheet metal to different shapes using various types of snips</p> <p>Folding/Bending sheet metal to 90° using wooden mallet Practice On hard soldering method (Lead &amp; Tin)</p>
<p>Cutting methods - straight cutting - circle cutting - Louver cutting, Nibbling, Slot cutting, Notching,</p> <p>Sheet Metal Works - Folding, Bending &amp; Flanging</p> <p>Solder - Different types of Solder and their uses (Soft &amp; hard solids Heating appliances</p> <p>Description and uses of guillotine shears and circle cutting machines.</p> <p>Description and use of hand punching machine</p> <p>Description of Drilling machines, Drill bits, etc..</p>	<p>Making holes in sheet metal using punching machine</p> <p>Making hole in sheet metal with a twist drill</p> <p>Riveting practice using various types of rivet heads</p> <p>Making a dust pan. Corner and handle riveted</p>
<p>Methods of laying out pattern Parallel line method Radius line method Triangular line method Fastening of sheet metal, various types of fastening devices Introducing to tube and pipe Bending of pipes</p> <p>Laying out pattern of cylinder cut obliquely</p> <p>Description of roll forming machine types and operators principle</p>	<p>Practice on removing dents of spherical and hemi - spherical articles.</p> <p>Practice on cutting cylinder obliquely. To make 90° L piece of equal diameter and join them at right angle. Practice on pipe bending by hand Making 60° off set "T" piece (round)</p>
<p>Safety in welding work</p> <p>Types of welding processes and application</p> <p>Nomenclature of welding joints &amp; Edge preparation</p> <p>Terms applied to welding</p> <p>Welding symbols - Description and uses</p> <p>Distortion and its control</p>	<p>Setting up of gas welding plant Opening and closing procedure of gas welding plant.</p> <p>Lighting and adjustment of flame Setting up of beading practices Setting of Arc welding plant Striking an Arc Beading practices</p>

<p>Different process of metal joints - Bolting - Riveting - Soldering - Brazing, &amp; Welding Simple Electrical terms - uses of Electricity and applied to welding</p>	
<p>Gas welding hand tools - uses Oxy-acetylene welding - Principles and applications. Common gases used for welding Types of Oxy-acetylene flames -their uses Flame Temperature - chemistry and structure of oxy-acetylene flame Oxygen cylinder, DA Cylinder description Regulator - Types - Construction Care &amp; maintenance of blow pipes and cutting torches. Filler rods used in Gas welding Welding flux Faults in gas welding - Causes -Corrections</p>	<p>Brazing, soldering &amp; silver soldering by oxy- Ace. Process. Fusion run with / without filler rods Square butt joint on M S plate Oxy acetylene, hand cutting on M S plate Pipe Butt joint on M S pipe Production jobs as per drawing such as Furniture items, Windows, Grills.</p>
<p>Principles of Arc welding, tools &amp; accessories Types of welding machine AC/DC and applications Care &amp; maintenance of welding machine</p>	<p>Straight bend on M S plate Horizontal bead on M S plate Fillet Tee joint on M S plate, open corner joint on MS plate Square butt joint on M S</p>
<p>Welding position - Flat, Horizontal, Vertical and O.H. Electrodes - Types, Functions of flux loading Criteria for choice of electrodes Welding defects, Causes and remedy.</p>	<p>Single V Butt joint</p>
<p>Manufacturing processes in brief- Outline of various subject to be covered -Disciplinary rules of the Institute, Training and other facilities available. Introduction to Lathe, description, Lathe types - construction - parts and functions Specification of a centre lathe, lathe operations</p>	<p>Manufacturing process and their importance in Industries Introduction to an Engine Lathe, identification of different parts of engine lathe, holding the job in 3 jaw chuck, Perform facing and plain turning operation to an accuracy of <math>\pm 0.1</math> mm Use of Measuring instruments required for turning</p>
<p>Work holding devices - Mounting and dismounting procedure and their safety. Lathe tools, their angles for roughing and finishing operation Classification of steels, alloy steels and effect of alloying elements.</p>	<p>Hold round job on independent chuck and perform the following operations. Facing Plain turning Step turning Taper turning</p>

<p>Taper - types and uses Calculation on taper</p> <p>Different methods of producing a taper on a lathe, their merits and demerits Types of threads, forms of thread and its depth calculation.</p>	<p>Turn an angular surface – By compound slide method.</p> <p>Set a grooving tool &amp; perform an undercutting operation for threading</p> <p>Perform Chamfering operation</p> <p>Set a threading tool to cut 'V' thread and cut 'V' thread</p>
<p>Calculation of spindle speeds, feeds &amp; depth of cut for different lathe operations. Method of producing a thread on a lathe. Cutting tool materials Types of coolants and their applications Heat treatment process - uses and types</p>	<p>Perform knurling operation</p> <p>Perform center drilling and drilling</p> <p>Perform boring operation.</p> <p>Cut "V" thread on through bore.</p> <p>Perform parting off operation</p> <p>Demo on parallel turning between centers</p>
<p>Grinding - Principle, types of grinding machine and their uses. Safety in grinding operation and principles of 5S.</p> <p>Surface grinding machine parts - function and operations.</p> <p>Method of grinding, taper surface by surface grinding</p> <p>Annealing of work material (Steel, CI &amp; Aluminum )</p>	<p>Safety precautions followed in grinding</p> <p>Re-sharpen of plain turning tool on pedestal grinding to an accuracy of one degree.</p> <p>Check the tool angle using bevel protractor.</p> <p>Familiarize with controls of surface grinding machine</p>
<p>Grinding wheels - specification and classification</p> <p>Types of grinding wheels</p> <p>Selection Criteria of grinding wheels, wheel balancing, wheel truing</p> <p>Work holding devices such as magnetic vice, chucks etc.</p> <p>Demagnetisation of jobs</p> <p>Normalizing of Forging, Casting &amp; Machined jobs.</p>	<p>Use of work holding devices on grinding machine</p> <p>Grind parallel surface and stepped surfaces to a dimensional accuracy of <math>\pm 0.05</math> mm on surface grinder Demonstration of taper grinding</p>
<p>Cylindrical grinding machine parts - function and operation</p> <p>Methods of producing external and internal cylindrical surfaces of plain taper and stepped surfaces</p> <p>Basic idea of hardness testing, Hardness testing m/c different types.</p> <p>Hardening &amp; Tempering of chisels ( water hardening ) cutting tools</p> <p>( oil hardening ) &amp; H S S ( Air Hardening)</p>	<p>Grind cylindrical external, step surfaces on a cylindrical grinder to a dimensional accuracy of <math>\pm 0.05</math> mm</p> <p>Balancing and truing of grinding wheel</p>
<p>Grinding defects, causes and remedy Work holding devices for internal grinding Balancing, truing and dressing of grinding wheel</p> <p>Importance of case hardening &amp; stress relieving</p>	<p>Grind cylindrical internal surfaces on a cylindrical grinder to an accuracy of <math>\pm 0.05</math> mm</p> <p>Mounting and dressing of grinding wheel</p>



## List of Tools

1	Steel Rule 300 mm
2	Wing Divider 200 mm
3	Centre Punch 100 mm
4	Spring Dividers 150 mm
5	Ordinary Wooden Mallet 50 mm
6	Cross Peen Hammer 0.25 Kg with handle
7	Protractor with blade 150 mm
8	Steel Tape 2 meters
9	Ballpane Hammer 0.5 Kg with handle
10	Scriber 150mm x 3 mm (Engineers)
11	Steel Square 450mm x 600 mm
12	Sheet Metal Gauge
13	Stake Round and Bottom
14	Half Moon Stake
15	Funnel Stake
16	Anvil Face Stake
17	Bick Iron stake
18	Tinmans Horse
19	Hammer Peaning with handle
20	Hammer Creasing with handle
21	Hammer Planishing with handle
22	Hammer Block with handle
23	Sher Tinmans 300 mm
24	Snips straight 250 mm
25	Right cut snips 250 mm
26	Left cut Snips 250 mm
27	Hand Shear Universal 250 mm
28	Punch Round 3 mm , 4mm & 6mm Dia
29	Punch Round 4 mm Dia
30	Punch Round 6 mm Dia
31	Rivet sets snap and Dolly combined 3 mm ,4 mm, 6mm
32	Chisel cold flat 25 mm x 250 mm
33	Punch Letter 4mm and Punch Number 4 mm
34	File flat 250 mm second cut and smooth
35	File flat 250 mm smooth
36	File flat 300 mm bastard
37	File half round 300mm smooth
38	Hacksaw frame 300 mm adjustable ( tubular)
39	Hand Groover 3 mm, 4mm, 5mm
40	Plier Combination 150 mm
41	Grip Wrench 200mm
42	Ladle 150 mm Dia
43	Blow Lamp 1 litre

44	H.S.S. Twist Drill 3 mm, 4mm & 6 mm (Parallel Shank)
45	Hand Drill 0 to 6 mm, 8mm, 10mm & 12mm
46	Soldering Copper Hatchet type 500 gms
47	Pneumatic rivet gun
48	Trammel Point ( with beam 600 mm)
49	Vernier caliper ( 0mm - 150mm)
50	Micrometer outside (0 to 25mm)
51	Raspcut file 250 mm
52	D.E.Spanner G.P ( 6 mm to 32 mm) ( Set of 12 spanner)
53	Bessing Mallet
54	Endfaked Mallet
55	Soft Hammer ( Brass, Copper, Lead, Rubber and Rawhide heads with handle)
56	Steel Rule 600mm
57	Oil Can Pressure feed 500 ml
58	Raising Hammer with handle
59	Rawl Punch holder and bits ( No.8,10, 12,14)
60	Hollowing Hammber with handle
61	Tripaning tool 70mm
62	Safety Glasses
63	Handvice 50mm
64	Steel wire Brush 50mm x 150mm
65	Gloves for Welding (Leather and Asbestos)
66	Leather Apron
67	Tongs, Close mouth and pick up ( 1 each)
68	Portable Electric drill ( Single phase)
69	Crow bar 910 x 25mm
70	Trowel Medium

**Theory & Practical - III**  
**Basic Petrol, Diesel Engines, Transmission, Suspension,**  
**Steering System & Brakes**

**Part - I**

**Basics of Petrol & Diesel Engines**

<b>Theory</b>	<b>Practical</b>
Introduction to the trade and general precautions to be observed in the trade in storing and handling fuels, brake fluids, lubricants, acids, refrigerants, dust and asbestos. Description of safety equipment, its purpose and use. Elementary First Aid. Types of materials used in packing and gaskets, Fastening devices General description, working principle, classification and characteristics of Petrol & Diesel engines. Working principle of two stroke petrol engine. Difference between petrol and diesel engines. Difference between two stroke and four-stroke engines.	Familiarization with the hand tools, machinery and type of work done in the trade. Safety precautions in the use of hand tools and equipment on shop floor. Safety equipment and its use. Use of jacks, hoist and horses in the shop. Selection of materials for gaskets, packing and locking devices and their uses in the trade. Familiarization with working of four stroke petrol and Diesel engines. Identification of differences between Petrol & diesel Engine. Identification of difference between two stroke and four stroke engine.
Precautions in starting, running and stopping a petrol & diesel engine. Brief description of engine auxiliaries and function of various gauges used with the engine., concept of torque, clamping force, torque wrench-use and care method of torquing, and detorquing.	Identifying various petrol & Diesel engines auxiliaries. Practice on starting and stopping of the engine. Adjusting speeds in idling and running conditions. Running the engine and checking temperature, fuel, oil pressure and speed. Testing engine compression and vacuum with gauges. Torquing & detorquing of cylinder head bolts.
Engine details - types, functions, materials and maintenance of, cylinder heads, cylinder, cylinder liners, Piston, piston rings, crank shaft, cam shaft, vibration damper and fly wheel.	Dismantle 2-stroke petrol engine. Examine its parts their materials and other working details. Measurement of cylinder bore. Assemble and start the engine.
Valve and valve operating system, valve timing diagram, camshaft and timing gears, Importance of correct tappet clearance and timing.	Dismantle 4-stroke petrol engine. Examine inner details of moving parts, their materials and other working details. Assemble and start the engine.
Ignition system of petrol engines, purpose of induction coil, flywheel magneto, distributor and spark plug. Working principle of carburetor and its adjustments. Importance of correct air fuel mixture on the engine performance. Introduction to Multi Point Fuel Injection (MPFI) System	Familiarization with ignition system of Petrol engine. Clean spark plugs, adjust gaps and refit. Servicing air cleaner. Carry out minor adjustments on carburetor.

General description, working principle and constructional details of Diesel engines. Precautions while starting, running and stopping diesel engine. Precautions while dismantling diesel engine and engine assembly procedure.	Practice on starting and stopping of diesel engine. Running engine on stand and checking speed, temperature, and oil pressure. Compression testing of cylinders. Dismantle 4-stroke diesel engine. Examine inner details of moving parts, their materials and other working details. Measure cylinder wears and piston clearance. Decarbonise the cylinder head. Assemble and start the engine
Functions and types of Fuel feed systems in diesel engines. Various components of fuel feed system and their functions. Common troubles in fuel feed systems and remedies, Types, purpose and application of fuel injection pump. Details of In - line fuel Injection pump and Injectors.	Identifying main parts of fuel injection and mounting of fuel Injection pump to the engine. Injector overhauling & testing. Replacing fuel filter elements and air cleaners.
Engine cooling systems. Functions and types of lubrication systems. Various components of lubrication system and their functions. Types of lubricants and their properties. Common troubles in lubrication systems and remedies.	Flushing of cooling system in engine. Dismantling and assembling oil pump, servicing oil filters, changing oil in engine.

## Part - II

### Transmission, Suspension, Steering System & Brakes

Theory	Practical
Description of single plate and multi-plate clutches functions of different parts of the clutch assembly. Material for linings.	Safety precautions in handling asbestos. Dismantling a clutch assembly from the engine, clean and inspect parts for wear and damage. Changing pressure plate and flywheel. Testing the of clutch springs for uniform tension, assembling of pressure plate and spring, adjusting the fingers and aligning clutch with flywheel.
Purpose of the gearbox, different types of power flow layouts (Front wheel drive, Rear wheel drive etc), gear ratios and function of a sliding mesh gearbox and its draw backs. Lubrication system in a gearbox. Description and advantage of (1) constant mesh gearbox, (2) synchromesh gearbox. Function of the gear shifter rod. Type of lubricating oil used in gearboxes.	Cleaning, assembling gearshift mechanism, changing oil in the gearbox. Studying different types of oil seals and bearings used in the gearboxes.
Working of propeller shaft, 'U' joints and a rear axle. Description and function of final drive (differential). Tooth contact and backlash adjustment in rear axle assembly.	Studying the gear ratios in the gearbox. Removing, cleaning and refitting 'U' joints, propeller shaft drive. Dismantling of an old final rear axle assembly, clean and inspect parts, cut packing and gaskets. Remove

	crown wheel, pinion and bearings, clean parts. Check tooth contact in the crown and pinion and adjust backlash. Assemble rear axle assembly and study its functioning.
General description of conventional suspension system, Leaf spring & shock absorber, Wheels, tyres and tube sizes, applications, care & maintenance	Removing and refitting a leaf spring as an assembly in a vehicle, changing rubber bushes of shock absorbers and independent front suspension. Lubrication of suspension units.
Types and functions of steering gear boxes. Layout of steering assembly and linkages, function of each part. Lubrication of linkages and steering gear box.	Removing and refitting steering boxes from vehicle, checking and topping up oil in steering box. Checking and adjusting steering wheel play and backlash.
Steering geometry: Ackerman steering, castor, camber, king pin inclination, toe, toe-out on turns, description and purpose, common steering troubles and remedy.	Checking and correcting the steering geometry with instruments,
Introduction to Pneumatics, Pneumatic Symbols, block diagrams, Compressed Air Theory, Production, Purification and Distribution Construction and applications of directional control valve, pressure control valve and flow control valve with accessories	Identification of Pneumatic valves, Components, parts of Air compressor and to draw the symbols. Construction of circuits using single acting cylinder, Double acting cylinder and direction control valve. Construction of circuits for pneumatic power press, pneumatic hammer using double acting cylinder, directional control valve and flow control valve.
Direction control valves - types, construction and functions Pressure Control valves - types, construction and functions Flow control valves- types, construction and functions Construction of circuits using single acting cylinders, double acting cylinders with direction control valves and flow control valve on the trainer kit	Dismantling and assembling of 4 / 3 way directional control valve Dismantling and assembling of flow control valve Dismantling and assembling of Single acting, Double acting and double acting double rod cylinders Dismantling and Assembling of Pressure Control valve Tracing and drawing the hydraulic circuits for the following machines Hydraulic Power hack saw machine
Types of braking systems. Layout of Mechanical & hydraulic brake systems. Description and advantages of vacuum assisted hydraulic brakes. Master Cylinders - types including the tandem master cylinder, special features ,Construction , functions , common troubles and remedy. Drum brakes and disc brakes	Checking and adjusting hand brakes and pedal play in foot brakes. Dismantling wheel brake assembly- removing old lining and fitting new lining on the brake shoe.
Brake linings - types and materials. Relining the brake shoes - precautions to be observed.	Removing & cleaning of brake drums. Fittings new cups and brake hose pipes - reassembling. Adjusting all four wheel brakes and testing for brake concern.

## List of Tools

01	Hammer ball peen 0.75 kg.	10 Nos.
02	Steel rule 15 cm, English and metric	10 Nos.
03	Screw driver 20 cm X 9 mm, Blade (Plastic handle)	10 Nos.
04	Screw driver 30 cm X 9 mm, Blade	10 Nos.
05	Spanner D.E. set of 6 mm. To 32 mm. Set of 12	10 Nos.
06	Pliers combination 15 cm.	10 Nos.
07	Hand file 20 cm. Second cut	10 Nos.
08	Centre punch 10 mm x 100 mm	10 Nos.
09	Chisel cold flat 20 cm	10 Nos.
10	Ring spanner set of 12 (6 to 32 mm)	10 Nos.
11	Feeler gauge 20 blade	10 Nos.
12	Steel tool box with lock and keys	10 Nos.
13	Allen Key set of 12 pieces (2 mm to 14 mm)	04 Sets
14	Philips Screw Driver Type set of 5 pieces 100 mm to 300 mm	04 Sets

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