



**SUMMER– 19 EXAMINATION**  
**Model Answer**

**Subject Name: VMGP**

**Subject Code: 17618**

**Important Instructions to examiners:**

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No	Sub Q.N.	Answer	Marking Scheme																												
1	a)	<b>Attempt any THREE of the following:</b>	<b>12</b>																												
	(i)	<b>List any four equipments used for denting and painting along with their purpose.</b>	<b>04</b>																												
		<p>Answer: (Any Four-1 mark each)</p> <table border="1"> <thead> <tr> <th>Tools used for Denting and Painting</th> <th>Purpose</th> </tr> </thead> <tbody> <tr> <td>1) Hammer/Mallet</td> <td>To repair the major damage</td> </tr> <tr> <td>2) Dolly block</td> <td>To shape the sheet metal surface profile</td> </tr> <tr> <td>3)Spoons</td> <td>To set high spot back</td> </tr> <tr> <td>4) Files</td> <td>To correct and smoothen surface.</td> </tr> <tr> <td>5) Soldering equipment</td> <td>To join metal / electric parts/ wires</td> </tr> <tr> <td>6) hand grinder</td> <td>To finish the surface</td> </tr> <tr> <td>7) Buffing and polishing machine</td> <td>To polish the surface</td> </tr> <tr> <td>8) drilling machine</td> <td>To drill hole</td> </tr> <tr> <td>9) press machine</td> <td>To bend the parts or to straighten parts.</td> </tr> <tr> <td>10) Spray gun</td> <td>To apply paint</td> </tr> <tr> <td>11) air compressor</td> <td>To clean parts by air</td> </tr> <tr> <td>12) infra red backing element</td> <td>To back the painted surface</td> </tr> <tr> <td>13) Brush</td> <td>To touch up by paint on small area.</td> </tr> </tbody> </table>	Tools used for Denting and Painting	Purpose	1) Hammer/Mallet	To repair the major damage	2) Dolly block	To shape the sheet metal surface profile	3)Spoons	To set high spot back	4) Files	To correct and smoothen surface.	5) Soldering equipment	To join metal / electric parts/ wires	6) hand grinder	To finish the surface	7) Buffing and polishing machine	To polish the surface	8) drilling machine	To drill hole	9) press machine	To bend the parts or to straighten parts.	10) Spray gun	To apply paint	11) air compressor	To clean parts by air	12) infra red backing element	To back the painted surface	13) Brush	To touch up by paint on small area.	<b>02</b>
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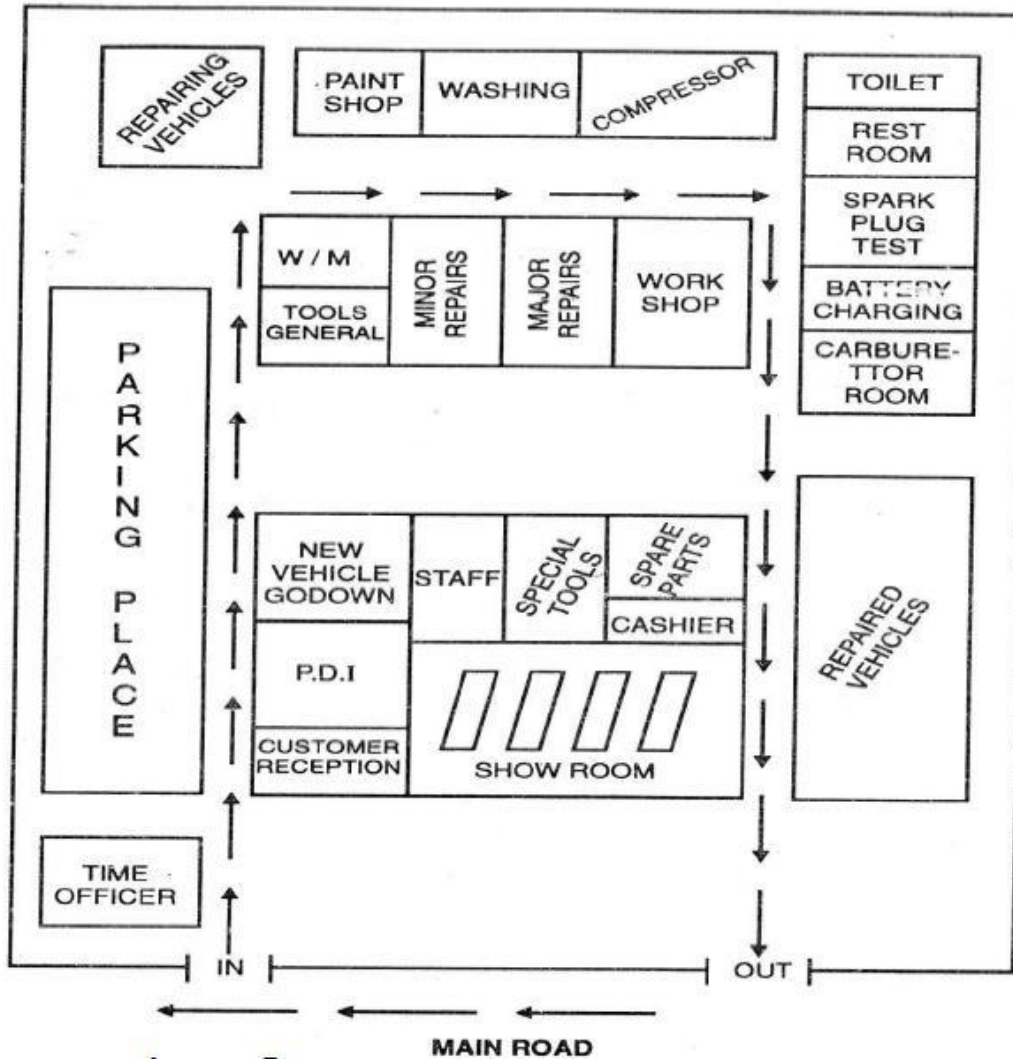
(ii)	<b>State safety precautions to be taken while using</b> <b>1. Torque wrench</b> <b>2. Arbor press</b> <b>3. Valve grinder</b> <b>4. Cylinder boring machine</b>	<b>04</b>
	<b>1. Torque wrench/Pneumatic tools:</b> (List down any two points mentioned below, each of ½ Marks) [1] Should wear and use necessary personnel protective devices. [2] Pneumatic tools shall not be connected to, or driven by, air pressure in excess of that for which the tools are designed. [3] The wearing of appropriate eye protection equipment is mandatory while using Pneumatic Tools. [4] Pneumatic tools should be laid down in such a manner that no harm can be done if the switch is accidentally tripped. No idle tools should be left in a standing position. [5] Pneumatic tools should be kept in good operating condition. [6] They should be thoroughly inspected at regular intervals with particular attention given to the ON-OFF control valve trigger guard (if installed), hose connections, guide clips on hammers, and the chucks of reamers and drills. [7] Either effective mufflers can be installed on the exhaust, or hearing protection should be worn to avoid or minimize the noise level from pneumatic tools. [8] Protect the hose from physical damage. When using quick disconnect type fittings, install the male end on the tool. <b>2. Arbor press</b> (List down any two points mentioned below, each of ½ Marks) [1]. Read and understand the warnings posted on the machine and in manual. Failure to comply with all of these warnings may cause serious injury. Replace the warning labels if they become obscured or removed. [2]. Do not use the arbor press for anything other than its intended use. [3]. Always wear approved safety glasses while using this arbor press. [4]. Check for damaged parts. Before further use of the arbor press, a part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function. Check for alignment of moving parts, binding of moving parts, breakage of parts, mounting and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced. [5]. Give your work undivided attention. Looking around, carrying on a conversation and “horse-play” are careless acts that can result in serious injury. [6]. Maintain a balanced stance at all times so that you do not fall into the arbor press. Do not overreach or use excessive force to perform any machine operation. [7]. Use only recommended accessories; improper accessories may be hazardous. [8]. Do not overload the arbor press by using extension (cheater) bars. [9]. Use steel collars to support parts when pressing on bearings to prevent damage to the bearings.  <b>3. Valve grinder</b> Safety Precautions while using Valve Grinder: (List down any two points mentioned below, each of ½ Marks)	<b>01</b>                      <b>01</b>                <b>01</b>



	<p>[1] Don't wear loose clothes. Make sure your clothes are right for the job. Dangling sleeves or ties can get caught in machine and cause serious injury.</p> <p>[2] Floors must be dry and operator doesn't work with wet hands while operations. Wipe excess oil and grease, or any liquid off your hands and tools; clean it, so that you can get a good grip on tools or parts.</p> <p>[3] Watch out for sparks flying from a grinding wheel because it can set your clothes on fire.</p> <p>[4] Machine should properly ground. Machine tools must have a separate ground lead or be double insulated to guard against shock.</p> <p>[5] Don't leave a running machine unattended. Whenever using a machine and have to leave it for a moment, turn it off.</p> <p>[6] Never try to adjust the tool rest while the grinder is running. Shut down the grinder and wait until the wheels stop moving.</p> <p>[7] Don't touch the rotating wheels, it can take skin and flesh off on contact.</p> <p>[8] Wear insulated rubber gloves, shoes with insulated soles, protective garments and safety goggle or face shield while working.</p> <p>[9] Do not wear sandals or open toe shoes.</p> <p>[10] Do not wear rings or bracelet or watches while working around running machine.</p> <p>[11] Observe and strictly follow the safety precautions displayed and instructed on electrical equipment.</p> <p><b>4. Cylinder boring machine:</b> (List down any two points mentioned below, each of ½ Marks)</p> <ol style="list-style-type: none"><li>1. Do not support the workplaces by hand. Use a holding device to prevent the workpiece from being tom from the operator's hand.</li><li>2. Never make any adjustments while the machine is operating.</li><li>3. Never clean away chips with your hand. Use a brush.</li><li>4. Keep all loose clothing away from turning tools.</li><li>5. Make sure that the cutting tools are running straight before starting the operation.</li><li>6. Never place tools or equipment on the tables.</li><li>7. Keep all guards in place while operating.</li><li>8. Avoid damaged tools or workplaces.</li><li>9. Remove all chuck keys and wrenches before operating.</li><li>10. Always wear eye protection while operating any drilling machines.</li></ol>	<b>01</b>
	<p><b>(iii) Write weekly maintenance schedule for light motor vehicle.</b></p>	<b>04</b>
	<p><b>Answer:</b> <b>Weekly Maintenance or at 500 km :</b></p> <ol style="list-style-type: none"><li>1. Check engine oil level and fill, if necessary.</li><li>2. Check electrolyte level in battery and fill, if necessary.</li><li>3. Drain oil from engine sump and replenish.</li><li>4. Clean gauge filters in petrol.</li><li>5. Check engine mounting nuts.</li><li>6. Check cylinder head nuts.</li><li>7. Tight inlet manifold and exhaust manifold nuts.</li></ol>	<b>04</b>
	<p><b>(iv) What is 'Engine Tune-up'? State its necessity.</b></p>	<b>04</b>
	<p><b>Answer: Engine tune-up:</b> Engine tuning is the adjustment, modification of the internal combustion engine or modification to its control unit to obtain optimum performance, to increase an engine's power output, economy, or durability.</p>	<b>02</b>



		<p style="text-align: center;">OR</p> <p>A tune-up usually refers to the routine servicing of the engine to meet the manufacturer's specifications. Tune-ups are needed periodically as according to the manufacturer's recommendations to ensure an automobile runs as expected.</p> <p><b>Necessity of engine tune-up:</b> If regular maintenance and inspection isn't performed on engine, vehicle may not be operating as reliably or efficiently as it should. A well-tuned engine operates at maximum performance levels. During a tune-up, engine parts that affect performance are checked, cleaned adjusted and replaced.</p> <p>e.g. Spark plugs create an electrical spark that ignites the gasoline/air mixture in engine. They create, and must be able to withstand, a tremendous amount of voltage and heat. If engine's spark plugs aren't working properly, the engine can stall and may not even start. Spark plug wires are also very important. They have to be able to transfer and withstand the voltage created by the spark plug. If they are old, they can burn out and cause a misfire.</p>	<b>02</b>
<b>1.</b>	<b>b)</b>	<b>Attempt any ONE of the following:</b>	<b>06</b>
	<b>(i)</b>	<b>A dealer of commercial vehicles, require to maintain 100 vehicles per month. Draw a layout of workshop required to carry maintenance and sell of these vehicles. Also state facilities and major equipments required.</b>	<b>06</b>
		<p><b>Answer:</b> <b>Facilities and List of Major Equipment's: (Any six points = 2 marks)</b></p> <ol style="list-style-type: none"><li>1. Battery charger.</li><li>2. Arbor press</li><li>3. Nitrogen filling Station.</li><li>4. Car Lifts</li><li>5. Engine analyzer</li><li>6. Electric Drill.</li><li>7. Vehicle washer.</li><li>8. Electric soldering iron.</li><li>9. Grease gun</li><li>10. Fuel injector tester</li><li>11. Computerized wheel aligner.</li><li>12. Computerized wheel balancer</li><li>13. Air Conditioner Charging Unit</li><li>14. Head light aligner,</li><li>15. Engine analyser,</li></ol>	<b>03</b>



03

(ii) State and describe general servicing procedure for major assemblies and components.

06

**Answer:**

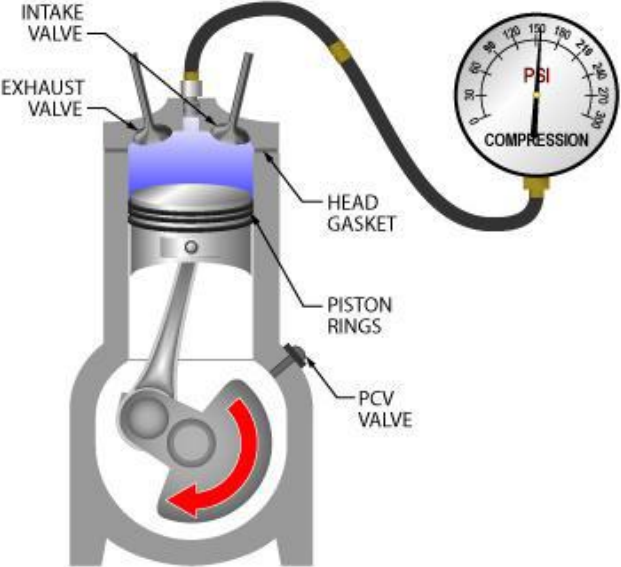
**General Servicing Procedure for major assemblies and components:**

- [1] Park the vehicle on the servicing ramp.
- [2] Place the stopper at the front and rear of the wheel.
- [3] Drain the Engine oil from engine oil sump and fill up new recommended oil.
- [4] Check oil level in gear box and differential. If level found less top up to correct level by Specified oil.
- [5] Clean air filter by blow of compressed air. If clogged replace with new one.
- [6] Check the water level, coolant level and Belt tension of the alternator.
- [7] Check battery electrolyte level. If necessary top up to correct level.
- [8] Perform engine tune up, if required.
- [9] Do the brake and clutch adjustments as required.
- [10] Check tyre condition and do tyre rotation if required
- [11] Perform Wheel alignment and wheel balancing if necessary.
- [12] Wash the vehicle thoroughly and by using grease gun lubricate the points where grease lubricant required.

06



<b>2.</b>		<b>Attempt any FOUR of the following:</b>	<b>16</b>																																				
	<b>a)</b>	<b>State the importance of :</b> <b>1. Work order :</b> <b>2. Activity file</b>	<b>04</b>																																				
		<b>Answer:</b> <b>1. Work order :</b> It contains details of vehicle owner as well as vehicle, job to be done on vehicle, list of spare parts and cost, and labour cost incurred.  <b>2. Activity file :</b> It is useful for Analysis of unnecessary jobs, Identification of warranty claims, Investigation of accident to determine insurance and Identification of cases, what type of repair, equipments used.	<b>02</b>  <b>02</b>																																				
	<b>b)</b>	<b>Compare preventive maintenance with breakdown maintenance.</b>	<b>04</b>																																				
		<b>Preventive Vs Breakdown Maintenance:</b> (Any Four Points, 1 Marks of each) <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th style="width: 5%;">S. N</th> <th style="width: 45%;">Preventive Maintenance</th> <th style="width: 50%;">Breakdown Maintenance</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>It is an extremely important method of maintenance for the reduction of maintenance cost and to keep the vehicle in good operating condition.</td> <td>It is the attention provided when a vehicle is stopped due to faults created during running.</td> </tr> <tr> <td style="text-align: center;">2</td> <td>It is so reliable that you can practice to your customer to reach safely in time.</td> <td>Frequent breakdown may lead to bad impression on business hence it is not reliable.</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Required man power, material, equipment and the availability of</td> <td>Time required for breakdown and repair is much more.</td> </tr> <tr> <td></td> <td>vehicle can be scheduled and down time is reduces.</td> <td></td> </tr> <tr> <td style="text-align: center;">4</td> <td>As it is done in workshop, quality of work is good.</td> <td>It must to be done on the spot or in road side garages hence quality of work is not so good.</td> </tr> <tr> <td style="text-align: center;">5</td> <td>All required spares and tools are available.</td> <td>There may be lack of tools and spares or duplicate parts may be fitted.</td> </tr> <tr> <td style="text-align: center;">6</td> <td>Life of vehicle increases.</td> <td>Life of vehicle decreases.</td> </tr> <tr> <td style="text-align: center;">6</td> <td>Proper maintenance reduces running cost.</td> <td>Increase in running cost.</td> </tr> <tr> <td style="text-align: center;">7</td> <td>It increases the safety of driver and passenger.</td> <td>Breakdown may cause accidents and it is not safe for driver and passenger.</td> </tr> <tr> <td style="text-align: center;">8</td> <td>Preventive Maintenance System includes; (i) Oil Changes (ii) Chassis lubrication (iii) Engine Tune up (iv) Inspection and testing of various other components. (v) Tyre Service</td> <td>Breakdown includes: (i) Starting difficulties (ii) Tyre puncture (iii) Electrical faults (iv) Carburettor &amp; Fuel supply faults (v) Curing overheating problems (vi) Breakage &amp; Accidents</td> </tr> <tr> <td style="text-align: center;">9</td> <td>Repair at proper time may avoid further breakdowns and losses due to breakdown.</td> <td>Failure of one part in running condition of vehicle may cause failure of other parts which will increase cost of repair.</td> </tr> </tbody> </table>	S. N	Preventive Maintenance	Breakdown Maintenance	1	It is an extremely important method of maintenance for the reduction of maintenance cost and to keep the vehicle in good operating condition.	It is the attention provided when a vehicle is stopped due to faults created during running.	2	It is so reliable that you can practice to your customer to reach safely in time.	Frequent breakdown may lead to bad impression on business hence it is not reliable.	3	Required man power, material, equipment and the availability of	Time required for breakdown and repair is much more.		vehicle can be scheduled and down time is reduces.		4	As it is done in workshop, quality of work is good.	It must to be done on the spot or in road side garages hence quality of work is not so good.	5	All required spares and tools are available.	There may be lack of tools and spares or duplicate parts may be fitted.	6	Life of vehicle increases.	Life of vehicle decreases.	6	Proper maintenance reduces running cost.	Increase in running cost.	7	It increases the safety of driver and passenger.	Breakdown may cause accidents and it is not safe for driver and passenger.	8	Preventive Maintenance System includes; (i) Oil Changes (ii) Chassis lubrication (iii) Engine Tune up (iv) Inspection and testing of various other components. (v) Tyre Service	Breakdown includes: (i) Starting difficulties (ii) Tyre puncture (iii) Electrical faults (iv) Carburettor & Fuel supply faults (v) Curing overheating problems (vi) Breakage & Accidents	9	Repair at proper time may avoid further breakdowns and losses due to breakdown.	Failure of one part in running condition of vehicle may cause failure of other parts which will increase cost of repair.	<b>04</b>
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	<p><b>c) What is mean by phasing and calibration of fuel injection pump?</b></p> <p><b>Answer: Phasing FIP:</b> The camshaft of the pump rotates at half the speed of the crankshaft. Therefore, the supply of oil from each plunger should be at 90<sup>0</sup> differences for a four cylinder engine. This means that the timing of fuel delivery and cut off between one cylinder and the other should be 90<sup>0</sup>. The adjustment of fuel pumps at correct timing intervals is known as the as the „phasing of the pump“.</p> <p><b>Calibration of FIP:</b> FIP is calibrated for efficient delivery, so that quantity of diesel fuel supplied by all the plungers in a given pump is more or less same at any rpm. Calibration of FIP is done on FIP test bench. If these measured quantities differ much, then the quantity of fuel is adjusted by loosening the clamping screw of the toothed quadrant and rotating the plunger by turning the control sleeve of pump.</p>	<p><b>04</b></p> <p><b>02</b></p> <p><b>02</b></p>
	<p><b>d) Write the procedure for compression testing of multi-cylinder petrol engine.</b></p> <p><b>Answer: Procedure of Engine compression test:</b> The compression test checks the sealing qualities of the rings, valves and combustion chambers.</p> <ol style="list-style-type: none"> <li>1. Operate the engine until it reaches normal operating temperature.</li> <li>2. Disable the ignition system by disconnecting the positive primary wire from the ignition coil and insulate the wire.</li> <li>3. Disable the fuel injection system by shutting off the fuel pump.</li> <li>4. Loosen the spark plugs and blow any dirt from the plug recesses with an air blow gun. Remove all plugs.</li> <li>5. Place a screw driver in the throttle linkage to hold the throttle open. This permits the maximum amount of air to be drawn into the engine.</li> <li>6. Install or thread the compression tester into one spark plug hole.</li> <li>7. Crank each cylinder through at least four compression strokes. Observe gauge pointer reading.</li> <li>8. Release the pressure from the compression tester, and follow the same procedure to obtain the compression reading on each cylinder. Record the reading obtained on each cylinder.</li> <li>9. Compare the readings to the manufacture’s specifications.</li> </ol> 	<p><b>04</b></p> <p><b>04</b></p>



	e)	<b>For the fault ‘Battery does not charge while engine is running’, give probable causes and suggest suitable remedies.</b>	<b>04</b>																					
		<p><b>‘Battery does not charge while engine is running’ :</b> <b>(Any four points, 1 marks each)</b></p> <table border="1"> <thead> <tr> <th>Sr. No.</th> <th>Causes</th> <th>Remedies</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Dead Battery</td> <td>1. Add water or 2. Replace battery</td> </tr> <tr> <td>2</td> <td>Loose battery terminals</td> <td>Tighten battery terminals</td> </tr> <tr> <td>3</td> <td>Fuse blown</td> <td>Change fuse</td> </tr> <tr> <td>4</td> <td>Loose alternator belt</td> <td>Replace belt</td> </tr> <tr> <td>5</td> <td>Cables burnt / cut / loose / damaged</td> <td>Check the alternator cables for abnormal wear, including cracking and fraying. Replace or tighten the cables as necessary.</td> </tr> <tr> <td>6</td> <td>Bad Alternator</td> <td>Repair or replace alternator.</td> </tr> </tbody> </table>	Sr. No.	Causes	Remedies	1	Dead Battery	1. Add water or 2. Replace battery	2	Loose battery terminals	Tighten battery terminals	3	Fuse blown	Change fuse	4	Loose alternator belt	Replace belt	5	Cables burnt / cut / loose / damaged	Check the alternator cables for abnormal wear, including cracking and fraying. Replace or tighten the cables as necessary.	6	Bad Alternator	Repair or replace alternator.	<b>04</b>
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	f)	<b>Describe how fan belt tension is checked and adjusted.</b>	<b>04</b>																					
		<p><b>Answer: Checking the belt tension:</b> 1. Note the line the belt makes. 2. Push the belt inwards with your finger. 3. It should only deflect 1/2" to 3/4" (9 - 10mm).</p> <p><b>To adjust cooling fan belt tension.</b> 1. Remove the pulley nut. 2. Observe that there are some notches in the front half of the pulley. 3. Take screwdriver and stick that in one of the notches so it can hold the pulley stationary while using wrench to loosen the pulley bolt. 4. By removal of bolt, see a metal bell-looking thing, and under that are some shims. 5. Remove the rear pulley half. 6. Then add or subtract shims as required to bring your belt tension into specification.</p>	<b>02</b> <b>02</b>																					
<b>3</b>		<b>Attempt any FOUR of the following;</b>	<b>16</b>																					
	a)	<b>What are the reasons due to which cylinder head is inspected?</b>	<b>04</b>																					
		<p>Following are the reasons due to which cylinder head is inspected 1.cracks, 2.corrosion, 3.distortion, and 4.fouling.</p> <p><b>1. CRACKS:</b> The symptoms of a cracked cylinder head are the same as those of a cracked liner. Cracks in cylinder heads are best located by either visual inspection or magnetic powder inspection. On some types of engines, a defective cylinder can be located by bringing the piston of each cylinder, in turn, to top dead center and applying compressed air. When air is applied to a damaged cylinder, a bubbling sound indicates leakage. When the cylinder head is removed from the engine, it can be checked for cracks by the hydrostatic test used on cylinder liners equipped with integral cooling passages. Cracks generally occur in cylinder heads on the narrow metal sections between such parts as valves and injectors. The cracks may be caused by adding</p>	<b>04</b>																					





cold water to a hot engine, by restricted cooling passages, by obstructions in the combustion space, or by improper tightening of studs. A cracked cylinder heads usually must be replaced. It is possible to repair them by welding, but this process requires special equipment and highly skilled personnel normally found only at repair activities.

## **2. CORROSION:**

Burning and corrosion of the mating surfaces of a cylinder head may be caused by a defective gasket. Although regular planned maintenance ordinarily prevents this type of trouble, burning and corrosion may still take place under certain conditions. When corrosion and burning occur, there may be a loss of power due to combustion gas leakage out of or water leakage into the combustion space.

Other symptoms of leakage may be (1) hissing or sizzling in the head where gases or water may be leaking between the cylinder head and the block, (2) bubbles in the cooling water expansion tank sight glass, or (3) overflow of the expansion tank. Gaskets and grommets that seal combustion spaces and water passages must be in good condition; otherwise the fluids will leak and cause corrosion or burning of the area contacted. Improper cooling water treatment may also accelerate the rate of corrosion. In general, cylinder heads that are burned or corroded by gas or water leakage are so damaged that they must be replaced.

## **3. DISTORTION**

Warping or distortion of cylinder heads becomes apparent when the mating surfaces of the head and block fail to match properly. If distortion is severe, the head will not fit over the studs. Distortion may be caused by improper welding of cracks or by improper tightening of the cylinder head studs. Occasionally, new heads may be warped because of improper casting or machining processes. Repair of distorted or damaged cylinder heads is often impracticable. They should be replaced as soon as possible and turned in to the nearest supply activity, which will determine the extent of damage and the method of repair.

## **4. FOULING**

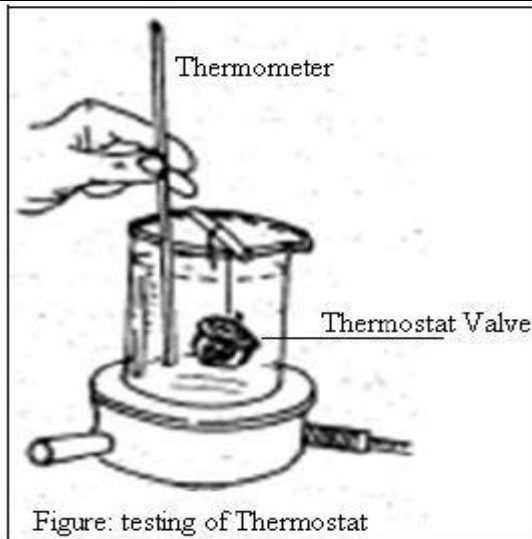
If the combustion chambers become fouled, the efficiency of combustion will decrease. Combustion chambers are designed to create the desired turbulence for mixing the fuel and air; any accumulation of carbon deposits in the space will impair both turbulence and combustion by altering the shape and decreasing the volume of the combustion chamber. Symptoms of fouling in the combustion chambers are smoky exhaust, loss of power, or high compression. Such symptoms may indicate the existence of extensive carbon formation or clogged passages. In some engines, these symptoms indicate that the shutoff valves for the auxiliary combustion chambers are stuck. Combustion chambers may also become fouled because of faulty injection equipment, improper assembly procedures, or excessive oil pumping. Cleaning of fouled combustion spaces generally involves removing the carbon accumulation. The best method is to soak the dirty parts in an approved solvent and then wipe off all traces of carbon. You may use a scraper to remove carbon, but be careful to avoid damaging the surfaces. If oil pumping is the cause of carbon formation, check the wear of the



		rings, bearings, pistons, and liners. Replace or recondition excessively worn parts. Carbon formation resulting from improperly assembled parts can be avoided by following procedures described in the manufacturer's technical manual.	
	<b>b)</b>	<b>What are the types of cylinder bore wear? How cylinder bore wear is checked?</b>	<b>04</b>
		Types of Cylinder Bore Wear: 1. Abrasion - wear due to foreign particles in the oil film. 2. Erosion - wear due to metal contact between the pistons or rings and the cylinder bore. 3. Corrosion - oxidization or chemical action of the cylinder wall by the products of combustion.  Checking of cylinder bore for wear: i) Inspect cylinder walls for scratches roughness or ridges which indicate excessive wear. If the cylinder bore is very rough or deeply scratched or ridged rebore the cylinder and use an oversize piston.  ii) Using a cylinder gauges measure the cylinder bore in thrust and axial direction at three positions i.e. at top, middle and bottom. If any of following conditions is noted rebore the cylinder. Cylinder measurements at two positions give taper limit. Difference between the thrust and axial measurements gives the out of round limit.	<b>02</b>  <b>02</b>
	<b>c)</b>	<b>Describe how servicing of CRDI injector is performed.</b>	<b>04</b>
		<b>Answer: Servicing of CRDI injector:</b> Engine Common Rail Injectors sometimes need to be cleaned, repaired or replaced. <b>1. Common Rail Injector Removing:</b> Under the hood, a plastic dust heat shield rests on the four bolts. Unscrew them and remove the cover. Open the box and fuse under the hood and pull out the fuel pump relay. This is to ensure that diesel fuel is not flooded the engine. Disconnect the electrical connector's nozzles. Pull out the locking brackets that are fixed reverse connection hose. Use a screwdriver to disconnect the injector return hose and remove it.  <b>2. Dismantling and inspection of CRDI injector:</b> Hold the injector's body with wrench. Twist off solenoid and check inside spring and ring. Check upper part of back-valve's mechanism. Twist off fuel pick-up fitting. Remove three-lobe metal detail - one is supported from the bottom with the spring and other detail is located on the small braking clamp. Twist off screw having external thread and internal hexagon. Take out the contents of the valve. Measure the diameter of this ball with the caliper. Check the bottom of the back valve and orifice output hole in the center. Hold and twist the mouth piece with the help of box-wrench. Take out the nozzle carefully and do not lose the small details, needle out of nozzle and other small details. Press out the multiplier and the package of control chamber.  <b>3. Cleaning and repairing CRDI injector:</b> Clean all injector components with carburetor cleaner, duster and solvent. Nozzle was blown with the help of cleaner's balloon. Rub the needle with the duster moistened with the carburetor cleaner and ideally the needle must be shined without any yellow colours. Clean ball by rolling it between two pieces of paper moistened in carburetor cleaner. Clean ball housing	<b>04</b>



	<p>and input orifice by blow out from the cleaner balloon. All other details have to be cleaned in order to remove deposits. After cleaning assemble all the parts of injector.</p> <p><b>4. Assembly of CRDI injector:</b> Put pivot and control chamber. It is necessary to put it's inside package but peculiarity is that the hole on the valve side must be opposite of input hole on the inside package of injector. Otherwise the fuel will not fill in chamber of back-valve and not to pour out when the valve opening. Under these conditions the injector will not start running. Put together the details of atomizer, insert needle, put up small details, twist mouse pieces but not tighten its. Put up valve accurately. It is necessary to bolt on fuel supply fitting and to tighten it. Assemble the mechanism with tri-lobe device, put on spring on it, mounts and fix with the available half-ring. Insert plate and the ring into solenoid and twist it, not forgotten to lay plate-laying. Connect the electrical connector's nozzles.</p>																							
	<b>d) Write the causes for "excessive engine oil consumption".</b>	<b>04</b>																						
	<p><b>Causes for Excessive oil consumption of engine:( any eight causes 4 marks)</b></p> <table border="1"> <thead> <tr> <th>Sr. No</th> <th>Causes</th> </tr> </thead> <tbody> <tr> <td>01</td> <td>Loose main or connecting rod bearings.</td> </tr> <tr> <td>02</td> <td>Tapered or out of round cylinders.</td> </tr> <tr> <td>03</td> <td>Worn out piston rings, piston or scored liner.</td> </tr> <tr> <td>04</td> <td>Worn oil seals (front and rear main bearings).</td> </tr> <tr> <td>05</td> <td>Clogged oil return pipe.</td> </tr> <tr> <td>06</td> <td>Worn out rear camshaft oil seals.</td> </tr> <tr> <td>07</td> <td>Clogged air breather.</td> </tr> <tr> <td>08</td> <td>Leaky fuel pump vacuum booster.</td> </tr> <tr> <td>09</td> <td>Excessive clearance in intake valve guide.</td> </tr> <tr> <td>10</td> <td>Improperly installed oil pan.</td> </tr> </tbody> </table>	Sr. No	Causes	01	Loose main or connecting rod bearings.	02	Tapered or out of round cylinders.	03	Worn out piston rings, piston or scored liner.	04	Worn oil seals (front and rear main bearings).	05	Clogged oil return pipe.	06	Worn out rear camshaft oil seals.	07	Clogged air breather.	08	Leaky fuel pump vacuum booster.	09	Excessive clearance in intake valve guide.	10	Improperly installed oil pan.	<b>04</b>
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	<b>e) Describe the procedure for testing of thermostat.</b>	<b>04</b>																						
	<p><b>Answer:-</b> <b>Removal:</b> 1) Disconnect negative cable at battery. 2) Drain the cooling system and tighten the drain plug. 3) Disconnect thermostat cap from thermostat case and remove the thermostat.</p> <p><b>Inspection:</b> 1) Make sure that air bleed valve of thermostat is clear. If it is clogged, engine tends to overheat. 2) Check to make sure that valve seat is free from foreign matters which would prevent valve from seating tight. 3) Check thermostatic movement of wax pallet as follows- <input type="checkbox"/> Immerse thermostat in water and heat water gradually as shown in figure. <input type="checkbox"/> Check that valve starts to open at specific temperature. <input type="checkbox"/> If valve starts to open at temperature substantially below or above specific temperature.</p>	<p><b>02</b></p> <p><b>02</b></p>																						



		<p style="text-align: center;">Thermometer</p> <p style="text-align: right;">Thermostat Valve</p> <p style="text-align: center;">Figure: testing of Thermostat</p>	
4	a)	<b>Attempt any THREE of the following:</b>	<b>12</b>
	i)	<b>Give procedure for cleaning and testing of MPFI injector.</b>	<b>04</b>
		<p><b>Cleaning of MPFI Injector:</b> Clean all injector components with carburetor cleaner, duster and solvent. Nozzle was blown with the help of cleaner's balloon. Rub the needle with the duster moistened with the carburetor cleaner and ideally the needle must be shined without any yellow colours. Clean ball by rolling it between two pieces of paper moistened in carburetor cleaner. Clean ball housing and input orifice by blow out from the cleaner balloon. All other details have to be cleaned in order to remove deposits.</p> <p><b>Procedure of Testing Fuel Injector of MPFI Engine:</b> (Explain any one testing methods in detail, Each of 2 Marks) Three tests are conducted for testing of diesel engine injector [1] Pressure Test [2] Leak off Test [3] Spray Test</p> <p><b>[1] Pressure Test:</b> 1. Fix the injector to be tested to injector pipe of Injector tester as shown in above figure. 2. Work the hand pump. 3. Note the opening pressure of spray on gauge provided. 4. If the pressure is less, it is increased by loosening the check nut and tightening the adjusting screw. 5. If it is more than the specified, the adjusting screw is loosened. 6. After adjusting pressure, lock the lock nut and replace the cap. 7. In some make of nozzles shims are added or removed instead of adjusting screw.</p>	<b>02</b>       <b>02</b>

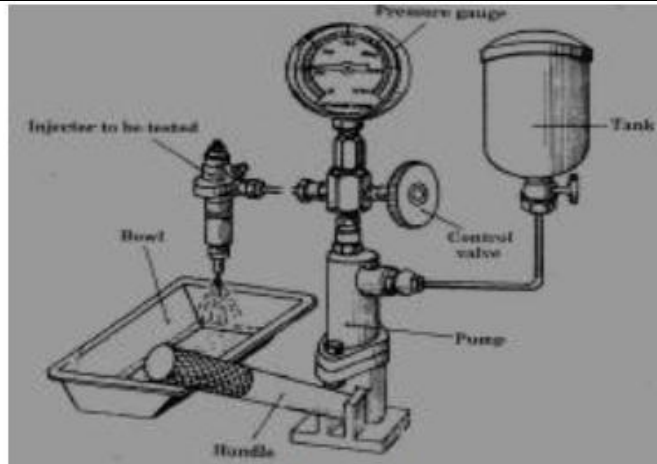


Figure: Injector Tester

**[2] Leak off Test:**

1. Fix up injector on tester.
2. Build up pressure of 150 atoms (1 atom = 14.7 lb/in<sup>2</sup>) and keep the pressure for about 10 second without spraying.
3. After 10 seconds check up that there is no drop in pressure and wetness is not felt on tip of nozzle body.
4. If there is drop in pressure or wetness is felt on tip of nozzle body:
  - (i) Dismantle the injector.
  - (ii) Get the seat of nozzle body grounded.
  - (iii) Get the nozzle body seat lapped.
  - (iv) If nozzle valve seat is pitted, it should be replaced or grounded.
5. Fix up the injector again and test it in same manner as prescribed in steps 1 to 3.

**[3] Spray Test:**

1. Fix the injector on tester.
2. Disconnect the pressure gauge by closing the valve.
3. Work the handle of tester four times in second and note the spray pattern.
4. If it is in fine atomized form, it is okay.
5. If it is in stream form, nozzle seat and valve seat should be grounded and check once again.
6. Check sprays sound also. It should give peculiar whistling sound.
7. Check spray angle also.

ii) **Write probable causes and suitable remedies for symptom 'Engine Overheating'**

**04**



		<i>(Consider any four causes and their remedy, each point carry 1 mark )</i>																												
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	iii)	<b>Describe how will you check engine oil level and condition of oil.</b>	04																											
		<p><b>Answer: To check engine oil level:</b> Oil level is checked by dip stick.</p> <ol style="list-style-type: none"> <li>1. Park the vehicle on a flat even surface to get an accurate reading.</li> <li>2. Be sure the engine is cold or has been off for at least ten minutes before oil check.</li> <li>3. Identify the location of the oil dipstick on vehicle.</li> <li>4. Pop the hood. Usually, there will be a latch somewhere at the foot of the driver side door. Get some paper towels or an old rag.</li> <li>5. Slowly pull the dipstick out and wipe the oil off.</li> <li>6. Reinsert the dipstick in the dipstick bore.</li> <li>7. Slowly pull the dipstick out.</li> <li>8. There is a mark on the dip stick to indicate proper level of oil. If dip stick is not wet up to the mark, more oil has to be added up to correct level.</li> </ol> <p><b>To check engine oil condition:</b> Examine the colour and quality of the oil.</p> <ol style="list-style-type: none"> <li>1. The colour and the consistency of engine oil are indicative of its age, and possibly of other engine efficiency issues.</li> <li>2. Wipe the oil off the end of the dipstick and examine it on the rag. Engine oil that's in good condition should look slightly yellow-greenish on the rag, and shouldn't be super-dark.</li> <li>3. If colour of oil is milky appearance, this could mean coolant is leaking into the engine.</li> <li>4. Oil will change in colour from golden or amber colored to brown and black as more and more particulate gets in the oil from the engine.</li> <li>5. Look closely for any metal particles, too, as this could mean there is internal engine damage.</li> <li>6. If colour of oil is too black, then there is need of oil change.</li> </ol>	02  02																											
	iv)	<b>Give causes and remedies for symptom 'Clutch Drag'</b>	04																											
		<b>Answer: Causes and remedies for "Clutch Drag" (any four = 4marks)</b>	04																											



<b>Causes and remedies:-</b>			
Sr.	Causes	Remedies	
1	Oil or grease on the driven plate facings	Fit new plate and eliminate oil leak	
2	Binding of clutch pedal mechanism/ Incorrect pedal adjustment.	Make Free and lubricate joints./ Adjust the pedal.	
3.	Weak pressure springs.	Replace with new springs.	
4.	Incorrect setting of release levers.	Reset the lever properly.	
5.	Improper clutch free play.	Adjust properly.	
<b>b)</b>	<b>Attempt any ONE of the following:</b>		<b>06</b>
<b>i)</b>	<b>Describe the procedure for checking and servicing of piston and piston rings.</b>		<b>06</b>
	<p><b>Answer: Procedure for checking and servicing of- Piston:</b></p> <ol style="list-style-type: none"> <li>1) Clean the piston to remove dirt, carbon depositions etc.</li> <li>2) Check piston diameter with micrometer.</li> <li>3) Measure the clearance between cylinder bore and piston. If the clearance is not within specifications replace the piston.</li> <li>4) Check the piston ring groove clearance with the help of feeler gauge.</li> <li>5) Inspect the condition of piston skirt for wear.</li> <li>6) Check the oil holes in the oil ring groove.</li> <li>7) In case piston is scored, cracked, burned spots, scuffed sides and broken ring lands the piston should be replaced.</li> <li>8) If the piston is serviceable, the old rings must be removed and carbon must be cleaned from the ring grooves prior to the installation of new rings.</li> </ol> <p><b>Piston rings:</b></p> <ol style="list-style-type: none"> <li>1) Check piston Ring end gap.</li> <li>2) Insert the piston ring into the cylinder.</li> <li>3) Using the piston push the piston ring a little beyond the bottom of the ring travel.</li> <li>4) Using a feeler gauge measure the end gap.</li> </ol> <p>Standard piston ring end gap.            No.1 -Ring:- 0.30 to 0.51 mm            No.2- Ring:- 0.30 to 0.57 mm Oil ring :- 0.35 to 0.60 mm If the end gap is within specification</p> <ol style="list-style-type: none"> <li>5) Check the fit of each compression ring in its piston groove.</li> <li>6) If fit is tight, the groove probably need cleaning.</li> <li>7) If the ring is too loose, check the piston ring side clearance.</li> <li>8) To check the ring side clearance: Place the ring in the groove, measure the clearance between the ring and groove, with a thickness gauge. The side clearance should be maintained as per manufacturer's recommendation.</li> <li>9) Visual Inspection of ring for cut and damage.</li> <li>10) If piston rings are excessively worn-out, damaged, replace set of piston rings with new one.</li> </ol>		<p><b>03</b></p> <p><b>03</b></p>
<b>ii)</b>	<b>Describe the procedure of frame repairs.</b>		<b>06</b>
	<p><b>Answer: Procedure for frame repair.</b></p> <p><b>A) Cracks:</b></p> <p>Cracks can be detected by inspecting the chassis carefully. If it is not visible, wash</p>		

the chassis first, then coat the surface with a solution of chalk and water. When it becomes dry, tap the area with a hammer then the crack will be visible. In case, the crack is observed, it should be immediately repaired. In case the repair facilities do not exist, then drill 5 to 6 mm diameter hole at the end of cracks as shown in figure. This drilling of hole will stop further expansion of crack. The holes work like the first aid for the crack. Fig.

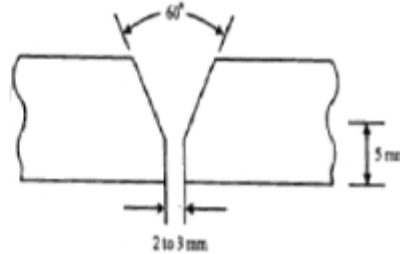
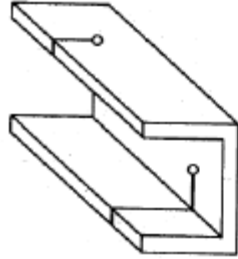


Fig. Drilling hole at the end of crack

Fig. Making „V“ groove for welding

**To repair cracks following procedure is adopted:**

1. For welding the chassis make a groove of 2 to 3 mm in the crack at bottom portion and chamfer the upper end of the groove to make a V shape. Weld a groove with at least 3 layers. After welding, it is cooled down, then grid the surface to make it smooth.
2. Considering second case. If crack is more than  $\frac{1}{2}$  of chassis cross-section, it will be necessary to reinforce the area, by placing a steel plate and chassis thickness. While welding the plate, never weld it fully on all sides.

**B) Loose Rivets:** Check for loose rivets especially in the vehicle which are being overloaded or run on bad road. The loose rivets can easily be detected by presence of the rust or bur around the rivets by visual inspection and then tapping it with a hammer. If found loose, it should be removed and a new rivet should be placed immediately. For replacement of rivets following procedure is adopted:

1. Cut the rivet head with drill or welding torch; do not use a chisel as it will damage the rivet hole. In case the hole is already damaged, drill a bigger hole and use bigger diameter rivet.
2. The diameter of new rivets should be 1 mm less than the hole diameter.
3. Clean the hole thoroughly, there should be no bur.
4. Heat the rivet, when hot, fix it in the hole and rivet its head.
5. Never fix up a cold rivet, as it will not make a good joint.
6. Do not weld rivet with chassis. If it is loose, remove and fix a new one.

**C) Procedure for checking skewness (Misalignment and repair):**

02

02

02



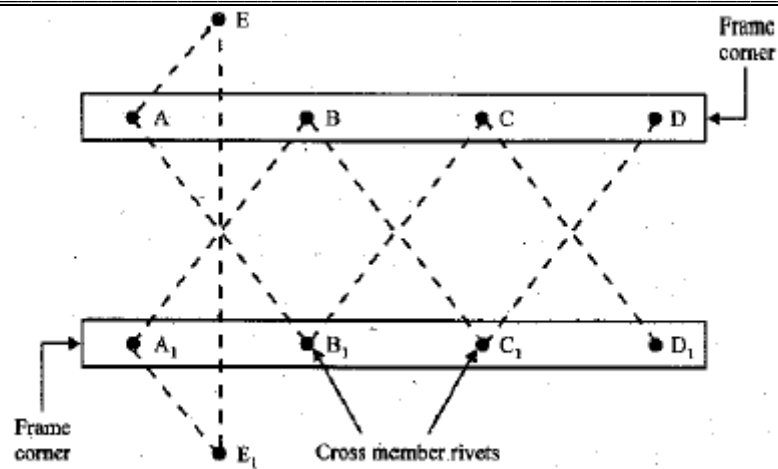
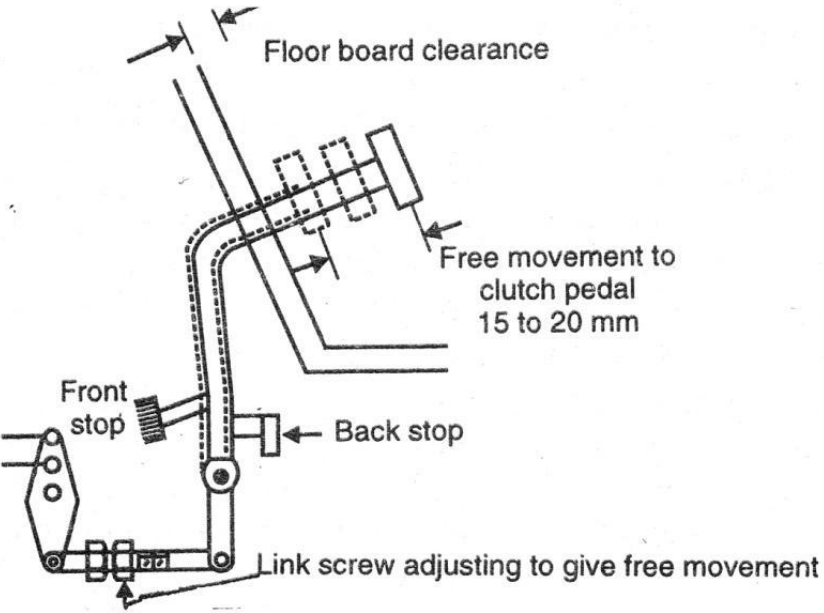


Fig: Checking alignment of frame.

1. Place the vehicle on plane leveled ground.
2. Mark the markings on the floor from all the points from which measurements should be taken by dropping the plumb bob directly underneath the point.
3. Move the vehicle away from the layout on floor.
4. Check frame width at front and rear end. If width is corresponds to specification, draw a center line up to full length of the vehicle half way between marks indicating front and rear width. If frame width is not correct draw center line through intersections of any two pairs of equal diagonals.
5. With the center line properly laid out, measure the distance from it to points opposite over the entire length of chassis. If frame is in proper alignment measurement should not vary.
6. To locate the points at which the frame is sprung measure the diagonals marked in pairs A-B, B-C, and C-D. If the diagonals in each pair are within 3.17mm, that part of the frame between the points of measurements is considered as in satisfactory alignment. These diagonals should intersect at center line.


**Repair of Skewness of frame:** Skewed frame can be repaired with two jacks, dolly block, special type of bending tools and localized heating of the particular chassis bend. After repairing of frame check alignment of chassis accurately.

<b>5</b>	<b>Attempt any FOUR of the following:</b>	<b>16</b>
a)	<b>Describe how clutch free play is adjusted.</b>	<b>04</b>
	<p><b>Answer: (Sketch 02 marks and Description 02 marks)</b>  <b>Procedure for clutch free play adjustment:</b> This adjustment can be done by changing the length of link rod located in the clutch linkage. The adjustment should be set, so that the specified amount of free play remains in the pedal after the clutch has been engaged. This measurement will vary slightly from model to model but the usual free play specified is 15 to 20 mm. After the correct adjustment is made, both nuts are tightened to effectively lock the adjustment. This adjustment should be done after the correct floor board clearance or clutch pedal has been established. If no free play is kept, it may result in noise and also slipping of clutch and damage of release bearing.</p>	<b>02</b>

	 <p>Figure. Clutch adjustment</p>	02
b)	<p><b>How backlash in differential gears is checked and adjusted?</b></p>	04
	<p><b>Checking of Backlash in differential gears.</b></p> <p>To check backlash, fix up the dial gauge on differential housing and its pointer resting on tooth of sun gear. Set the gauge at zero. Now move the wheel on both sides without moving the planet pinion and read the gauge, the play should be 0.15 to 0.18. Similarly, for checking the backlash in Crown wheel and bevel pinion, rest the pointer of dial gauge on the tooth of crown wheel and hold the bevel pinion. Now with screw driver move the crown wheel and note the reading on dial gauge.</p> <p><b>Adjustment of backlash in differential gears:</b></p> <ol style="list-style-type: none"> <li>1. Disconnect the parking brake actuator by releasing it with air pressure and removing the cotter pin and pin or use air to keep the brake disengaged while adjustments are being made.</li> <li>2. Remove locks on bearing nuts . These nuts are used to adjust the differential side bearing preloads.</li> <li>3. Insert a drive axle shaft through both side gears of the differential from the ring gear side .Turn the shaft with a pipe wrench to rotate the differential as the bearings are being adjusted.</li> <li>4. Tighten nut (on the side opposite the ring gear) as tight as possible by hand while rotating the ring gear with the axle shaft. The ring gear must be rotated for the bearings to seat properly. While tightening nut and rotating the ring gear periodically, rock the ring gear against the bevel gear so the backlash can be felt. An approximate backlash of .010 in. (0.25 mm) should be established by loosening or tightening nut (ring gear side) while nut (on the side opposite the ring gear) is being tightened.</li> <li>5. When the approximate backlash of .010 in. (0.25 mm) has been established, rotate the ring gear and tighten nut (ring gear side) as tight as can be done with hands. Mark the position of nuts (ring gear</li> </ol>	02



	<p>side) and (on the side opposite the ring gear) with a marking pen or something similar.</p> <p>6. Tighten nut (ring gear side) an additional three notches.</p> <p>7. An accurate backlash setting must now be made. Refer to the Specifications section of the model being adjusted.</p>													
c)	<b>Write causes and remedies for a symptom “Shaky Propeller shaft”</b>	<b>04</b>												
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4. Misaligned Propeller shaft at front and rear end.	Align it properly.													
d)	<b>How wear of friction lining of clutch plate is checked? Write procedure to replace friction lining.</b>	<b>04</b>												
	<p><b>Procedure for checking clutch plate thickness.</b></p> <ol style="list-style-type: none"> <li>1. Remove the clutch assembly from the vehicle and dismantle it properly.</li> <li>2. With the help of external micrometer/ Vernier calliper measure the thickness of clutch plate and compare it with Manufacturer’s specification.</li> <li>3. If the thickness is less than the recommended value, clutch plate should be relined or replaced.</li> </ol> <p><b>Procedure to replace clutch plate friction lining:</b></p> <ol style="list-style-type: none"> <li>1. Drain the engine oil.</li> <li>2. Detach the clutch cable from the lever on the crankcase cover</li> <li>3. Remove the rear cylinder exhaust pipe.</li> <li>4. Unscrew the external oil pipe lower bolt from the right-hand side crankcase cover, and the pipe holder bolt from the crankcase. Discard the lower bolt sealing washers as new ones must be used.</li> <li>5. Working in a criss-cross pattern, evenly slacken the right-hand side crankcase cover retaining bolts, noting the position of the clutch cable bracket . Lift the cover away from the engine, being prepared to catch any residual oil which may be released as the cover is removed.</li> <li>6. Remove the gasket and discard it. Note the positions of the two locating dowels fitted to the crankcase and remove them for safekeeping if they are loose .<b>Remove the oil orifice, noting which way round it fits, and discard its O-ring as a new one must be used.</b></li> <li>7. Working in a criss-cross pattern, gradually slacken the clutch release plate retaining bolts until spring pressure is released, then remove the bolts, plate and springs .</li> <li>8. To remove the clutch nut the mainshaft must be locked. This can be done in several ways. If the engine is in the frame, engage 1 st gear and have an assistant hold the rear brake on hard with the rear tyre in firm contact with the ground. Alternatively, the Honda service tool can be used to stop the clutch centre from</li> </ol>	<b>02</b>												

	<p>turning whilst the nut is slackened. If the engine has been removed from the frame (and the Honda tool is not available), install the universal joint onto the output driven shaft and engage 5th gear, then fit a suitable spanner onto the flats of the universal joint and secure it against the work surface. This locks the mainshaft and allows the clutch nut to be removed. Whilst the shaft is locked, also slacken the oil pump driven sprocket bolt. Unscrew the clutch nut and remove the washer from the mainshaft, noting how it fits.</p> <p>9. Grasp the clutch centre with the complete set of clutch plates and the pressure plate and remove them as a pack . Unless the plates are being replaced with new ones, keep them in their original order. Note that of the eight friction plates, there are three types, identified as A,B and C . The outermost (type A) plate has a slightly larger internal diameter allowing it to fit over the anti-judder spring and spring seat, and its tangs fit into the shallow slots in the clutch housing. It is also slightly thicker than the rest. The innermost (type C) plate has different tang ends to the rest. The six middle plates are type B. Take care not to mix them up.</p> <p>10. After replacing the plates, install the clutch.</p>	
e)	<p><b>How will you check run out of gear box main shaft?</b></p>	04
	<p><b>Answer:</b> Dial test indicators (DTIs) of the type shown in Fig. are used for measurements, such as checking run-out on brake discs and checking end float on a crankshaft, run out of gear box main shaft. There are many other instances where a DTI would be used.</p> <div style="text-align: center;">  <p style="text-align: center;">DTI mechanical      DTI digital</p> <p style="text-align: center;">Fig. 31.12 Dial test indicators (DTIs)</p> </div> <p>Dial test indicator that has been set up to test the axial run-out that occurs when the shaft is rotated, as shown in Fig. This measurement is important because of the effect that excessive run-out may have on the operation of the transmission system. Excessive shaft run-out may be caused by a distorted shaft Run-out should not exceed 0.15 mm (0.006 in).</p>	04
f)	<p><b>It is found that brake drum is scored and rusted, how it can be reconditioned.</b></p>	04
	<p><b>Answer:</b> <b>1. Clean Brake Rotors on The Vehicle:</b> Step 1: Loosen lug screws/nuts Step 2: Remove the wheels by unscrewing the lug screw/nuts and take the wheels off Step 3: Apply/spray brake cleaner to the brake arear thoroughly Step 4: Make sure to spray the calipers and rotors</p>	04

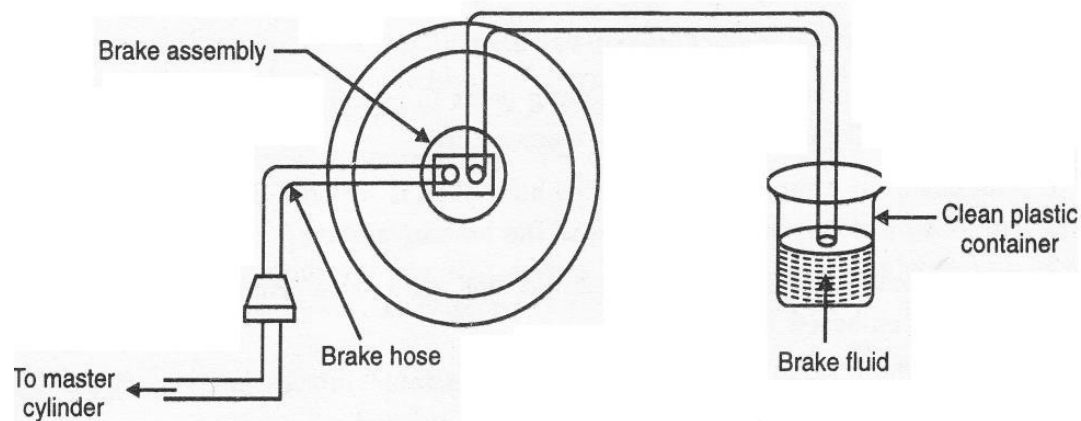


	<p>Step 5: Use micro-fiber cloth or regular rag to wipe the rotors and the outside of calipers Step 6: Put the wheels back on Step 7: Lower the car to the ground Step 8: Start driving, the brakes will continue cleaning themselves * The brake cleaner will continue to clean underneath the calipers while driving</p> <p style="text-align: center;"><b>OR</b></p> <p><b>2. Clean Brake Rotors by Removing Rotors From The Vehicle:</b> Step 1: Put on gloves, safety goggles, and other safety equipment Step 2: Raise or lift your vehicle with a lift or jack on a leveled ground carefully Step 3: Loosen lug screws/nuts Step 4: Remove the wheels by unscrewing the lug screw/nuts and take the wheels off Step 5: Take off the calipers Step 6: Remove brake rotors Step 7: Spray brake cleaner on rotors Step 8: Drip off extra brake cleaner Step 9: Use a regular cleaning brush and gently scrub the rotors to soften the rust and corrosion Step 10: Use the stainless-steel wire brush to scrub the rotor in circular motion Step 11: Spray with Windex or other similar cleaning supplies to spray and wipe down rotors</p> <p style="text-align: center;"><b>OR</b></p> <p><b>3. Clean Brake Rotors with White Vinegar:</b> Step 1: Put on gloves, safety goggles, and other safety equipment Step 2: Raise or lift your vehicle with a lift or jack on a leveled ground carefully Step 3: Loosen lug screws/nuts Step 4: Remove the wheels by unscrewing the lug screw/nuts and take the wheels off Step 5: Take off the calipers Step 6: Remove brake rotors Step 7: Put the rotors in a bucket or a vessel that is big enough to hold the rotors and water Step 8: Pour white vinegar in the bucket with rotors in it (completely soak the rotors in white vinegar) Step 9: Soak the rotors for at least 1 hour Step 10: Some gas bubbles will start to form after soaking for at least 1 hour Step 11: Take the rotors out Step 12: Use a cloth or rag to wipe the rotors *If very rusty, soak rotors in vinegar overnight *Repeat these steps if necessary *The longer the rotors soak in white vinegar, the easier it is to wipe of the rust</p>	
<b>6</b>	<b>Attempt any FOUR of the following:</b>	<b>16</b>
	<b>a) Write the procedure for adjustment of mechanical type service brakes.</b>	<b>04</b>
	<p><b>The Procedure</b></p> <ol style="list-style-type: none"> <li>1. Get repair manual and refer to the brake drum repair and maintenance section.</li> <li>2. The tools that you will need are a ratchet and socket set with extensions,</li> </ol>	



		<p>screwdrivers, hammer, lug wrench, lubricant, jack stands and most importantly, a brake adjustment spoon.</p> <ol style="list-style-type: none"> <li>3. Lift up the rear part of the car using a jack and then support it with jack stands.</li> <li>4. Remove the wheels by removing the nuts so that we can gain access to the brake mechanism. Observe it, with the brake in place.</li> <li>5. In order to adjust the brake, remove the plug that blocks the drum porthole, to access the adjusting retainer clip inside.</li> <li>6. This clip is actually a lever attached to a star wheel inside. To tighten the brakes (to position the brake shoes properly), depress the clip (away from the star wheel using a screw driver) and move the star wheel in the right direction with the adjustment spoon. Determine which is the right direction for the star wheel to move so that a tightened hold of brake shoes on drum is possible.</li> <li>7. Keep making adjustments with the star wheel and adjustment clip. Rotate the drum, once in a while, to know if the brake shoe contact with the drum is right and there is sufficient friction.</li> <li>8. Spin the drum several times to check, if the adjustment is right.</li> <li>9. To ensure that the shoes are centrally aligned, pull the parking brake cable. Refer to the car manual for more details.</li> <li>10. After assuring the adjustment and central alignment ,put the plug back and then proceed to put the wheels back again.</li> </ol>	<b>04</b>																											
	<b>b)</b>	<b>It is observed that “steering is hard”, give probable causes and suitable remedies for them.</b>	<b>04</b>																											
		<p><b>(any four points = 4 marks)</b> <b>Answer:1) Hard Steering</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">Sr</th> <th style="width: 60%;">Causes</th> <th style="width: 35%;">Remedies</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Lack of lubricating oil in steering gear box.</td> <td>Top up oil up to correct l</td> </tr> <tr> <td>2</td> <td>Tight or jam steering gear unit.</td> <td>Adjust as necessary</td> </tr> <tr> <td>3</td> <td>Defective or bent rocker shaft or drop arm</td> <td>Replace or repair.</td> </tr> <tr> <td>4</td> <td>Wrong adjustment of worm or sector shaft in steering gear box.</td> <td>Make correct adjustment.</td> </tr> <tr> <td>6</td> <td>Bent steering tube.</td> <td>Repair or replace</td> </tr> <tr> <td>7</td> <td>Incorrectsteering geometry factors</td> <td>Make correct alignment</td> </tr> <tr> <td>8</td> <td>Underinflated tyres.</td> <td>Inflate to correct pressure</td> </tr> <tr> <td>9</td> <td>Bent front axle.</td> <td>Repair or replace</td> </tr> </tbody> </table>	Sr	Causes	Remedies	1	Lack of lubricating oil in steering gear box.	Top up oil up to correct l	2	Tight or jam steering gear unit.	Adjust as necessary	3	Defective or bent rocker shaft or drop arm	Replace or repair.	4	Wrong adjustment of worm or sector shaft in steering gear box.	Make correct adjustment.	6	Bent steering tube.	Repair or replace	7	Incorrectsteering geometry factors	Make correct alignment	8	Underinflated tyres.	Inflate to correct pressure	9	Bent front axle.	Repair or replace	<b>04</b>
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	<b>c)</b>	<b>How hydraulic brakes are bled manually?</b>	<b>04</b>																											
		<p><b>Answer:</b> <b>Manual bleeding of Hydraulic brakes:</b> Two service technicians are needed for the manual bleeding. One technician opens a bleeder and the other technician depress the pedal, to force out air and brake fluid from bleeder screw. To bleed the system following procedure is adopted.</p> <ol style="list-style-type: none"> <li>a) Attach a bleeder hose to bleeder screw at the wheel cylinder and insert the other end of hose into the clean plastic container which is partially filled with clean brake fluid.</li> <li>b) Loosen the bleeder screw at least one full turn.</li> <li>c) Have an assistant to depress and hold the brake pedal and then tighten the bleeder screw.</li> <li>d) Have your assistant to release the brake pedal.</li> <li>e) Repeat steps b ,c &amp; d until the fluid flow in container is free of air bubbles .Periodically check the brake fluid level in the master cylinder and brake fluid of</li> </ol>	<b>02</b>																											
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correct grading to keep the reservoir filled.  
f) Repeat this procedure at each wheel.



**Fig. Manual bleeding of hydraulic brakes**

d) Write “Hot retreading ” procedure for tyres.

04

Hot retreading involves the vulcanisation of a tyre in a mould at a temperature of around 150 °C. The tread and the sidewall veneer of the tyre are made up of non-vulcanised rubber compounds. The shape and tread of the tyre are created in the heating press.

The source for the hot retreading process is current and steam. Mostly in small industries boilers i.e. steam is used as source for the process because it should be convenient for them it takes 2 hours to heat completely.

Stages of Retread

1. **Buffing**

The primary objective of buffing is to prepare the worn out tread surface of tyre for retread process. The original tread design and the some of the under tread is also removed to provide the casing with required dimensions and surface texture. In other words it increases the co-efficient of friction of untread surface of tyre so that it can hold firmly the cushion and sole of new tread.

2. **Tread Preparation and Building**

Building is the process of applying a premoulded retread or new tread rubber to the buffed and prepared casing. It done by rotating a tyre continuously and vulcanized rubber solvent is placed over the surface of tyre .the solvent is prepared by mixing black vulcanizing cement and petrol ,here petrol is used for reducing the viscosity of the solvent so that they can be applied on the tyre smoothly In this way it spreads uniformly. Take another dip of solvent if required. After the application of sufficient solvent a cushioning strip is fixed and tyre is slowly rotated so that complete circumference of painting brush depth in tyre is covered and uncured tread compound is extruded or applied as a strip of sufficient length directly to the casing.

3. **Mechanical Pressing**

The rubber with solution and the tyre with solution is fixed for process and with the help of machine which gives some force to the tyre for making them fixed.

4. **Enveloping**

The tyre with roll of rubber fixed is placed in a mould and air pressure is maintained at about 50 atm so that it expands uncured material takes the position of the mould temperature of 150° C the tread and after some time the mould is opened and tyre is taken from the mould. Therefore the tyre from the vacuum system is

04



		ready for use and it taken from the system carefully. <b>5. Curing:</b> The tyre is then placed in the hot retreading machine-segmented mould retreading machine. During this processing, the tyre threads are to be printed by the flower patterns of machine mould. After vulcanization, the new retreaded tyre is taking shape. It is new tyre and have own brand. <b>6. Final Inspection</b> To insure a quality retread each tyre passes through the inside and outside visual inspection. It is mandatory that the tyre meets all customer and government regulations. Some retreaders are also using instrumented inspections X-ray shearographic or high pressure tester.	
	e)	<b>Describe procedure of “wheel alignment” using wheel alignment gauges.</b>	<b>04</b>
		<b>Answer: Procedure of wheel alignment using wheel alignment gauges:</b> <ol style="list-style-type: none"><li>1. For checking and making adjustments for wheel alignments, always use manufacturer’s manual. Because, there are cars of number of makes and models. So the specification varies in wide range.</li><li>2. All alignments check and adjustments should be made with the car on leveled ground, at curb weight, spare tyre in place, normal supply of water, fuel and oil, but with no passengers or load.</li><li>3. Check <b>castor, camber and king pin inclination by using combination gauge.</b></li><li>4. Check toe in with toe in gauge provided.</li><li>5. If these measurements are not within limit then adjust it as per the manufacturer’s manual</li><li>6. <b>Castor and camber</b> are adjusted by adding o removing shims provided, at the upper control arm and inside the frame. For positive castor remove shims from the front and/or add shims from both the front and rear. For positive camber remove an equal number of shims from both the front and rear.</li><li>7. For <b>toe in adjustment:</b> loosen the clamps on the tie rod ends and shorten one tie rod and lengthen the other. Adjust equal amount until the steering wheel position is correct.</li></ol>	<b>04</b>