# *MODEL ANSWER*

**SUMMER– 17 EXAMINATION**

**Subject Title**: **VEHICLE SYSTEMS MAINTENANCE** 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) | **Attempt any THREE of the following: (3 x4)** | **12** |
| | (i) | **Describe the procedure for removal of a cylinder head of a multi cylinder engine.** | **04** |
| | | **Procedure for Removal of a Cylinder Head of a multi cylinder engine:**<br>(Complete procedure- 4 Mark)<br>Cylinder heads come in many different configurations that each have their own specific steps to remove.<br>1) Drain the oil and coolant<br>2) Clean valve cover.<br>3) Remove valve cover.<br>4) Rocker arm and rocker removal.<br>5) Remove the pushrods.<br>6) Loosen head bolts.<br>7) Remove the head bolts.<br>8) Lift off the cylinder head.<br>If the cylinder head sticks, lightly use a dead blow or rubber mallet to tap the cylinder head to be able to remove it. Set to the side in a safe area. | 04 |
| | (ii) | **Write any two uses of dial indicator gauge and cylinder bore gauge.** | **04** |
| | | **Uses of Dial Indicator Gauge:**<br>(Mention any 2 of the following, 1 Marks each)<br>**Dial Indicator Gauges** are one of the primary measuring tools used in precision engine building. They are typically used,<br>[1] To measure deck clearances.<br>[2] To measure crankshaft thrust and straightness.<br>[3] To measure lifter travel<br>[4] Measurements that involve the distance between two surfaces or small amounts of component travel.<br>[5] Runout measurement.<br>[6] Taper, Ovality, Backlash checking.<br>**Uses of Cylinder Bore Gauge:**<br>(Mention any 2 of the following, 1 Marks each) | 02 |

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| | | **Cylinder Bore Gauge** is a measuring tool used for measure inside diameter of engine cylinder (bore).<br>Cylinder Bore gauge is widely used,<br>[1] To measure the diameter of the cylinder liner.<br>[2] To measure the Main bearing diameter in the hole.<br>[3] To measure the diameter of the housing.<br>[4] To measure the diameter hydraulic cylinder and<br>[5] To measure in another place not cramped or free. | 02 |
| | **(iii)** | **What precautions should be taken while using pneumatic tools?** | **04** |
| | | **Precautions to be taken while using Pneumatic Tools:**<br>(Any four points mentioned as below with brief description, Each of 1 Marks)<br><br>Pneumatic (Air powered) tools present many of the same hazards as their electrically Powered counterparts, plus hazards you may not have considered. Here are things to remember when using Pneumatic tools:<br>[1] Should wear and use necessary personnel protective devices.<br>[2] Pneumatic tools shall not be connected to, or driven by, air pressure in excess of that for which the tools are designed.<br>[3] The wearing of appropriate eye protection equipment is mandatory while using Pneumatic Tools.<br>[4] Pneumatic tools should be laid down in such a manner that no harm can be done if the switch is accidently tripped. No idle tools should be left in a standing position.<br>[5] Pneumatic tools should be kept in good operating condition.<br>[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.<br>[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.<br>[8] Protect the hose from physical damage. When using quick disconnect type fittings, install the male end on the tool. | 04 |
| | **(iv)** | **State four causes of Break Down Maintenance.** | **04** |
| | | **Causes of Break Down Maintenance:**<br>(List down any Four points-1 Mark each)<br>(i) Due to unpredictable failures of components.<br>(ii) Due to gradual wear and tear of parts.<br>(iii) Incorrectly inflated tyres.<br>(iv) Improper Engine oil level and condition.<br>(v) Rash and Careless driving habits.<br>(vi) Overloading, over running and over speeding of the vehicle.<br>(vii) Coolant level not maintained. (Neglected cooling system)<br>(viii) Clogged filters.<br>(ix) Incorrect or improper steering geometry.<br>(x) Improper braking system.<br>(xi) Failure to replace worn out parts<br>(xii) Lack of lubrication<br>(xiii) Negligence towards minor faults<br>(xiv) Negligence towards the unusual vibrations of the vehicle.<br>(xv) Overheating of the engine | 04 |

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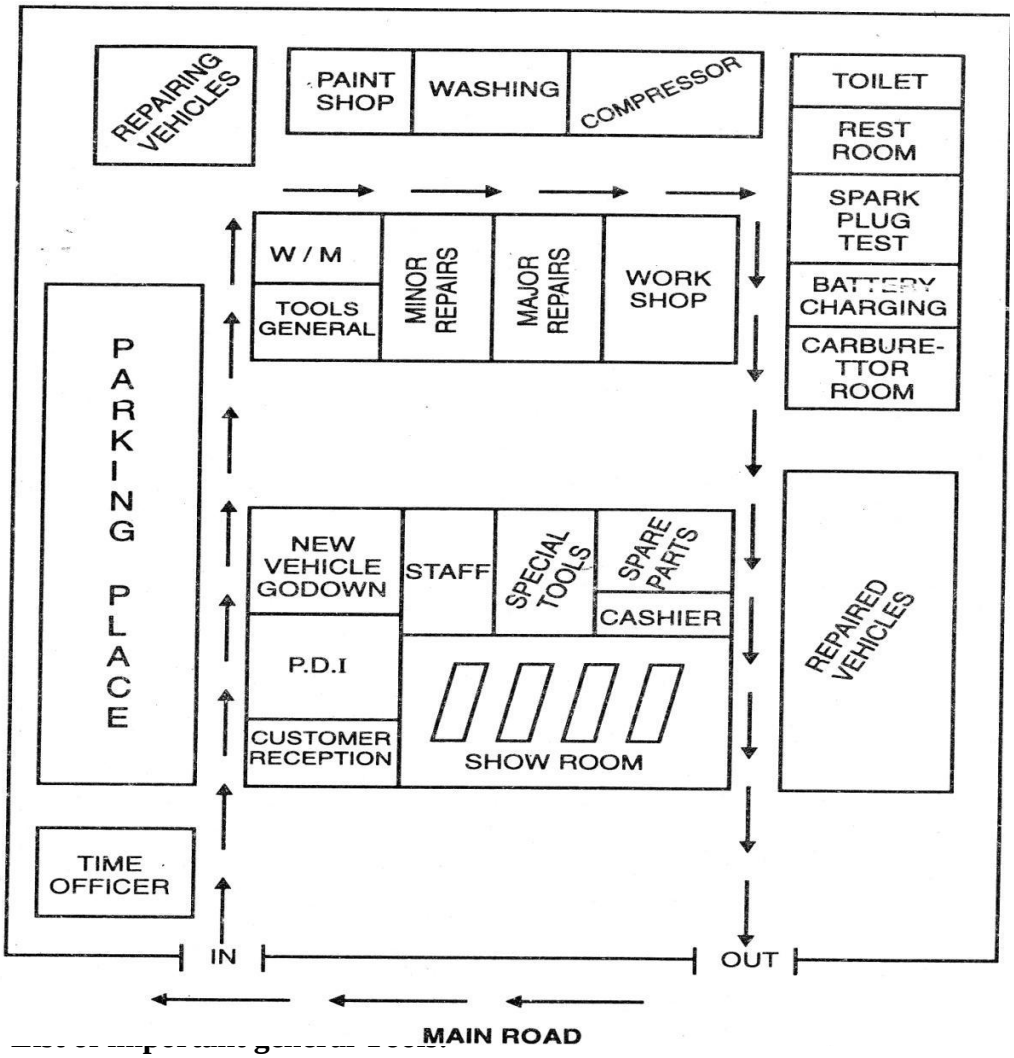
| | b) | **Attempt any ONE of the following: (1 x 6)** | **06** |
| | (i) | **Draw a layout required for dealers of two wheeler. List important general tools, special tools and equipments required for the same.** | **06** |
| | | **Layout required for dealers of two wheeler:**<br>(Credit should be given to suitable layout, 3 Marks for Proper Layout)<br>  <br> | 03 |
| | | (List down any 3 generalized Tools, Special tools & Equipments, 1 Marks each)<br>**List of important general Tools**<br>[1] Hand Tools (Service Tools)<br>[2] Measuring Tools<br>[3] Shop Power Tools<br>[4] Hydraulic & Arbor Press<br>[5] Shop Cutting Tools<br>[6] Air Compressor & Tyre Inflator<br>[7] Battery Tester<br>[8] Hydraulic Jack, Axle Stands, Creeper & Hydraulic Lift<br>**List of Specialized Tools**<br>[1] Grease Gun<br>[2] Vehicle Washer | 01 |

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| | | [3] Portable Electric Drill<br>[4] Headlight Beam Aligner<br>[5] Brake Tester<br>[6] Electronic Soldering Iron<br>[7] Spark Plug Cleaner & Tester<br>[8] Valve Grinder<br>[9] Piston ring compressor<br>[10] Piston ring expander,<br>[11] Valve spring compressor<br>[12] Bearing Puller | 01 |
| | | **List of Equipments:**<br>[1] Computerized wheel balancer<br>[2] Battery charger<br>[3] Ignition timing Light<br>[4] Arbor press<br>[5] Hydraulic press,<br>[6] Engine analyzer. | 01 |
| | **(ii)** | **Describe the maintenance schedule for a car on day basis or kilometer travelled basis.** | **06** |
| | | **Schedule Maintenance for a Car on Day Basis or Kilometer travelled Basis:**<br>(List down major parameters in any 4 schedule period mentioned below, Each of 1.5 Marks)<br>**[1] Daily Maintenance:**<br>1. Clean the vehicle and check fuel in the fuel tank.<br>2. Check water level in the radiator.<br>3. Check oil level in the oil sump.<br>4. Check tyre pressure.<br>5. Check brake pressure warning light.<br>**[2] Weekly Maintenance or at 500 km :**<br>1. Check engine oil level and fill, if necessary.<br>2. Check electrolyte level in battery and fill, if necessary.<br>3. Drain oil from engine sump and replenish.<br>4. Clean gauge filters in petrol.<br>5. Check engine mounting nuts.<br>6. Check cylinder head nuts.<br>7. Tight inlet manifold and exhaust manifold nuts.<br>**[3] Monthly Maintenance or at First 1000 Km:**<br>1. Drain oil in sump to clear it of any impurities in accumulator, refill it with the appropriate grade of lubricant.<br>2. Drain gearbox by unscrewing the drain plug, now fill it with correct amount of the recommended lubricant.<br>3. Drain oil from the rear axle; refill it with the recommended lubricant up to the prescribed level.<br>4. Lubricate the water pump bearing with recommended grease.<br>**[4] Three Quarterly Maintenances or Every 1000 km:**<br>1. Repeat items described under every 500 km with addition of the following.<br>2. Provide grease to the sliding joint and two needle type universal joints<br>3. Grease each of the swivel pin with grease gun.<br>4. Grease gun should be applied to the nipple on the ends of steering rods.<br>5. Test the tyre pressure.<br>6. Fill radiator to full level. | 06 |

**[5] Half Yearly Maintenance or Every 2000 Km:**

1. Repeat the items less than 1000 km with addition of the following.
2. Replenish gear box oil. Oil level should not be too high, otherwise it will get into the clutch housing and cause clutch slipping.
3. Top up the rear axle.
4. Change oil in the sump to remove any impurities that have accumulated.
5. Check the fluid level of the master cylinder by turning back the front floor carpet on driver's side and removing the exposed rubber plug. The fluid should be within 13 mm of the bottom of the filter neck.
6. Apply grease to the nipples on the hand brake cable.
7. Check specific gravity of the battery fluid by taking hydrometer readings.

**2 Attempt any FOUR of the following: (4 x 4) 16**

**a) What records are necessary in Auto garages? How do they benefit management in taking decision? 04**

**Necessary Records in Auto Garages and their usefulness to management in taking Decision:**

(Any Four record along with benefit-01 mark each)

**[1] Vendor service work order:**

It contains details of vehicle owner as well as vehicle, job to be done on vehicle, list of spare parts and cost, and labor cost incurred.

**[2] History sheet:**

History sheet is useful for knowing the amount spent on the maintenance of vehicle. In the remark column type of maintenance should be mentioned and reason for such repair should be found out to control the maintenance.

**[3] Activity file:**

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.

**[4] Maintenance instruction manual:**

In this, instructions are given which are helpful to carry maintenance of vehicle. It provides information, data, limits and guidelines required for maintenance work.

**[5] Spare procurement register:**

It used to analyze the requirement of spares.

**[6] Defect register:**

Defective items are entered in this register. 04

**b) Write on preventive maintenance verses break down maintenance. (Any four Points) 04**

**Preventive Vs Breakdown Maintenance:**

(Any Four Points, 1 Marks of each)

| S. N | Preventive Maintenance | Breakdown Maintenance |
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| 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. |

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| | | | | 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;<br>(i) Oil Changes<br>(ii) Chassis lubrication<br>(iii) Engine Tune up<br>(iv) Inspection and testing of various other components.<br>(v) Tyre Service | Breakdown includes:<br>(i) Starting difficulties<br>(ii) Tyre puncture<br>(iii) Electrical faults<br>(iv) Carburettor & Fuel supply faults<br>(v) Curing overheating problems<br>(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. |
| | **c)** | **Mention the affects of crank shaft wear and bearing failure on engine performance.** | | | **04** |
| | | **Effect of Crankshaft wear and bearing failure on engine performance:**<br>( List any four parameters, 1 marks each)<br><br>A crankshaft is usually distorted due to extreme operating conditions, such as "over speeding" and "lugging". It may also be caused by improper handling prior to installation. A distorted crankshaft subjects the main bearings to excessive loads, with the greatest load being at the point of greatest distortion. The result is excessive bearing wear. Also, the oil clearance spaces between journals and bearings are reduced, making it possible for metal to metal contact to occur at the point of greatest distortion.<br><br>Following are the effects of crank shaft wear and bearing failure on engine performance;<br>[1] Results in engine vibration<br>[2] Loss of power<br>[3] Excessive fuel consumption<br>[4] Wearing of other engine components<br>[5] Decrease in engine efficiencies<br>[6] It also causes the lubrication problems<br>[7] Increasing the maintenance cost | | | 04 |
| | **d)** | **What are the causes and remedies when engine does not start?** | | | **04** |
| | | **Probable causes and remedies for Engine does not start:**<br>(List down any 4 Probable causes with remedies, Each of 1 Marks) | | | |

| S. No. | Possible Causes | Remedies |
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| | | 1 | No fuel or incorrect fuel | Add the correct grade of fuel to the fuel tank | 04 |
| | | 2 | Engine in crank-without-inject mode | observe the crank-without-inject indicator & repair | |
| | | 3 | Low Engine oil level | Fill the crankcase with the appropriate engine oil | |
| | | 4 | Restriction in air intake system | Repair it | |
| | | 5 | Cold ambient temperature | Maintain the temperature | |
| | | 6 | Batteries not providing sufficient voltage | Charge the beaneries | |
| | | 7 | Battery terminals are lose or corroded | Tighten or Clean it. | |
| | | 8 | Jammed Bendix drive | Repair it. | |
| | | 9 | Open starting circuit | Repair it | |
| | | 10 | Faulty ignition switch, wiring solenoid or starter motor | Repair or Replace it | |
| | | 11 | Low compression | Repair it | |
| | | 12 | Broken teeth on Starter pinion or flywheel | Replace it | |
| | | 13 | Lack of spark due to distributor cap/rotor cap is bad | Replace it | |
| | | 14 | Defective ignition coil | Replace it | |
| | | 15 | Defective injector | Test and Replace | |
| | | 16 | Broken or disconnected fuel hose | Connect or Replace Fuel hose | |
| | **e)** | **Mention any four causes and remedies when engine emits whitish blue smoke.** | | | **04** |
| | | **Causes & Remedies when engine emits Whitish Blue Smoke:**<br>(List down any 4 Probable causes with remedies, Each of 1 Marks)<br><br>Blue or white smoke coming from your engine usually indicates burning oil, which can be caused by: | | | 04 |
| | | **S.N.** | **Possible Causes** | **Remedies** | |
| | | 1 | Overfilling the crankcase with oil. | Check and correct the oil level. | |
| | | 2 | Incorrect oil grades | Check and correct the proper oil grades. | |
| | | 3 | Operating engine at greater than a 15 Degree angle. | Check and correct. | |
| | | 4 | Inoperative crankcase breather. | Service/Repair it | |
| | | 5 | Crankcase air leak. | Remove leakages properly. | |
| | | 6 | Blown head gasket. | Replace it. | |
| | | 7 | Worn cylinder and/or rings. | Replace. | |
| | | 8 | Turning/tilting the engine on its side for storage, oil change or any other reason. | Service/Repair it. | |
| | | 9 | Damages to the cylinder/piston rings | Repair or Replace. | |
| | | 10 | Broken piston rings, ring sticking in piston grooves | Replace piston ring | |
| | | 11 | Worn out piston | Overhaul the engine, use new piston | |
| | **f)** | **State the purpose of a manifold absolute pressure (MAP) sensor used in an engine.** | | | **04** |
| | | **Purpose of Manifold Absolute Pressure (MAP) Sensor :**<br>[1] The Manifold Absolute Pressure (MAP) sensor is a key sensor because it senses engine load.<br>[2] The sensor generates a signal that is proportional to the amount of vacuum in the intake | | | |

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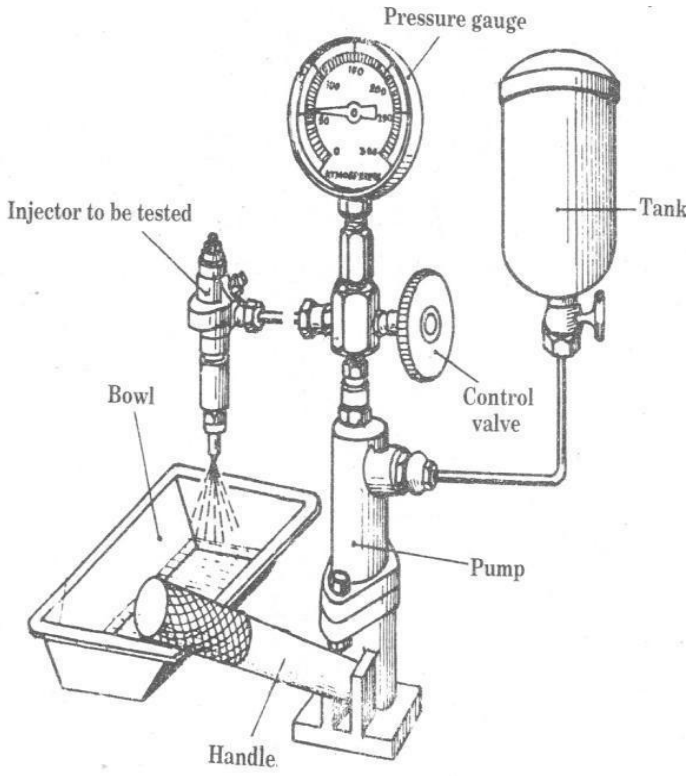
| | | manifold. The engine computer then uses this information to adjust ignition timing and fuel enrichment.<br>[3] Engines that use a MAP sensor are typically fuel injected. A fuel-injected engine may alternatively use a mass airflow sensor (MAF sensor) to detect the intake airflow.<br>[4] The MAP sensor converts engine vacuum/manifold pressure to an electrical signal so the computer knows how much load the engine is under. This data is the basis for fuel delivery and timing control.<br>[5] The MAP sensor is typically located in the air cleaner, fender wall, firewall, intake manifold or under the dash. | 04 |
| **3** | | **Attempt any <u>FOUR</u> of the following.** | **16** |
| | **a)** | **Write stepwise procedure to carry out Leak-off test of injector.** | **04** |
| | | **Answer: Procedure to carry out Leak-off test of injector.**<br>1) Fix up injector on tester.<br>2) Build up pressure of 150 atoms (1 atom = 14.7 lb/in$^2$) and keep the pressure for about 10 Second without spraying.<br>3) After 10 seconds check-up that there is no drop in pressure and wetness is not felt on tip of nozzle body.<br>If there is drop in pressure or wetness is felt on tip of nozzle body:<br>i) Dismantle the injector.<br>ii) Get the seat of nozzle body grounded.<br>iii) Get the nozzle body seat lapped.<br>If nozzle valve seat is pitted, it should be replaced or grounded.<br>4) Fix up the injector again and test it in same manner as prescribed in steps 1 to 3.<br>  <br><br>**Fig. Leak off Test**<br>(*credits will be given for right figure)* | 04 |

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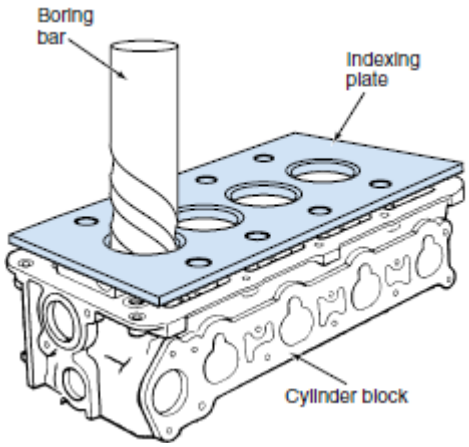
| | **b)** | **Write the procedure for re-boring of cylinder** | **04** |
| | | **Answer: Procedure for re-boring of cylinder**<br>1. Select a cylinder to be bored and the pistons will have to be replaced with the correct oversize.<br>2. Use the inspection notes to determine the oversize of the bores required to clean up the Worst cylinder.<br>3. The cylinders should be bored to the smallest oversize piston that will, clean the worst cylinder bore.<br>4. Center the cutting bit using the bottom of the cylinder where no wear has occurred.<br>5. Once the boring bar is located at the centering location, turn the control knob to expand the centering fingers. The bar may have three or four fingers The fingers contact the indexing the engine block by inserting an anchor assembly through the cylinder adjacent to the one being bored, next , raise the boring bar out of the cylinder.<br>6. Install the cutting bit into the tool holder using a micrometer that has been set to the desired dimension of the cylinder.<br>7. Fit the tool holder into the boring bar head and adjust it to the required setting using a special boring bar micrometer. The set screw locks the tool holder into the head before cutting the bore, set the feed stop to prevent the boring bit from going past the bottom of the cylinder.<br>8. Finally, set the spindle speed and feed rate. The settings used will depend upon the type of machine used, the type of material the block is constructed of, and the type of bit used.<br>9. Finally, turn on the motor and engage the feed lever. The cutting bit will work its way down the cylinder as it cuts the bore. When the bore bar reaches the bottom of its travel, turn off the motor.<br>10. Remove or relocate the cutting bit so the bore bar can be raised out of the cylinder<br>11. Without damaging the new cylinder wall surface<br>12. If a chamfer was not already cut, do so now. Check the bottoms of the cylinders for chamfer. Some chamfer should remain. A sharp edge at the bottom of the cylinder can scrape oil off of the piston skirt.<br>  <br><br>**Fig. An indexing plate is used to center the bore bar.**<br>*(Equivalent Credit shall be given for suitable sketch)* | 04 |
| | **c)** | **How will you check and adjust the fan belt tension? Explain.** | **04** |

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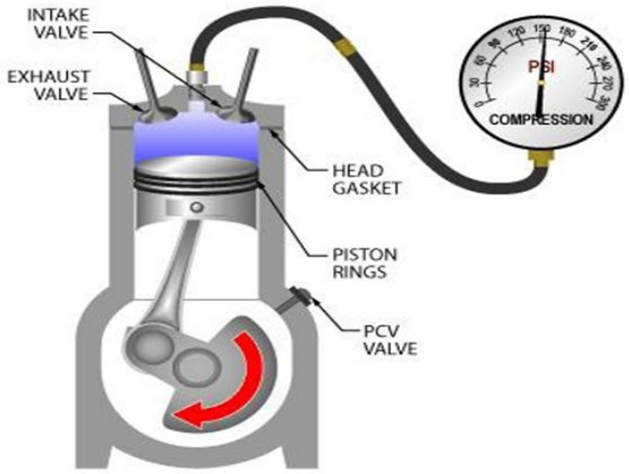
| | | **Answer:-**<br>**Checking the belt tension:**<br>1. Note the line the belt makes.<br>2. Push the belt inwards with your finger.<br>3. It should only deflect 1/2" to 3/4" (9 - 10mm).<br>**To adjust belt tension.**<br>1. Remove the pulley nut.<br>2. Observe that there are some notches in the front half of the pulley.<br>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.<br>4. By removal of bolt, see a metal bell-looking thing, and under that are some shims.<br>5. Remove the rear pulley half.<br>6. Then add or subtract shims as required to bring your belt tension into specification**.** | 02<br><br>02 |
| | **d)** | **Describe the procedure for checking the compression of the engine.** | **04** |
| | | **Answer: - Procedure for checking the compression of the engine.**<br>All cylinders must have equal compression An engine can lose compression by leakage of compression through one or more of only three routes<br>• Intake or exhaust valve<br>• Piston rings<br>• Cylinder head gasket<br>For best results the engine should be warm to normal operating temperature before testing. An accurate compression test should be performed as follows-<br>1) Removes all spark plugs. This allows the engine to be cranked to an even speed. Be sure to label all spark plug wires.<br>2) Block opens the throttle. This permits the maximum amount of air to be drawn into the engine. This step also ensures consistent compression test results.<br>3) Thread a compression gauge into one spark plug bole and crank the engine. Continue cranking the engine through four compression strokes. Each compression stroke makes puffing sound<br>4) Record the highest and compare the results.<br>  <br><br>*(Equivalent Credit shall be given to 2-D diagram)* | 04 |
| | **e)** | **What are the reasons of high oil consumptions? (Any four points)** | **04** |

**Answer:** (*Any four points: 1 mark for each point )*

1. High Engine Speed.
2. Engine wear and engine sealing, wear of rings and cylinder walls.
3. Wear between the valve guide and stems.
4. External leakage.
5. Loose main or connecting rod bearings.
6. Tapered or out of round cylinders.
7. Worn out piston rings, piston or scored liner.
8. Worn oil seals (front and rear main bearings).
9. Clogged oil return pipe.
10. Worn out rear camshaft oil seals.
11. Clogged air breather.
12. Leaky fuel pump vacuum booster.
13. Excessive clearance in intake valve guide.
14. Improperly installed oil pan.

04

**4a) Attempt Any <u>THREE</u> of the following.** **12**

**i) What are the troubles that occurs in the cooling system and give its remedies?(Any four)** **04**

**Answer:-** *( Any four troubles & remedies:-1 mark for each)*

| Sr No | Troubles | Remedies |
|---|---|---|
| 1 | Engine Overheating | 1. Maintain coolant level.<br>2. Top up to the correct level.<br>3. Repair or replace radiator.<br>4. Replace the defective hose and to tighten the various connection.<br>5. Remove scaling with use of suitable chemical and reverse flushing.<br>6. Repair or Replace the pump.<br>7. Replace the valve.<br>8. Replace the fan belt.<br>9. Repair or replace warpage cylinder head. |
| 2 | Slow warm up | Thermostat valve tested or replaced. |
| 3 | Leak, loss of coolant. | 1. Replace the defective gasket<br>2. Replace Leaky or broken hose pipe.<br>3. Repair the radiator |
| 4 | Overcooling | 1. Thermostat valve tested or replaced.<br>2. Check Temperature gauge. |
| 5 | Poor circulation | 1. Top up sufficient cooling.<br>2. Repair or replace water pump.<br>3. Adjust fan belt<br>4. Check thermostat valve. |
| 6 | Noise in cooling system | 1. Replace bearing<br>2. Adjust the pulley on the pump shaft.<br>3. Adjust the end play in the shaft. |
| 7 | Water loss | 1. Avoid boiling of water by adding proper grade of coolant. |

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| | | | | 2. Repair external and internal leakages<br>3. Thermostat valve tested or replaced. | |
| | **ii)** | **Mention the causes of low oil pressure in the engine.** | | | **04** |
| | | **Answer: Low oil pressure in the engine.** *(Any 4 Causes :1 Mark Each)*<br>**Causes:**<br>1. Less oil in crank case.<br>2. Use of low viscosity oil or diluted oil in sump.<br>3. Low grade of oil or poor quality of oil.<br>4. Worn out main and big end bearing.<br>5. Leaky filter, oil pipe or oil pumps.<br>6. Bypass valve spring defective.<br>7. Maladjustment of regulating valve spring.<br>8. Defective oil pressure gauge.<br>9. Too much play in oil pump gears.<br>10. Choked suction strainer of oil pump.<br>11. Choke oil gallery or suction pipe. | | | 04 |
| | **iii)** | **Write the procedure for finding out condition of $O_2$ Sensor by a voltmeter.** | | | **04** |
| | | **Answer: Procedure for finding out condition of $O_2$ Sensor by a voltmeter.**<br>1. Start the car and let it run until vehicle is warm, it usually takes 5-8 minutes.<br>2. Connect the back probe to the oxygen sensor signal wires.<br>3. Connect the positive lead from the digital voltmeter to the back probe.<br>4. Connect the negative lead from the digital voltmeter to a good solid ground point on the chassis of the vehicle.<br>5. Turn the voltmeter on a set it to 1 volt scale. The voltage of the O2 sensor. Will fluctuate between 1000 and 1000 milli volts which are 0.1 and 1.0 volts.<br>6. Turn the vehicle back on and check the reading on voltmeter. The reading should fluctuate rapidly. If reading stays at around 0.5 volts. Ensure that the vehicle is fully warm up .if the vehicle is warm up and the O2 sensor reading does not changes, then there is problem in O2 sensor and stop the test. | | | 04 |
| | **iv)** | **What is clutch grabbing and chattering? Write its causes.** | | | **04** |

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| | | **Answer:-** *( Explanation: 1 marks, causes: 3 marks )*<br>**Grabbing and chattering of clutch:**<br>A clutch is said to be grabbing and chattering when it does not engage smoothly. A grabbing clutch during engagement causes the vehicle to move in a series of jerk. A chattering clutch causes the vehicle to vibrate during engagement.<br>**Causes of grabbing and chattering clutches are :** *(any four)*<br>1. Grease or oil on lining or facing. Burned or glazed facing.<br>2. Worn splines on clutch gear.<br>3. Too much play between gears.<br>4. Loose engine mountings.<br>5. Warped pressure plate or flywheel.<br>6. Hardened lining due to dirt and wear.<br>7. Bent or tight release shaft.<br>8. Cracked or damaged pressure plate or flywheel.<br>9. Badly turned engine.<br>10. Worn bearing in rear axle or transmission.<br>11. Tight splines on the driven shaft.<br>12. Misalignment. | 01<br><br>03 |
| | **b)** | **Attempt any ONE of the following**. | **06** |
| | **i)** | **Explain how you will carry out phasing procedure of F.I.P. on test bench.** | **06** |
| | | **Answer: Phasing of fuel injection pump:**<br>**Procedure:**<br>The camshaft of the pump rotates at half the speed of the crankshaft. Therefore, the supply of oil from each plunger should be at 900 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 900. The adjustment of fuel pumps at correct timing intervals is known as the as the 'phasing of the pump'.<br>1. Pump element No. 1 is first kept at its TDS.<br>2. The setting of the other pump elements is then checked.<br>3. The gap between the lower end of the plunger and the top of the tappet roller should be 0.5 mm.<br>4. If the position of the plunger can be raised or lowered in the barrel by means of an adjusting screw.<br>5. After this gap is made uniform for every plunger, element the phasing should be started.<br>6. The point of port closer in each element should be correctly noted.<br>7. This is done by gradually lifting the plunger from its bottom position.<br>8. For this the valve and valve spring are removed from the pump element.<br>9. As the plunger goes up gradually, the oil coming out of this valve keeps reducing.<br>10. When the plunger is just closing the two ports, the oil supply from the valve passage stops. This is found out by the attaching a swan neck pipe for the closure point of cut off to the pump barrel.<br>11. When the plunger moves up there is a supply of the fuel through this neck. When the plunger closes the ports, the supply of the fuel from the swan neck pipe stops.<br>12. Thus, the exact position of the timing of closure of the two ports can be found out. All other elements can be tested in a similar way. The difference one element and the | 06 |

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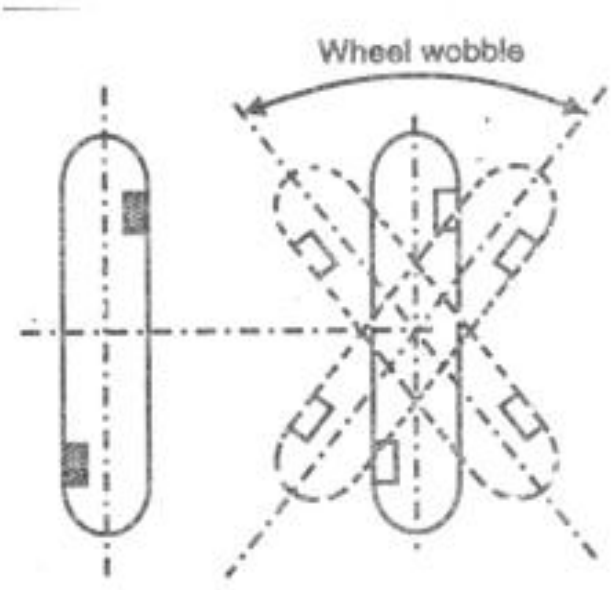
| | | other should be $90^0$. The phasing of the diesel pump can now be easily done. | |
| | **ii)** | **Write procedure for dynamic wheel balancing** | **06** |
| | | **Answer:** *( Procedure: 3 marks ,Sketch: 3 marks)*<br>**Procedure for Dynamic Balance:**<br>1. Mount the wheel on balancing machine.<br>2. Rote the wheel at different speeds.<br>3. Wheel balancer shows how much weight is to be attached and on location.<br>4. Then clip the required weight on both sides of rim opposite to heavy spot.<br>**5.** Recheck the wheel for balancing.<br>  <br><br>**Fig. Dynamic balancing.** | 03<br><br>**03** |
| **5** | | **Attempt any FOUR of the following** | **16** |
| **5** | a) | **Write possible causes and remedies of clutch noises.** | **04** |
| | | **Clutch Noise: (Any four)**<br>Sr. \| Causes \| Remedies<br>1 \| Worn out clutch components \| Repair/Replace with new one.<br>2 \| Excessive free play \| Adjust properly.<br>3. \| Weak/Broken pressure spring \| Replace<br>4. \| Insufficient clutch pedal travel adjustment \| Adjust the clutch pedal<br>5. \| Bent friction/pressure plate \| Replace | 04 |
| **5** | b) | **Write major causes for slipping out of gear.** | **04** |
| | | **Major Causes for slipping out of Gear: (Any four)**<br>1) Weak springs of fork rod.<br>2) Worn out teeth of sleeve or gears.<br>3) Worn out bearing of clutch shaft or main shaft or counter shaft.<br>4) Worn out synchronizer rings. | 04 |

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|---|---|---|---|
| | | 5) Too much play in gear shifting mechanism. | |
| **5** | c) | **Write the procedure for checking crown wheel and pinion back lash.** | **04** |
| | | **Procedure for checking crown wheel and pinion back lash:**<br>1) Fix up dial gauge on differential housing.<br>2) Make the pointer of dial to rest on one teeth of crown wheel.<br>3) Set the dial to zero reading.<br>4) Move the crown wheel on both sides without moving the pinion.<br>5) Note the reading on gauge.<br>6) The maximum play should be 0.18mm. | 04 |
| **5** | d) | **Write possible causes when vehicle dose not move when put in gear.** | **04** |
| | | **Possible causes when vehicle dose not move when put in gear: (Any four)**<br>1) The brakes may be locked up. (Hand Brake pulled, fluid contamination or a brake master cylinder failure.)<br>2) Clutch plate totally worn out.<br>3) Clutch doesn't engage with the fly wheel.<br>4) Clutch slipping.<br>5) Clutch housing in the transmission fail and lock up.<br>6) Transmission system problem.<br>7) Fault in shift linkage.<br>8) For automatic transmission -Transmission fluid level is less.<br>Excessive fluid leaks.<br>Detached fluid lines. | 04 |
| **5** | e) | **Describe clutch plate reconditioning procedure.** | **04** |
| | | In most cases, the clutch disc is replaced when any kind of clutch teardown is done, since it is relatively inexpensive. If the disc was recently replaced or appears to be in excellent condition, it can be reused. Before deciding to reuse the disc, it should be carefully checked.<br>Inspect the lining on the clutch disk for wear.<br>The clutch disc has brake pad material on either side of it which is held on by rivets. When this lining wears it allows the rivets to contact the flywheel or pressure plate which causes the clutch to slip.<br>There should be at least 2mm of friction material remaining above the rivet heads.<br>Check the clutch disk for loose rivets, distortion, cracks, broken springs and other obvious damage.<br>Check the clutch disk for runout.<br>Verify that the clutch disk slides freely on the drive shaft splines without excessive radial play. | 04 |
| **5** | f) | **With a neat sketch explain pressure bleeding procedure for hydraulic brake system.** | **04** |
| | | **Answer:**(*Description -2 Marks, Fig.-2 Marks)*<br>**Pressure Bleeding Procedure of hydraulic brake system**:<br>Pressure Bleeding a) Using air b) By forcing brake fluid<br>**Pressure bleeding:***(Credit should be given any equivalent Figure)*<br>Pressure bleeder is a device used for bleeding procedure which is attached to the master cylinder. The pressure bleeder supplies pressurized brake fluid to master cylinder.<br>When bleeder screw is opened, the pressure force air and brake fluid out of the bleeder screw.<br>With a pressure bleeder, you can bleed the hydraulic system without any helper. The pressure used in a pressure is usually 104 to 138 KPa | 02 |

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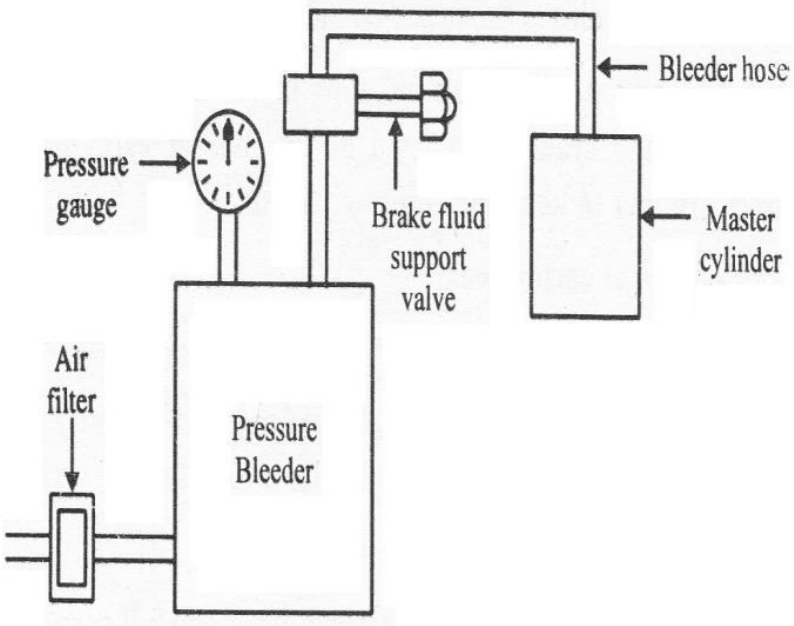
| | |  | 02 |
| **6** | | **Attempt any FOUR of the following** | **16** |
| **6** | a) | **Explain 'X' or diagonal method for chassis frame alignment.** | **04** |
| | | **'X' or diagonal method for chassis frame alignment:**<br>1) Place the vehicle on plane leveled ground.<br>2) Mark the markings on the floor from all the points from which measurements should be taken by dropping the plumb bob directly underneath the point.<br>3) Move the vehicle away from the layout on floor.<br>4) Check frame width at front and rear end. If width is corresponds to specification, draw a centre line up to full length of the vehicle half way between marks indicating front and rear width. If frame width is not correct draw centre line through intersections of any two pairs of equal diagonals.<br>5) With the centre 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 be vary.<br>6) To locate the points at which the frame is sprung measure the diagonals marked in pairs A-B, B-C, 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 centre line. | 03 |

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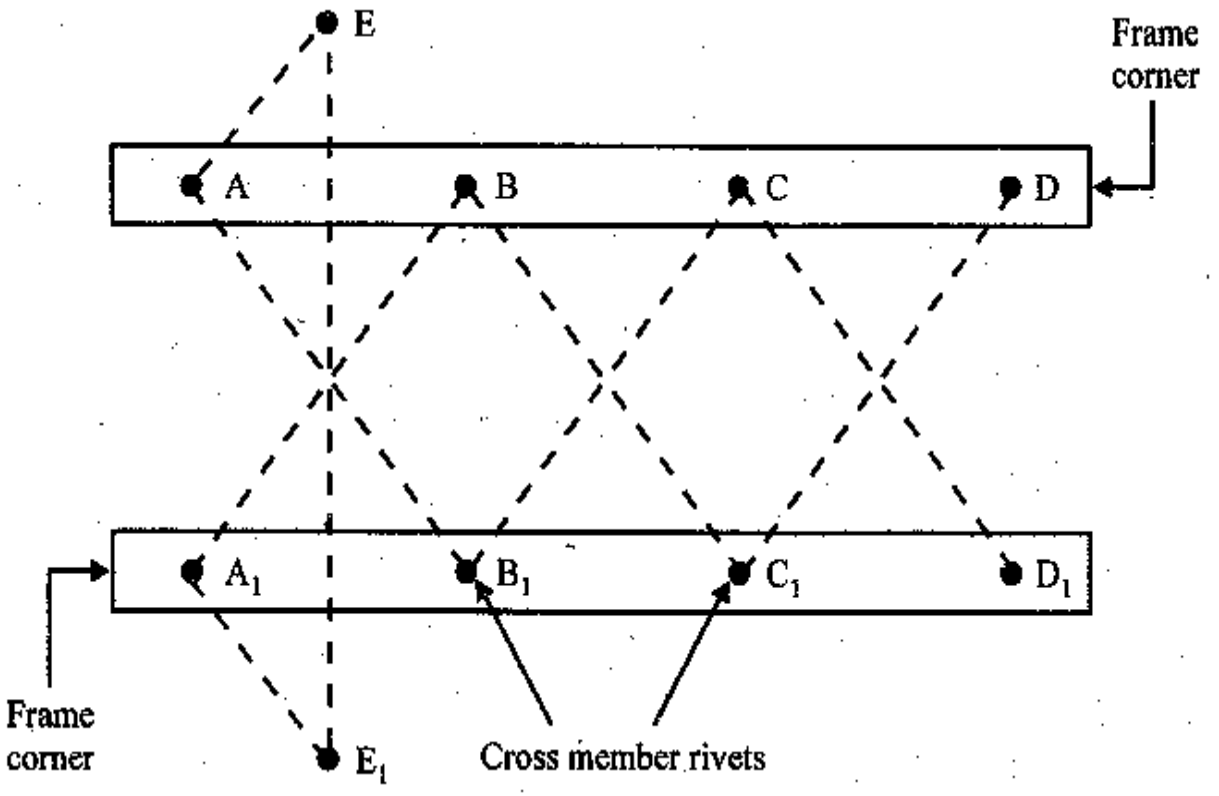
| | |  | 01 |
| **6** | b) | **Write cold retreading process for tyre.** | **04** |
| | | **Cold retreading process for tyre:**<br>1. **Inspection:** The surface of the tyre must be intact; both the sides should not have oversize mangled.<br>2. **Drying**: Clean the tyre, and then dry it.<br>3. **Buffing:** After drying, the tyre's old tread is mechanically removed on high speed buffers. Then people make second polishing and section repairs.<br>4. **Building-tread rubber:** The buffed tyre needs a thin layer of cushion gum to be wrapped around its crown area. The pre-cured tread rubber is then applied with the Tire Surface Press fit Machine.<br>5. **Enveloping:** The built tyres are then mounted with envelops and rims to prepare them for curing.<br>6. **Fixing steel ring:** After enveloping the tyre, fix them on the felly on the working platform. And they are ready for being made vacuum and vulcanization.<br>7. **Curing by pre-cure pots:** The tyre is then placed in a pre-cure pot and pre-cured tread becomes adhered to the tyre through a vulcanizing process.<br>8. **Final inspection:** The retreaded tyre is subjected to a final inspection. This inspection insures that only tyres that meet industry quality standards are allowed to leave the retread plant. | 04 |
| **6** | c) | **Describe painting process after the surface is well prepared for painting.** | **04** |
| | | **1) Bond rising:**<br>To increase bonding strength of paint or to get a firm bond of paint of metal surface the work surface is passed through tanks of different solutions for several periods. The solutions may be alkies oxides distilled water bath etc.<br>**2) Primer coating:**<br>Primer coating is done as protective and anticorrosive treatments. It gives a necessary paint | 04 |

film thickness and close adheres of paint over a base metal.

**3) Sanding and putty operation:**

Sanding is done to improve appearance of primer surface by removing flaws defects, bents, damages etc. Putty is applied with a material strip to all surfaces to emit paint shop defects.

**4) Final painting:**

In this coating is done with the paint. Two three coats of paint are applied to base metal.

**6 d) Write procedure for checking and replacement of loose rivets. 04**

**Loose Rivets:**

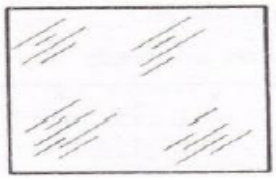
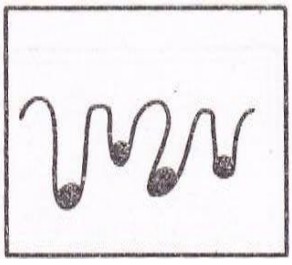
Check for loose rivets especially in the vehicle which are being overloaded or run on bad road. The loose rivets can easily be detected by presence of the rust or bur around the rivets by visual inspection and then tapping it with a hammer. If found loose, it should be removed and a new rivet should be placed immediately. 02

**Replacement of loose 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. 02
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.

**6 e) Explain the following terms with regard to defects found in painting. 04**

**i) Cracking**
**ii) Run and sags**
**iii) Blistering**
**iii) Fish eye**

| | Defects | Description |
|---|---|---|
| 1 | **Cracking**  | Fine minute cracks in the finish usually only appear on the surface of the paint film. This condition is generally caused by too heavy of film of lacquer top-coat or by sudden temperature changes the surface has to be sanded and refinished |
| 2 | **Run and sags**  | A paint film that has dropped under its own weight and display a thick edge or wrinkle at a lower part. It is caused by to heavy application of paint |
| 3 | **Blistering** | This condition is caused by oil and moisture in spray line or temperature variation between shop material and surface to be painted or by high |

(1 Mark each)

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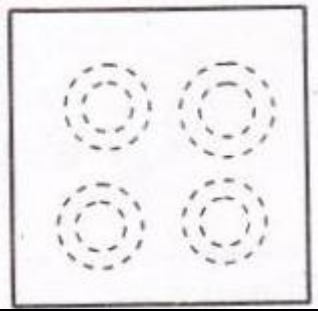
| | | |  | humidity conditions. | | |
| | | 4 | **Fish eye**<br>  | Fish eyes are small quasi-circular areas of substrate that are exposed through the applied coating.<br>Fish eyes can be caused by oily spots or silicone particles and/or by airborne droplets deposited on the painted surface.<br>It is produced when a coating is contaminated with particles such as oil, wax, grease or silicone. | | |