



Winter – 15 EXAMINATION
Model Answer

Subject Code: 17618

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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 judgment 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.

	Marks
1. a) Attempt any <u>THREE</u> of the following-	12
i) Write the function of following equipments. <ol style="list-style-type: none"> 1) Wheel balancer 2) Valve grinder 3) Engine analyser 4) Cylinder boring 	4
Answer : (Each correct function carries 1 mark) <ol style="list-style-type: none"> 1. Wheel balancer: To detect imbalance in the wheel and locate the position of weight to be added to balance the wheel. 2. Valve Grinder: To reface the valve face, valve stem, valve seat, valve angle. 3. Engine analyser: To check engine rpm, dwell angle, contact breaker point gap, cylinder leakage, oil temperature, exhaust emission, vacuum checking, engine performance, battery charging, engine timing, spark leakage, engine troubles etc. 4. Cylinder Boring: To bore holes in large and heavy parts such as engine block. 	4
ii) State general safety precautions and procedure to be followed in auto workshop.	4
Answer: General safety precautions and procedure to be followed in auto workshop are as follows: (Consider any four points. Each point carries 1 mark) <ol style="list-style-type: none"> 1. Keep the tools and equipment at specified place. 2. Don't wear loose clothes 3. Never work under a car when it is supported by screw jack only. Use proper stands before going under. 4. Be careful while working with spring under compression e.g. clutch. 5. Don't clean cloth by compressed air because dirt particle may embed in your skin causes infections. 6. Never run the engine in a closed space without proper ventilation. 	4



<ol style="list-style-type: none">7. Don't smoke in auto workshop because petrol and diesel are highly flammable.8. Keep the place of work clean.9. Clean up any spilled oil, fuel or grease.10. Wear safety shoes, safety goggles, helmet.	
iii) State the general maintenance schedule for two wheeler on the kilometers travelled basis.	4
<p>Answer: General maintenance schedule for two wheeler on the kilometers travelled basis.</p> <p>a) 500 to 750 Kms</p> <ol style="list-style-type: none">1) Check and adjust idle speed / CO%, valve tappet clearance, drive chain slackness, clutch play, throttle play, brake play, steering play gap between reed switch and TPS magnet (as applicable to model)2) Top up engine oil specified by the manufacturer.3) Replace engine oil filter.4) Clean air filter, oil strainer5) Check fuel pipes.6) Check and adjust coolant level in expansion tank, brake fluid level (as applicable to model)7) Check battery electrolyte level and specific gravity.8) Check and replace brake lining9) Clean and adjust spark plug gap10) Check and tighten rear sprocket fastener.11) Check and tighten front and rear spoke (as applicable to model)12) Check and clean ignition switch contacts13) Check and adjust rear brake switch14) Check and tight loose fasteners.15) Wash the vehicle.16) Lubricate the vehicle. <p>b) 4500 to 5000 Kms</p> <ol style="list-style-type: none">1) Follow procedure of maintenance for 500 to 750 Kms2) Clean fuel cock sediment bowl3) Check and replace coolant hose (as applicable to model)4) Check and adjust radiator fins (as applicable to model)5) Check and tight battery connections6) Lubricate brake cam and pedal pivot pin (as applicable to model)7) Clean silencer drain hole, silencer tail pipe8) Replace drive chain link lock9) Check auto choke (as applicable to model)10) Lubricate starter clutch (as applicable to model)11) Check wiring harness.12) Check and tighten starter motor and starter relay connections, HT coil connections.13) Check and clean step- pillion LH and RH ball, plate (as applicable to model) <p>c) 9500 to 10000 Kms</p> <ol style="list-style-type: none">1) Follow procedure of maintenance for 4500 to 5000 Kms2) Clean carburetor float chamber3) Check and replace rear wheel rubber shock damper4) Replace front fork oil, oil seal	4



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<p>5) Check, clean, lubricate clutch switch, brake switch contacts (as applicable to model) 6) Check, clean, lubricate, replace steering stem bearing (as applicable to model) 7) Check and replace cap steering bearing. (as applicable to model)</p> <p>d) 14500 to 15000 Kms</p> <ol style="list-style-type: none"> 1) Follow procedure of maintenance for 9500 to 10000 Kms. 2) Replace air filter cover 'O' ring 3) Replace inline paper filter along with hose and clamps, fuel cock paper filter element and seal (as applicable to model) 4) Clean and adjust carburetor 5) Replace fuel pipes 6) Replace engine foundation silent bushes (as applicable to model) <p>e) 19500 to 20000 Kms</p> <ol style="list-style-type: none"> 1) Check engine compression pressure 2) Decarburizing of cylinder head 3) Replace engine air breather tube 4) Replace front fork oil <p>f) 24500 to 25000 Kms Follow procedure of maintenance for 9500 to 10000 Kms</p> <p>g) 29500 to 30000 Kms</p> <ol style="list-style-type: none"> 1) Follow procedure of maintenance for 9500 to 10000 Kms 2) Replace brake fluid, front brake hose, master cylinder piston kit, caliper piston seal and dust seal. <p><i>Note: Equivalent credit shall be given to any other suitable schedule.</i></p>																					
<p>iv) Describe the troubles, causes and remedies of cooling system.</p>	4																				
<p>Answer: Trouble causes and remedies of cooling system.</p> <p>1. Overheating. (Any two point, 1 mark each)</p> <table border="1" data-bbox="219 1407 1469 1942"> <thead> <tr> <th>Causes</th> <th>Remedies</th> </tr> </thead> <tbody> <tr> <td>1. Less coolant level in radiator</td> <td>Maintain coolant level.</td> </tr> <tr> <td>2. Lack of oil in oil sump.</td> <td>Top up to the correct level</td> </tr> <tr> <td>3. Defective radiator</td> <td>Repair or replace</td> </tr> <tr> <td>4. Defective hose or faulty connection.</td> <td>Replace the defective hose and to tighten the various connection.</td> </tr> <tr> <td>5. Accumulation of rust or scale in the coolant jacket and radiator.</td> <td>Remove scaling with use of suitable chemical and reverse flushing.</td> </tr> <tr> <td>6. Defective water pump</td> <td>Repair or Replace the pump</td> </tr> <tr> <td>7. Defective thermostat valve.</td> <td>Replace the valve.</td> </tr> <tr> <td>8. Loose or defective fan belt</td> <td>Replace the fan belt.</td> </tr> <tr> <td>9. Warpage of cylinder head</td> <td>Repair or replace</td> </tr> </tbody> </table>	Causes	Remedies	1. Less coolant level in radiator	Maintain coolant level.	2. Lack of oil in oil sump.	Top up to the correct level	3. Defective radiator	Repair or replace	4. Defective hose or faulty connection.	Replace the defective hose and to tighten the various connection.	5. Accumulation of rust or scale in the coolant jacket and radiator.	Remove scaling with use of suitable chemical and reverse flushing.	6. Defective water pump	Repair or Replace the pump	7. Defective thermostat valve.	Replace the valve.	8. Loose or defective fan belt	Replace the fan belt.	9. Warpage of cylinder head	Repair or replace	2 1
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2) Slow warm up.

Causes	Remedies
1. Defective thermostat valve.	It may be tested or replaced.

3) Leak, loss of coolant.

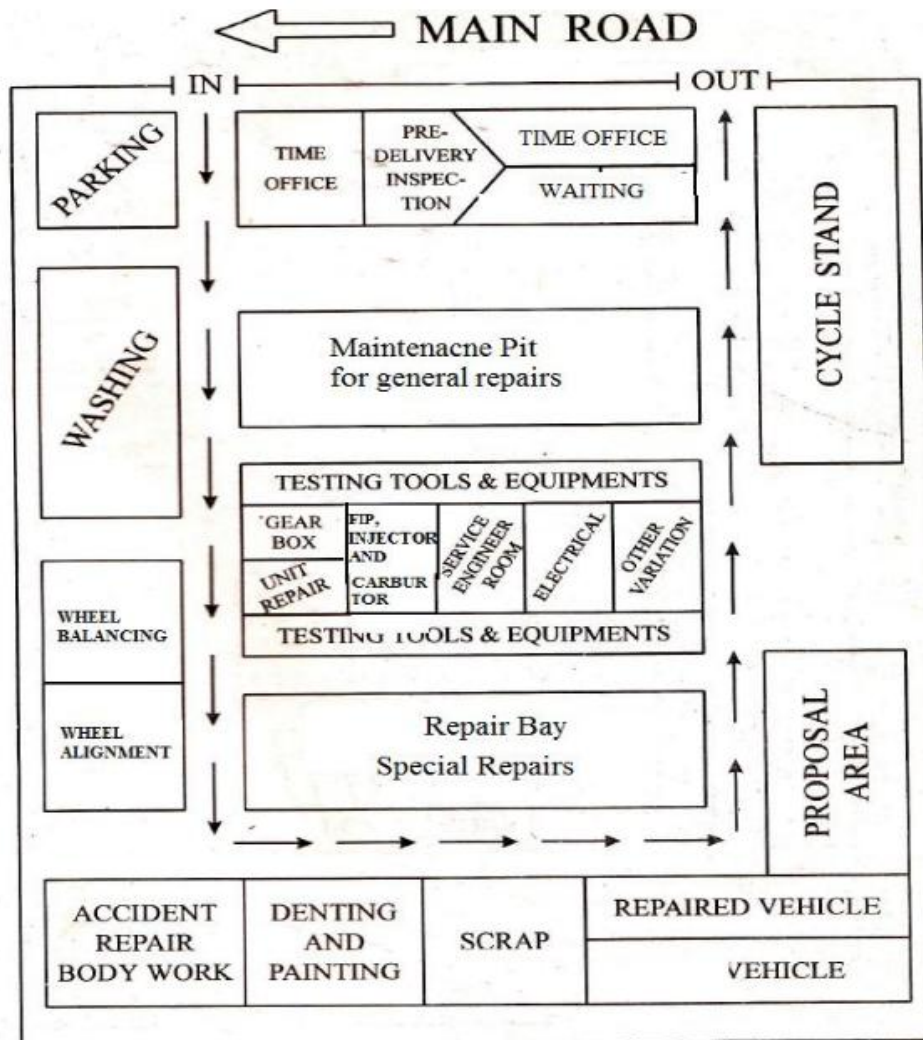
Causes	Remedies
1. Defective gasket	Replace the gasket
2. Leaky or broken hose pipe	Replace
3. Radiator leakage	Repair

b) Attempt any ONE of the following:

i) Draw the layout required for garage servicing different make of 20 passenger cars per day. List important generalized and specialized equipments required for the same

Answer:

Layout for garage servicing different make of 20 passenger cars per day.:(Note: Credit should be given to suitable layout)





Generalized Equipments: Battery charger, Ignition timing Light, Arbor press, Hydraulic press, Hydraulic Jack, Car Lifts, Electric Drill, Vehicle washer, electric soldering iron, grease gun,	1
Specialized equipments Computerized wheel aligner, Ignition timing Light, Head light aligner, Engine analyzer, Fuel injector tester, Wheel balancer, tyre changer, brake tester	1
ii) Describe preventive maintenance procedure for heavy vehicle.	6
Answer: Preventive maintenance procedure for heavy vehicle. Daily <ul style="list-style-type: none">• Water level or liquid level in radiator.• Oil level of engine.• Tyre pressure.• Braking system• Electrical system Weekly <ul style="list-style-type: none">• Fuel Level in fuel tank.• Clean the vehicle.• Lubrication of the vehicle.• Tighten the nut and bolts.• Battery electrolyte level• Clean air filter. Monthly <ul style="list-style-type: none">• Check brake and clutch pedal play.• Engine oil change.• Wheel alignment.• Change fuel filters.• Checking fan belt tension and adjusting if necessary.• Greasing of wheel bearing.• Wheel alignment.• Clutch pedal play and brake pedal play adjustment.• Engine tuning.	6
2. Attempt any <u>FOUR</u> of the following	16
a)List the documents which are to be maintained in automobile workshop and show the format of historysheet.	4
Answer: The documents required to be maintained in automobile workshop are- <ol style="list-style-type: none">1) Vendor service work order2) History sheet3) Activity file4) Maintenance instruction manual5) Spare procurement register6) Defect register	2



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Format of History Sheet:								
History Sheet								
Name of vehicle owner								
Address						Contact No.		
Registration No.				Make		Model		
Engine Number				Chassis No.			Colour	
Sr No	Arrival time and date	Departure time and date	Odometer reading	Description of service	Cost of repair	Remark	Sign of Owner	Sign of Works Manager
1								
2								
3								
b) State the necessity of maintenance of Automobiles								
<p>Answer: (Any four points - 1 mark each)</p> <p>Necessity of maintenance: In order to ensure satisfactory operation of motor vehicle and freedom from troubles, it is necessary to provide maintenance attention towards certain specified items of the motor vehicle at regular intervals</p> <ol style="list-style-type: none"> Many possible troubles can be prevented from happening by taking proper care and maintenance of motor vehicle Regular maintenance increases life of vehicle and also it provide safety to passengers and other road users. Regular maintenance also improves the performance of vehicle, availability or maximum utilization of vehicle and improve economically operation. To keep vehicle in good running condition, reduce breakdown of vehicle and accidents. To reduce repair cost 								
c) State various tests conducted when engine power decreases. Describe any one test with neat sketch.								
<p>Answer: (Types- 1 Mark, Description any one test - 3 Marks)</p> <p>Various tests to be conducted when engine power decreases</p> <ol style="list-style-type: none"> Compression test Vacuum test Cylinder leakage test <p>1. Compression test:</p> <p>All cylinders must have equal compression An engine can lose compression by leakage of air through one or more of only three routes</p> <ul style="list-style-type: none"> Intake or exhaust valve Piston rings Cylinder head gasket <p>For best results the engine should be warm to normal operating temperature before testing. An accurate compression test should be performed as follows-</p>								



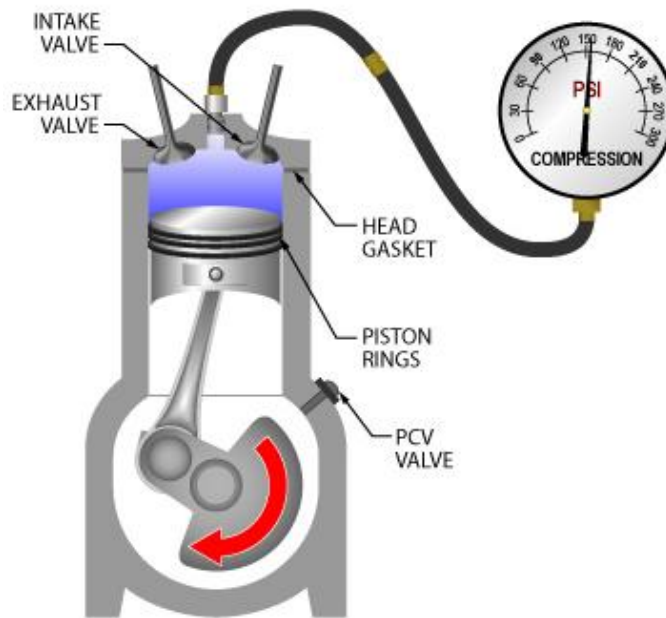
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- 1) Removes all spark plugs. This allows the engine to be cranked to an even speed. Be sure to label all spark plug wires.
- 2) Block opens the throttle. This permits the maximum amount of air to be drawn into the engine. This step also ensures consistent compression test results.
- 3) Thread a compression gauge into one spark plug hole and crank the engine. Continue cranking the engine through four compression strokes. Each compression stroke makes puffing sound.
- 4) Record the highest and compare the results



(Equivalent Credit shall be given to 2-D diagram)

2) Vacuum testing: Cranking vacuum test:

Measuring the amount of manifold vacuum during cranking is a quick and easy test to determine if the piston ring and valves are properly sealing (For accurate results the engine should be warm and the throttle closed)

1. Disable the ignition
2. Connect the vacuum gauge to a manifold vacuum source.
3. Crank the engine while observing the vacuum gauge.

3. Cylinder leakage test

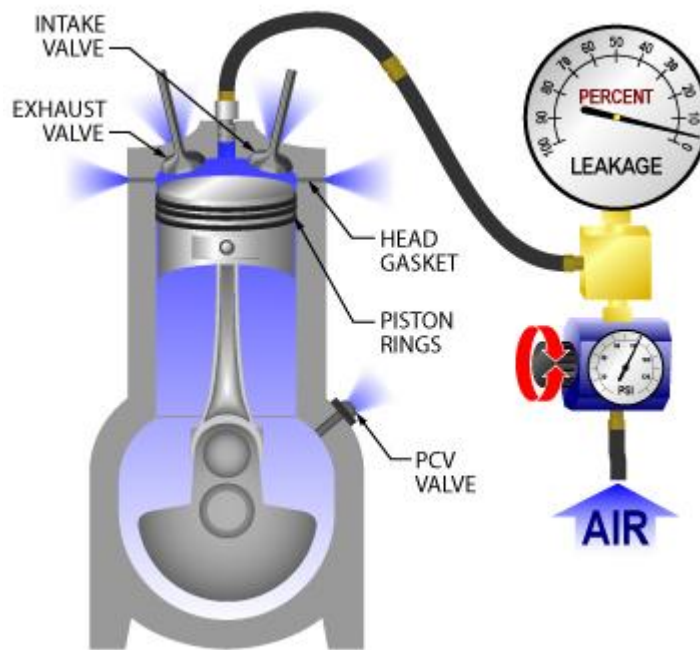
- 1) Engine should be at normal operating temperature.
- 2) The cylinder being tested must be at top dead center of the compression stroke
- 3) Calibrate the cylinder leakage unit as per manufacturer instructions.
- 4) Inject air into the cylinder, one at a time, rotating the engine as necessity by firing order to test each cylinder at TDC on the compression stroke.
- 5) Evaluate the results.
Less than 10% leakage- Good
Less than 20% leakage- Acceptable
Less than 30% leakage- Poor
More than 30% leakage- Definite problem

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- 6) Check the source of air leakage
- if air is heard escaping from the oil filter cap, the piston rings are worn or broken
 - If air is observed bubbling, out of the radiator there is possible blown head gasket or cracked cylinder head.
 - if the air is heard coming from carburetor or air inlet on fuel injection equipped engines there is defective intake valve.
 - If air is heard coming from the tail pipe, there is defective exhaust valve.



(Equivalent Credit shall be given to 2-D diagram)

OR

Procedure of hydrostatic test:

A hydrostatic test on cylinder block is done to detect any leakage or crack present in the cylinder block.

- Before testing it is necessary to clean the cylinder block thoroughly and inspect carefully.
- Mount the cylinder block on test bench, supply hydraulic fluid under pressure, usually water, which may be dyed to aid in visual leak detection, and pressurization of the cylinder block to the specified test pressure into passages of cylinder block.
- Note the pressure of fluid in cylinder block, if fluid pressure is drop it indicates the leakage in cylinder block.
- The location of a leak can be visually identified more easily if the water contains a colorant.
- If the crack is detected, it can be repaired but the usual practice is to replace the block.

d) Predict what will happen when water level is below minimum level mark in radiator. State the cause and remedial action to be taken.



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Answer: If water level is below minimum level mark in radiator then

- The temperature of working parts will be raised causing excessive distortion.
- The properties of lubricating oil will be adversely affected due to rise in temperature, lubrication will fail
- Engine will overheat soon.
- Engine will run at high temperature which results in pre-ignition, detonation, knocking, burning of piston, burning of valve
- Water will boils and evaporates.
- Engine will seize.

2

Causes and remedial action to be taken.(Any Two)

No.	Causes	Remedies
1	Chocked or leaky hose pipe	Clean, tighten or replace
2	Leaky water pump	Repair or replace
3	Leak in radiator	Repair or replace
4	Leak from water drain cock	Repair or replace
5	Cracked cylinder wall	Repair or replace
6	Loose cylinder head bolt	Tight bolt properly
7	Leak in heater connection or plug, water temperature plug gauge	Repair or replace .
8	Loose pressure cap.	Fit it properly or replace

2

e) Describe the diagnosis for excessive oil consumption.

4

Answer:

Diagnosis for excessive oil consumption:

The main factors that increase oil consumption are - engine speed, engine wear and engine sealing.

- Engine Speed:** High speed produces high oil temperature and thin oil or low viscosity. This combination causes more oil to be thrown onto the cylinder walls, piston rings, moving at high speed cannot function effectively. So more oil work up to the combustion chamber past the rings. In addition, churning effect on the oil into the crankcase creates more oil vapour or mist at high speed and so more oil is lost through the crankcase ventilation system.
- Engine wear: Rings and cylinder walls:** Another common cause of excessive oil consumption is passage of oil to the combustion chamber between piston rings and cylinder walls. These result from worn, tapered or out of round cylinder walls or worn carboned piston rings. When the bearings are worn, excessive amount of oil thrown onto the cylinder walls.
- Intake valve guide:** Oil can enter the combustion chamber through clearance cause by wear between the valve guide and stems. When the clearance is excessive; oil is drawn into the combustion chamber on each intake stroke. If underside of the valve has an excessive amount of carbon, there is possibility of the valve guide and valve stem are excessively worn out.
- External leakage:** Oil leakage may observe from oil pipe line, drain plug of sump, oil sump gasket, tappet cover gasket, fuel pump gasket, oil filter gasket, crankshaft main oil seal from front and rear etc.

1

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1



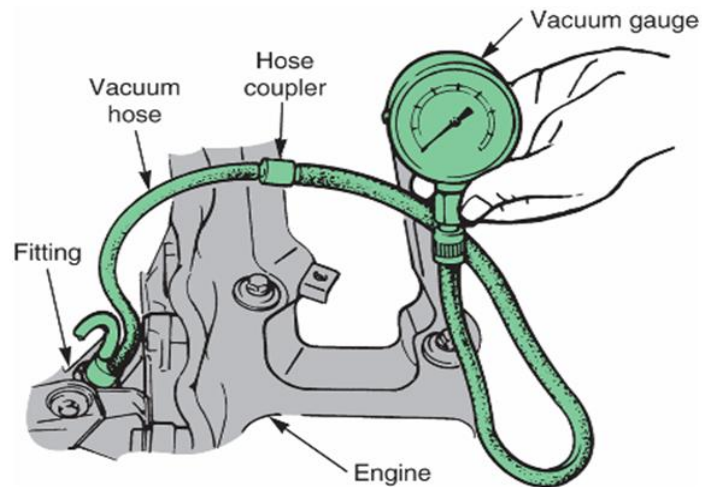
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f) State the sequential steps for FIP phasing.	4
<p>Answer: Phasing of fuel injection pump:</p> <p>The camshaft of the pump rotates at half the speed of the crankshaft. Therefore, the supply of oil from each plunger should be at 90^0 differences for a four cylinder engine. This means that the timing of fuel delivery and cut off between one cylinder and the other should be 90^0. The adjustment of fuel pumps at correct timing intervals is known as the 'phasing of the pump'.</p> <ol style="list-style-type: none">1. Pump element No. 1 is first kept at its TDS.2. The setting of the other pump elements is then checked.3. The gap between the lower end of the plunger and the top of the tappet roller should be 0.5 mm.4. If the position of the plunger can be raised or lowered in the barrel by means of an adjusting screw.5. After this gap is made uniform for every plunger, element the phasing should be started6. The point of port closer in each element should be correctly noted.7. This is done by gradually lifting the plunger from its bottom position.8. For this the valve and valve spring are removed from the pump element.9. As the plunger goes up gradually, the oil coming out of this valve keeps reducing.10. When the plunger is just closing the two ports, the oil supply from the valve passage stops.11. This is found out by the attaching a swan neck pipe for the closure point of cut off to the pump barrel.12. 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.13. 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 other should be 90^0. The phasing of the diesel pump can now be easily done.	4
3. Attempt any <u>FOUR</u> of the following	16
a) Write the stepwise procedure to be carried out the vacuum test of cylinder with suitable sketch.	4
<p>Answer :</p> <p>Procedure to be carried out the vacuum test of cylinder:</p> <p>Measuring the amount of manifold vacuum during cranking is a quick and easy test to determine if the piston ring and valves are properly sealing.</p> <ol style="list-style-type: none">1. Run the engine so that the water temperature is between 75^0C to 80^0C.2. Disable the ignition.3. Connect the vacuum gauge to a manifold vacuum source.4. Crank the engine while observing the vacuum gauge.5. Observe the gauge to note the reading. Reading should not be less than 40 cm of Hg. A low vacuum reading if recorded means that leaky cylinder head gasket, inlet manifold, weak valve spring etc.	3



(Credit should be given any equivalent figure)

b) Write the steps taken during servicing and checking piston.

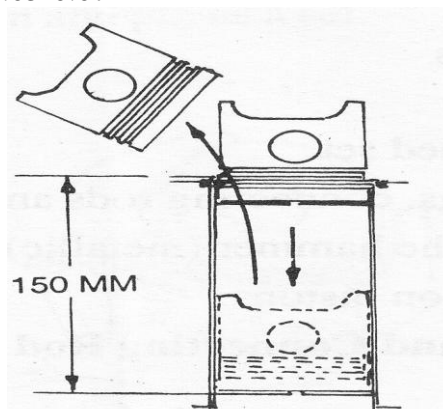
Answer :Steps taken during servicing and checking piston:

1. Clean the piston: Using a gasket scraper remove the carbon from the piston top. Using the groove cleaning tool or a broken ring clean the ring groove. Using a soft brush and solvent thoroughly clean the piston.

2. Inspect piston diameter and oil clearance:

- a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, the indicated distance below the skirt bottom edge.
- b) Measure the cylinder bore diameter in the thrust directions and subtract from the cylinder bore diameter measurement

Standard oil clearance = 0.05-0.07 mm



If the clearance is not within specifications replace the piston .If necessary, replace the piston.

3. Piston ring groove clearance

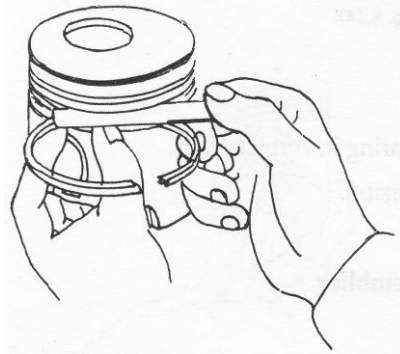
Using a feller gauge, measure the clearance between the new piston ring and ring land. Piston ring clearance is not within specifications replace the piston.



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OR

Checking procedure of piston

- Clean the piston to remove dirt, carbon depositions etc.
- Check piston diameter and oil clearance.
- Check the piston ring groove clearance with the help of feeler gauge.
- Inspect the condition of piston skirt for wear.
- Check the oil holes in the oil ring groove.

4

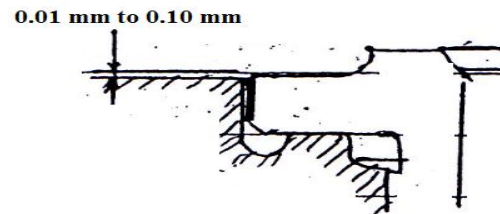
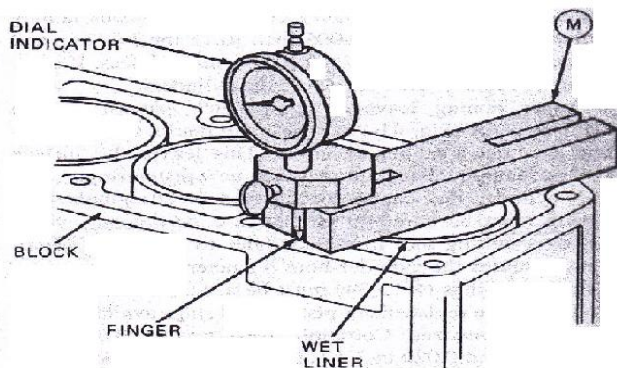
c) Describe inspection procedure for cylinder liner.

4

Answer:

Inspection procedure of cylinder liners:

1) Check Cylinder Liner Ridge Protrusion:



2

- Using a dial indicator, measure the ridge protrusion of the cylinder liner.
- Ridge protrusion = 0.01 mm to 0.10 mm
- If the protrusion is not within specifications, adjust it with a cylinder liner shim.
Cylinder liner shim thickness = 0.05 mm to 0.10 mm

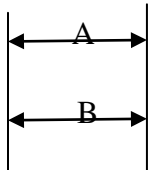
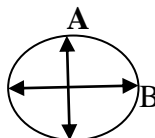


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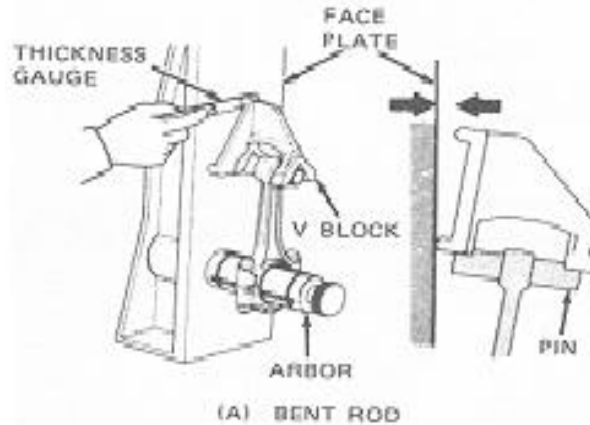
<p>2) Check cylinder liner for Taper and Ovality:</p> <p>Taper:</p> <ul style="list-style-type: none"> • Move the bore dial gauge top to bottom . • Note the maximum and minimum reading. • The difference in the reading is taper. • Taper = A - B  <p>Ovality:</p> <ul style="list-style-type: none"> • Take the measurement at A and B with bore dial gauge. • The difference in the reading is ovality. <p>Ovality=A-B</p>  <p>3) Inspect cylinder Liner for Vertical scratches:</p> <ul style="list-style-type: none"> • Visually check the cylinder liner for vertical scratches. <p>If deep scratches are present, replace the cylinder liner.</p>	<p>1</p> <p>1</p>
<p>d) What is vapour lock in petrol engine? How vapour lock can be removed?</p>	<p>4</p>
<p>Answer: Vapour lock in petrol engine: The combination of increased temperature and lower pressure or partial vacuum in the fuel pump can cause fuel to vaporize. It occurs when the liquid fuel changes state from liquid to gas while still in the fuel delivery system. This produces vapour lock, causes loss of feed pressure to the carburetor. Resulting in transient loss of power or complete stalling. Fuels that have high volatility can also cause vapour lock.</p> <p>Removal of vapour lock: Vapour return line: The vapour return line is connected to a special outlet in the fuel pump this allows any vapour to return fuel tank. Vapour return line also permit excess fuel being pumped by the fuel pump to return to tank. This excess fuel, in constant circulation helps keep the fuel pump cool. Therefore it prevents vapour from forming.</p> <p>Vapour separator- Some cars have vapour separator connected between fuel pump and carburettor.</p>	<p>2</p> <p>2</p>
<p>e) State the sequential steps to align connecting rod.</p>	<p>4</p>
<p>Answer:Sequential steps to align connection rod: (Note: Credit should be given to any equivalent Figure and suitable explanation) Using a rod aligner, check the connecting rod alignment as shown in figure in which big end of bore of connecting rod is held in self-entering spindle of the gauge while angle gauge is placed on the gudgeon pin.</p> <p>a) Check for bend:Bend in the connecting rod must not exceed 0.025 mm in every 100 mm length of connecting rod and bore of small end should be parallel to bore of big end. If bend is greater than service limit, replace the connecting rod assembly.</p>	<p>2</p>

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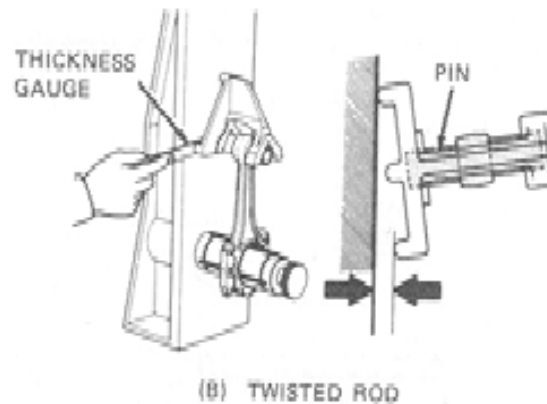
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b) **Check for Twist:** Twist in the connecting rod must not exceed 0.025 mm in every 100 mm length of connecting rod and bore of small end should be parallel to bore of big end. If twist is greater than service limit, replace the connecting rod assembly.



4.a) Attempt any THREE of the following:

i) State the causes and remedies of low oil pressure in an engine.

Answer: (Any 4 causes and remedies: 1 Mark Each)

Sr.	Causes	Remedies
1	Less oil in crank case.	Top up to correct level.
2	Use of low viscosity oil or diluted oil in sump.	Change the oil.
3	Low grade of oil or poor quality of oil.	Use specified oil stated by manufacturer.
4	Worn out main and big end bearing.	Replace bearing.
5	Leaky filter, oil pipe or oil pump.	Replace.
6	Bypass valve spring defective.	Replace.
7	Maladjustment of regulating valve spring.	Make correct adjustment.
8	Defective oil pressure gauge.	Repair or replace.
9	Too much play in oil pump gears.	Adjust play or replace gears.
10	Choked suction strainer of oil pump.	Clean the strainer.
11	Choked oil gallery or suction pipe.	Clean properly.



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ii) What is engine tune up? Write the procedure for engine tune up with the help of block diagram.

4

Answer:Tuning of engine:

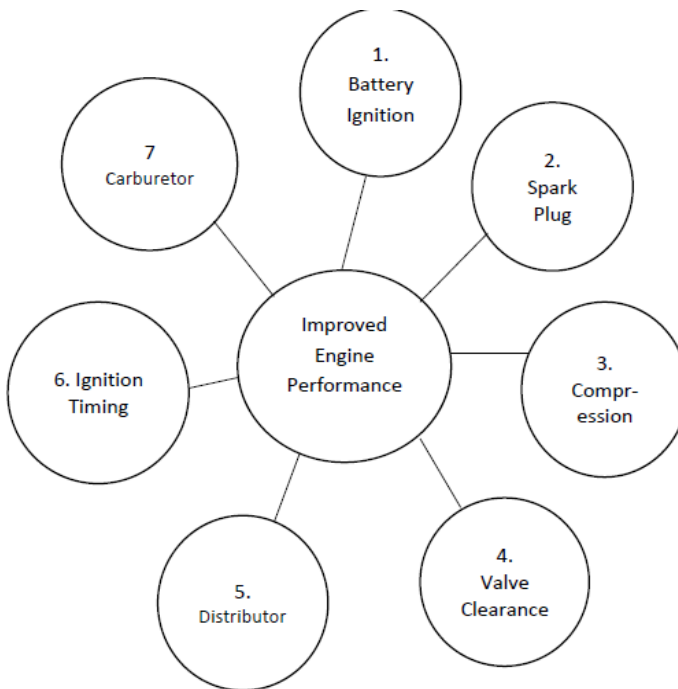
Engine tuning is the adjustment, modification of the internal combustion engine or modification to its control unit to obtain optimum performance, to increase an engine's power output, economy, or durability.

1

OR

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.

Tune-up procedure for petrol engine:*(Credit shall be given to brief description of block diagram)*



1

Figure: Engine tune up sequence

1.If the engine is cold, operate it for about 20 minute at 1500rpm or operate until it reaches theoperative temperature. If there any operational problems during this warm up time theseproblems may be noted.

2.Connect oscilloscope and exhaust gas analyzer and perform diagnosis. Check for anyabnormal condition and if possible the cylinder in which it appears.

3. Remove all spark plugs open the throttle & choke valve fully Disconnect the distributor leadfrom the primary oil terminal thus preventing excessive secondary voltage.

4.If the compression ratio is not upto specifications, perform engine services that will eliminatethe trouble. If the compression is all right, reinstall the spark plugs.

5. Clean inspect file gap and test the spark plugs replace worm or defective spark plugs.

6. Inspect and clean the battery, battery terminal cable and hold down brackets. Test the battery,add electrolyte if necessary. If the battery has been over charged or under charged the alternator & regulator should be checked.

7. Check distributor contact points and clean them. Read just the point opening.

2



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<p>8. Check drives belts. Tighten or replace them as required. 9. Inspect the distributor rotor, cap and primary and high voltage. 10. Check the condition of the manifold heat control valve making sure that it is free to operate. 11. Check the intake manifold bolts for tightness to proper specifications. 12. Check fuel lines for tight connections and kinks beads or leaks. 13. Check the cooling system for leaks, wear or collapsed hoses correct coolant level and anti freeze protection. 14. Check and adjust the accelerator linkage if necessary 15. Check crankcase ventilation system 16. Check intake manifold and air injection system 17. Remove carburettor, air cleaner and check choke valve to make sure choke is working normally. Clean or replace air filter element if necessary 18. Check and adjust idle speed and mixture to specification.</p>	
<p>iii) State the procedure for cleaning and tuning of carburetor.</p>	4
<p>Answer: Procedure for cleaning and Tuning of carburetor: 1. Dismantle of carburetor to completely wash it with clean petrol. 2. Check each circuit blowing compressed air in each to ensure these are absolutely clean. Check all the jets by blowing air by mouth to see they are not blocked. 3. Never clean jets or petrol passage in carburetor body with steel wire it may injure the passage only use compressed air for cleaning. 4. Always use a new gasket while assembling carburetor. 5. Start the engine and run it for at least five minutes to warm up. 6. Allow the engine to idle. The idle is set with a "Volume Control" screw and a "Bypass" screw of the left side of the carburetor. 7. Note the rpm. Adjust the screw on the top of throttle lever so that it just touches the fast idle cam. Then turn it in 1/4 turn. 8. Turn off the engine momentarily. 9. Slowly turn in the Volume Control screw until it bottoms lightly. Then back it out 2-1/2 to 3 turns. This is the starting point for this screw. 10. Restart the engine and adjust the Bypass Screw until you obtain the desired idle speed as indicated on the dwell-tachometer. Turning the bypass screw out increases the rpm; turning it in decreases the rpm. 11. Turn the Volume Control screw one way or the other to obtain the highest idle speed, then turn the screw clockwise (in) until the engine speed drops by about 25 rpm. 12. Reset the idle to desired rpm using the Bypass Screw.</p>	4
<p>iv) What sequential steps are necessary for adjustment of clutch</p>	4
<p>Answer: Clutch adjustment procedure: In clutches there are four adjustments to be made, three of which can be made without removing the clutch from the vehicle, and the other should be done after the clutch assembly has been removed. 1) Clutch release lever adjustment: When the vehicle has been used for long time, due to wear of the clutch facing, the distance between pressure plate and fly wheel reduces. So that, the distance between release bearing and clutch fingers increases. To cover up this increase distance, the travel of release is increased by the adjusting rod or release lever.</p>	1



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2) Floor board clearance adjustment:

. This adjustment can be done by means of a screw located near the lower end of the clutch pedal. This screw prevents the pedal arm from resting against the floor board. The screw should be so adjusted as to maintain the proper floor board clearance.

3) Clutch pedal travel adjustment: If the total travel is less than specification, the bumper stop is trimmed until the correct travel is obtained. The total travel of pedal should be 6 to 7 inches. This adjustment should be done before adjustment of free play.

4) Free play adjustment: 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 (15 to 20 mm.) remains in the pedal after the clutch has been engaged. 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.

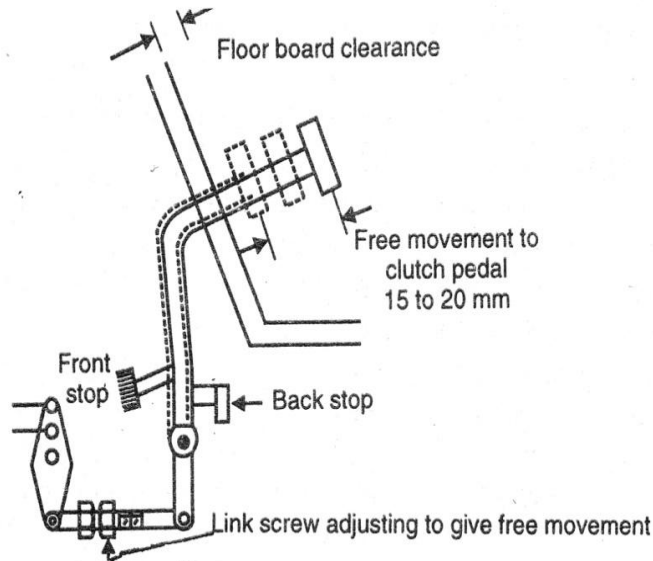


Fig: Clutch Adjustments.

b) Attempt any ONE of the following:

i) What is calibration of FIP? How calibration is carried out in FIP test bench?

Answer: Calibration of FIP:

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.

Procedure to do FIP calibration.

1. Place the pump on a fuel injection test bench.
2. Its engine is then rotated till it attains the speed of 2000 rpm.
3. Measure the quantity of diesel oil supplied by the each pump element in measuring cylinder.
4. If measured quantities are more or less same, it may be said that the pump is delivering properly to all the cylinders
5. If measured quantity differs 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.

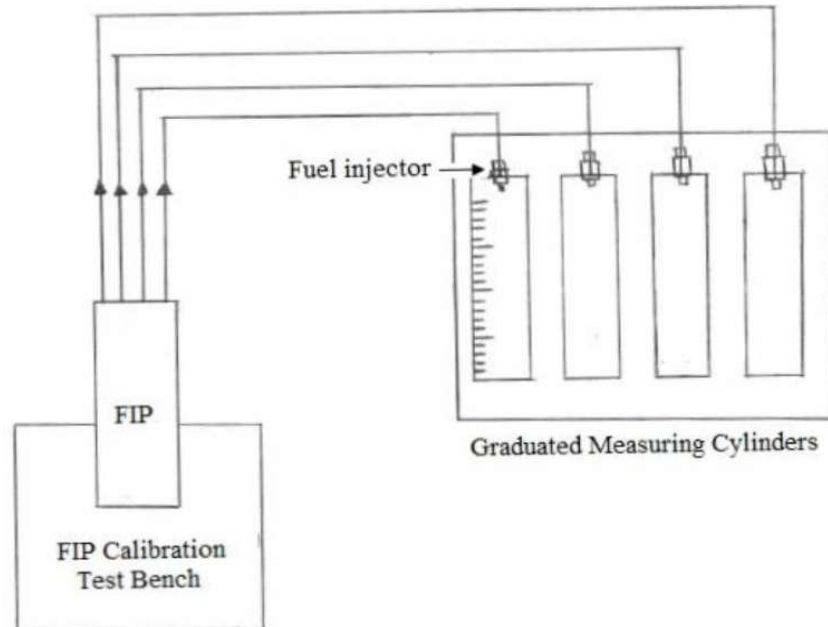


Figure: FIP calibration

ii) Describe bleeding of hydraulic brake of four wheeler with neat sketch.

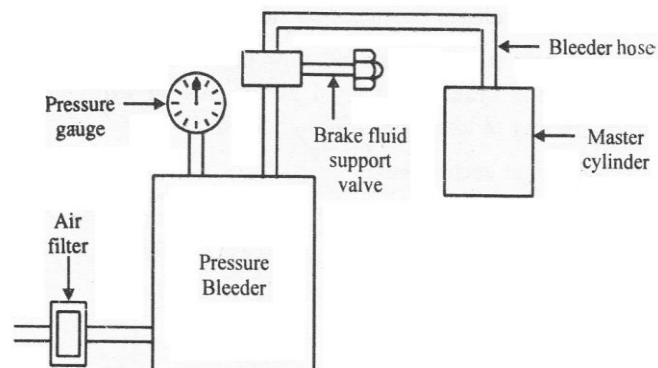
6

Answer: (Description any one method-4 Marks, Fig.-2 Marks)

Method of Bleeding of hydraulic brakes:

- 1) Pressure Bleeding a) Using air b) By forcing brake fluid
- 2) Manual Bleeding
- 3) Gravity bleeding

1) Pressure bleeding: (Credit should be given any equivalent Figure)



2

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.

When bleeder screw is opened, the pressure force air and brake fluid out of the bleeder screw. 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

4



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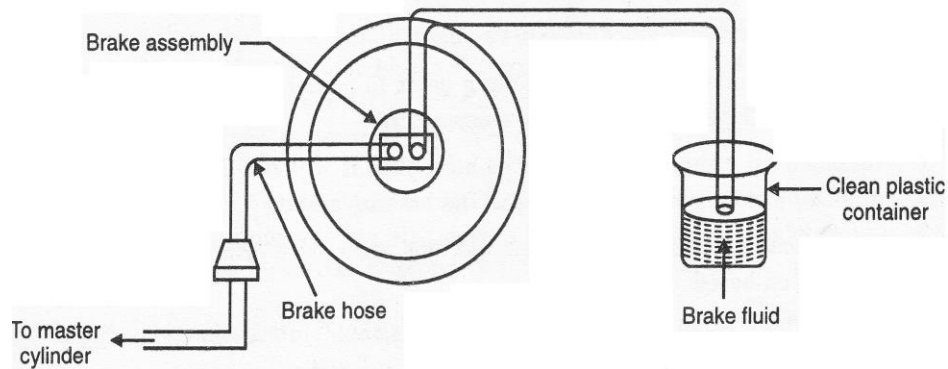
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OR

2)Manual bleeding:

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.

- 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.
- Loosen the bleeder screw at least one full turn.
- Have an assistant to depress and hold the brake pedal and then tighten the bleeder screw.
- Have your assistant to release the brake pedal.
- Repeat steps b ,c & 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 correct grading to keep the reservoir filled.
- Repeat this procedure at each wheel.



OR

3) Gravity bleeding:

Gravity bleeding is the method of bleeding that uses the earth gravity to bleed air from the hydraulic system. No external force is applied to brake fluid.To bleed the system following procedure is adopted.

- At the wheel cylinder loose the bleeder screw at least one full turn.
- Remove the cover from the master cylinder reservoir. The level of brake fluid to flow from the bleeder screw.
- Watch the bleeder hose when brake fluid flow from opening and tightening the screw.
- Repeat this procedure at each wheel in sequence and it should be changed.

5. Attempt any FOURof the following:

- Describe the procedure of checking run out of clutch plate with sketch.

Answer:

Procedure for checking clutch plate for run out:

a. For checking flat run out:

Place the clutch plate on revolving splined shaft as shown in figure. Fix up pointer of dial gauge on lining set the gauge at zero turn the plate slowly. The flat run out should not exceed 0.4mm if it is more replace the same.

b. For checking lateral run out.

Fix up the clutch plate in between the two centres as shown in figure. Fix up pointer of dial gauge



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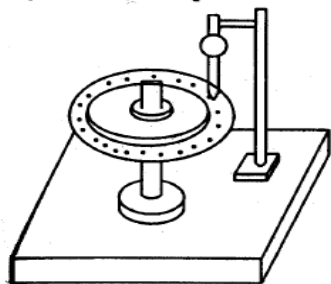
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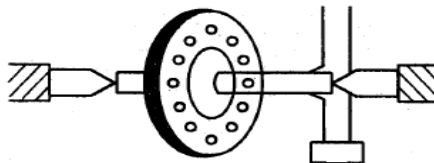
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and set it at zero Now revolve the plate slowly and note the reading the lateral run out should not exceed 0.7 mm if it is more clutch plate be discarded.

Check the clutch plate for run out.



Checking flat runout of clutch - plate



Checking lateral runout of clutch - plate

2

b) Describe common causes of troubles in the propeller shaft and rear axle.

4

Answer: Propeller Shaft: (Any one trouble)

1. Propeller shaft shake

Causes	Remedies
1. Improperly connected propeller shaft and splined yoke coupling.	Assemble splined yoke and yoke on rear end of the propeller shaft such that they are in same plane.
2. Bent Propeller shaft	Straighten it on press, check run out of shaft on lathe machine or v block. If the shaft is badly bent then replace it.
3. Worn out needle bearing of Universal Joint.	If needle bearing is slightly worn out, replace it.
4. Misaligned Propeller shaft at front and rear end.	Align it properly.

2

2. Noisy running of propeller shaft:

Causes	Remedies
1. Slip joint splines worn out.	If the play is more than 0.5 mm replace the splined shaft and yoke.
2. Universal joint needle bearing worn out	Replace the assembly.
3. Loose flanged yoke.	Tighten it fully.
4. Central bearing loose or worn out.	Replace the bearing or fit properly.
5. Central bearing misalignment.	Align it.
6. Lack of lubrication.	Provide adequate lubrication.

Rear Axle:

	Cause	Remedies
1) Axle noisy on acceleration	Heavy heel contact on ring gear teeth.	Move the ring gear nearer to the drive pinion.
	Improper adjustment of pinion and ring gear.	Adjust it properly.
	Rough pinion bearings.	Replace the bearings.
	Loose pinion bearings.	Adjust it properly.

2



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2) Axle noisy on coast	Excessive backlash in ring gear and pinion.	Adjust the backlash.	
	End play in pinion shaft.	Provide proper end play.	
	Heavy toe contact on ring gear.	Ensure proper toe contact.	
	Rough bearing.	Adjust or replace bearings.	
c) Write four major causes and remedies of humming noise from differential.			4
Answer: Humming Noisy from differential. (Any 4- 1 Mark Each)			
Sr. No	Causes	Remedies	4
1.	Less lubricating oil in differential housing.	Fill it at proper level.	
2.	Improper adjustment of pinion and ring gear.	Adjust it properly.	
3.	Improper backlash in differential gears.	Provide proper backlash as per recommendation.	
4.	Worn differential bearings.	Replace with new one	
5.	Worn differential side gear thrust washers.	Replace the washers.	
6.	Wear out of spline of half shaft	Replace the half shaft	
d) What is necessity of bearing preload? Write its procedure.			4
Answer: Necessity of bearing preload:			
<p>This is a slight over-tightening of taper bearing used on differential pinion shaft is known as preloading of bearing. Bearing preload is important because of degree of internal clearance within a bearing can influence a variety of factor including noise, Vibration; heat built up and fatigue life. When preload applied correctly -</p> <ol style="list-style-type: none"> 1. It controls rapid and axial play. 2. Reduces non-repetitive run out. 3. Reduces the difference in contact angle between inner and outer rings at very high speed. 4. It controls balls skidding under very high acceleration. 			2
Procedure of preload:			
<ol style="list-style-type: none"> 1. The pinion is held in position in the housing with the help of two taper rollers bearings. 2. Disconnect the rear end of the propeller shaft by loosening the flange bolts. 3. Remove the lock nut and thrust washer. 4. To remove free play in the bearing usually two methods are employed. By adding or removing shims under the cap of differential pinion housing or by check nut on pinion shaft. <p>In heavy vehicles, over two taper roller bearings one pilot bearing is also used at the front end of the pinion.</p>			2
e) Describe the troubles encountered in gear box.			4



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<p>Answer:(Any four:1 Mark each)</p> <p>1.Grinding noise in neutral: A grinding noise when the engine is running and vehicle is in neutral. Causes- Gear box properly aligned with the engine causing the shaft from the flywheel to the gearbox to bind.</p> <p>2.Noise in gears: When the vehicle is being driven or rear wheels turning off the ground noise is heard in gear.</p> <p>3. A hum or bowl in neutral: When the engine is running, it occurs due to following reasons.</p> <ul style="list-style-type: none">a) Lack of lubrication.b) Worn shaft.c) Too much backlash in gear train.d) Too much end play in gears or counter shaft.e) Worn bearing. <p>4.Hard shifting, sticking in gear: It occurs due to following reasons</p> <ul style="list-style-type: none">a) Distorted splines of the main shaft.b) Improper clutch adjustment.c) Battered gear teeth.d) Too strong shifter locks spring. <p>5.Oil leakage: Oil leaks from gear box due to following reasons</p> <ul style="list-style-type: none">a) Too high oil level in case.b) Damaged or Improperly installed gas kit or oil seal.c) Loose cover bolts.d) Cracked case,e) Loose drain or filler plug.	4
<p>f) Describe the procedure of tyre retreading.</p>	4
<p>Answer:Tyre Retreading Procedure:</p> <p>1. Inspection: Tyre will be inspected carefully to show up puncture, cracks, wears and any other damage on the tyre in retreading unit. Mechanic or technicians check the whole tyre and come to point if it is to be retreaded or not.</p> <p>2. Buffing: Tyre casing are buffed by inflated and using same size of rim as in original use. On lathe machine to assure proper radiation profile, less rubber is removed and under thread, rubber compound remain safe for giving extra protection to plies. This result in perfectly round and balanced tyre.</p> <p>3. Cementing: After buffing tyre is sprayed with rubber compound.</p> <p>4. Tread Preparation: After cementing tyre is prepared for tread design. For that purpose solution of cushion gum is applied on a tyre. When this is cured, the rubber material becomes strongest part of the tyre.</p> <p>5. Tread bonding: The rubber, newly coated with cushion gum is applied to the tyres on a special tyre builder. The tyre is kept in an inflated condition on the same size rim as originally in use during this operation.</p> <p>6. Enveloping: This is method to bond the tyre properly, that means, in this stage uniform pressure is applied at all points on the tread and it gives perfect bonding of the tread.</p> <p>7. Curing: The tyre is then placed in the hot retreading machine-segmented mould retreading machine. During this processing, the tyre tread 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.</p> <p>8. Final inspection: The retreaded tyre is subjected to a final inspection. This inspection insures that only tyres which meet the industry quality standards are allowed to leave the retread plant.</p>	4



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6. Attempt any <u>FOUR</u> of the following:	16																																										
a) State the probable causes and remedies of air brake system.	4																																										
Answer: Probable causes and remedies of air brake system. (<i>Consider any four points, each point carry 1 mark</i>)	4																																										
<table border="1"> <thead> <tr> <th>No</th> <th>Causes</th> <th>Remedies</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Insufficient air in the system.</td> <td>Identify the source of cause and rectify it.</td> </tr> <tr> <td>2</td> <td>Brake shoes worn out</td> <td>Repair or replace</td> </tr> <tr> <td>3</td> <td>No air pressure in brake system</td> <td>Identify the source of cause and rectify it.</td> </tr> <tr> <td>4</td> <td>Restricted or broken pipe or hose</td> <td>Clean or replace</td> </tr> <tr> <td>5</td> <td>Leaky, defective brake valve</td> <td>Replace</td> </tr> <tr> <td>6</td> <td>Broken return spring of brake shoe, brake pedal</td> <td>Replace spring</td> </tr> <tr> <td>7</td> <td>Leaky drain plug of reservoir</td> <td>Repair or replace</td> </tr> <tr> <td>8</td> <td>Defective air compressor</td> <td>Repair or replace</td> </tr> <tr> <td>9</td> <td>Loose compressor belt</td> <td>Tight it properly</td> </tr> <tr> <td>10</td> <td>Leakage in pipes or joints</td> <td>Repair or replace</td> </tr> <tr> <td>11</td> <td>Brake linkages jammed</td> <td>Lubricate</td> </tr> <tr> <td>12</td> <td>Damaged air boosters</td> <td>Replace</td> </tr> <tr> <td>13</td> <td>Defective air pressure gauge</td> <td>Replace</td> </tr> </tbody> </table>	No	Causes	Remedies	1.	Insufficient air in the system.	Identify the source of cause and rectify it.	2	Brake shoes worn out	Repair or replace	3	No air pressure in brake system	Identify the source of cause and rectify it.	4	Restricted or broken pipe or hose	Clean or replace	5	Leaky, defective brake valve	Replace	6	Broken return spring of brake shoe, brake pedal	Replace spring	7	Leaky drain plug of reservoir	Repair or replace	8	Defective air compressor	Repair or replace	9	Loose compressor belt	Tight it properly	10	Leakage in pipes or joints	Repair or replace	11	Brake linkages jammed	Lubricate	12	Damaged air boosters	Replace	13	Defective air pressure gauge	Replace	
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<ol style="list-style-type: none"> Surface Preparation: Prepare surface for repainting by using pretreatments such as degreasing, descaling and derusting. Bond rising-To increase the bonding strength of paint, the work surface is passed through series of tanks filled with alkali solutions. Primer coating-The components are dried with compressed air and all hole are filled. It is protective and anticorrosive treatment which gives necessary film thickness. Sanding and putty operation –it is carried out to improve appearance of primer surface. By removing small flaws, defects. Different grades of sand papers are used. Putty is applied with knife or metal strip to all surfaces to emit paint shop defects. Final painting. One or more coats of desired paint are applied to base metal; frontal exposed areas are coated with more vigorously than other surface. 																																											
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Answer: 1) Hard Steering																																											
<table border="1"> <thead> <tr> <th>Sr</th> <th>Causes</th> <th>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 level</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>Incorrect steering 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 level	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	Incorrect steering geometry factors	Make correct alignment	8	Underinflated tyres.	Inflate to correct pressure.	9	Bent front axle.	Repair or replace	4															
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2) Wandering of vehicle

Sr. No.	Causes	Remedies
1	Underinflated one tyre.	Inflate to correct pressure.
2	Worn out tyres.	Replace
3	Too tight steering connections	Adjust as necessary
4	Loose U bolt of road springs	Tighten
5	Loose king pin.	Tighten
6	Loose wheel bearing.	Adjust as necessary.
7	Loose or worn out bushes of springs.	Replace
8	Shifting of spring on front axle due to broken center bolt.	Replace center bolt and fix the spring at correct position.
9	Misalignment of caster, camber, toe in, steering axle inclination	Make correct alignment.

3) Vehicle pulls to one side:

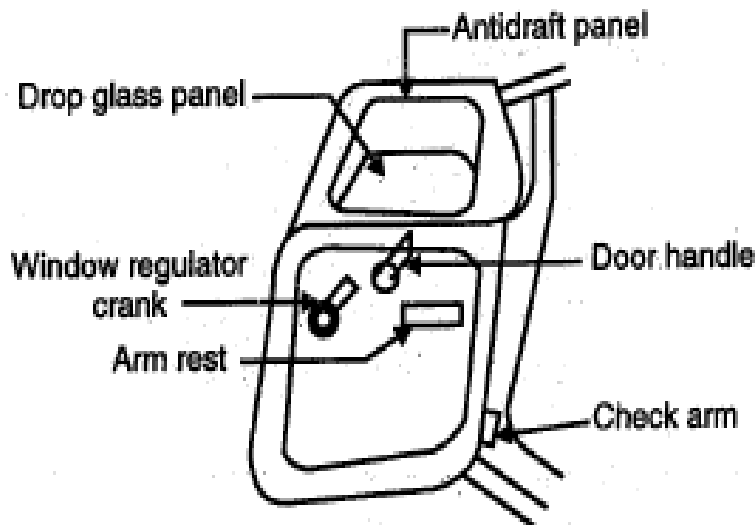
Sr. No.	Causes	Remedies
1	One front tyre underinflated or worn out.	Inflate to correct pressure or replace
2	Loose U or I bolt of font axle spring.	Tighten
3	Bent steering arm.	Repair or replace
4	Misaligned front axle with rear axle.	Make correct alignment.
5	Bent stub axle.	Repair or replace
6	Misalignment of caster, camber, toe in, steering axle inclination	Make correct alignment.

Note: Any two from above, (Causes and remedies of troubles like Front wheel shimmy, Excessive steering play, front wheel tramp may also be considered)

d) Describe repair procedure for door and lock.

4

Answer: Procedure for adjustment of door and lock:



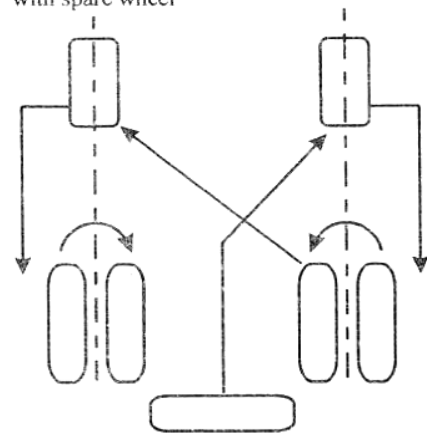
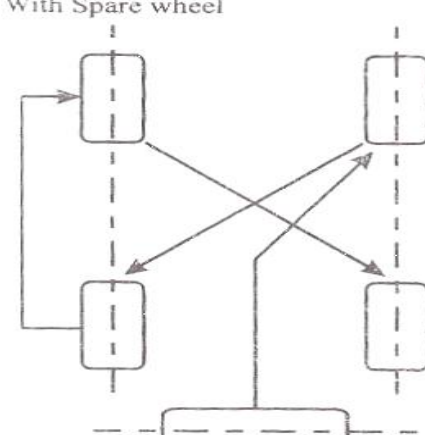


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<p>a. Adjustment of door and lock is necessary for smooth operation of door and security of vehicle.</p> <p>b. In door adjustment, handles of the door, locks children's safety lock, and striker joints are lubricated. When replacing locks, care should be taken to locate the position of the striker which is secured to body by two self-tapping screws. If the door does not close well, relocate the striker.</p> <p>c. Check hinges of doors for loose rivets, noise, corrosion etc.</p> <p>d. Check rubber weather strip for broken or damage. If weather strip is found damaged or broken, replace with new one.</p> <p>e. Check rubber pads for any damage, replace if required.</p> <p>f. If window regulator becomes in-operative then check gear for wear or damage, check spring for weakened condition and adjust linkage and lubricate it with oil</p>	4
<p>e) Suggest the tyre rotation of wheel arrangement shown in Figure No. 1 and draw the same.</p>	4
<p>Answer: (2 Marks for each figure)</p> <p>Front side For Heavy vehicle with spare wheel</p>  <p>With Spare wheel</p>  <p>Six wheeler with spare wheel Four wheeler with spare wheel</p>	4