



SUMMER- 18 EXAMINATION

Model Answer

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: (3X4)	12																											
	(i)	State causes and remedies of engine overheating	04																											
	Ans.	<div>(Consider any four causes and their remedy, each point carry 1 mark)</div> <table><tr><th>Sr. No.</th><th>Causes</th><th>Remedies</th></tr><tr><td>1</td><td>Insufficient coolant</td><td>Maintain coolant level.</td></tr><tr><td>2</td><td>Leakage in radiator</td><td>Repair or replace radiator.</td></tr><tr><td>3</td><td>Leakage in hose and connections</td><td>Replace the defective hose and to tighten the various connection</td></tr><tr><td>4</td><td>Accumulation rust or scale in jacket & inside surface of tubes.</td><td>Remove scaling with use of suitable chemical and reverse flushing.</td></tr><tr><td>5</td><td>Faulty water pump</td><td>Repair or Replace the pump</td></tr><tr><td>6</td><td>Defective thermostat valve</td><td>Replace the valve.</td></tr><tr><td>7</td><td>War page in cylinder head</td><td>Repair or replace webpage cylinder head.</td></tr><tr><td>8</td><td>Lack of oil in oil sump</td><td>Top up to the correct level</td></tr></table>	Sr. No.	Causes	Remedies	1	Insufficient coolant	Maintain coolant level.	2	Leakage in radiator	Repair or replace radiator.	3	Leakage in hose and connections	Replace the defective hose and to tighten the various connection	4	Accumulation rust or scale in jacket & inside surface of tubes.	Remove scaling with use of suitable chemical and reverse flushing.	5	Faulty water pump	Repair or Replace the pump	6	Defective thermostat valve	Replace the valve.	7	War page in cylinder head	Repair or replace webpage cylinder head.	8	Lack of oil in oil sump	Top up to the correct level	04
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	(ii)	State the function of following equipments: 1) Tyre changer 2) Feeler Gauge 3) Arbor Press 4) Wheel aligner	04																											
	Ans.	<div>(1 mark for each)</div> <div>1) Tyre changer: Device used to remove tyre from rim without damaging the tyre threads with less effort in minimum time.</div> <div>2) Feeler gauge: To check and measure the gap or clearance between the two</div>	04																											



		<p>components.</p> <p>3) Arbor Press: Used for assembly & disassembly of small components. To take out the press fitted components.</p> <p>4) Wheel aligner: To measure turning radius, camber, caster, king pin inclination, toe in</p>																															
	(iii)	Distinguish between preventive maintenance and breakdown maintenance.	04																														
	Ans.	<p>(Any four points: 1 Mark for each comparison)</p> <table border="1"> <thead> <tr> <th>Sr. No.</th> <th>Preventive maintenance</th> <th>Brake down maintenance</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>It is an extremely important method of maintenance for the reduction of maintenance cost and to keep the vehicle in good operating condition.</td> <td>It is the attention provided when a vehicle is stopped due to faults created during running.</td> </tr> <tr> <td>2</td> <td>It is so reliable that you can practice to your customer to reach safely in time.</td> <td>Frequent breakdown may lead to bad impression on business hence it is not reliable.</td> </tr> <tr> <td>3</td> <td>Required man power, material, equipment and the availability of vehicle can be scheduled and down time is reduces.</td> <td>Time required for breakdown and repair is much more</td> </tr> <tr> <td>4</td> <td>As it is done in workshop, quality of work is good.</td> <td>It must to be done on the spot or in road side garages hence quality of work is not so good.</td> </tr> <tr> <td>5</td> <td>All required spares and tools are available.</td> <td>There may be lack of tools and spares or duplicate parts may be fitted.</td> </tr> <tr> <td>6</td> <td>Life of vehicle increases.</td> <td>Life of vehicle decreases</td> </tr> <tr> <td>7</td> <td>Proper maintenance reduces running cost</td> <td>Increase in running cost.</td> </tr> <tr> <td>8</td> <td>It increases the safety of driver and passenger</td> <td>Breakdown may cause accidents and it is not safe for driver and passenger.</td> </tr> <tr> <td>9</td> <td>Preventive Maintenance System includes; 1) Oil Changes 2) Chassis lubrication 3) Engine Tune up 4) Inspection and testing of various other components. 5) Tyre Service</td> <td>Breakdown includes: 1) Starting difficulties 2) Tyre puncture 3) Electrical faults 4) Carburetor & Fuel supply faults 5) Curing overheating problems 6) Breakage & Accidents</td> </tr> </tbody> </table>	Sr. No.	Preventive maintenance	Brake down maintenance	1	It is an extremely important method of maintenance for the reduction of maintenance cost and to keep the vehicle in good operating condition.	It is the attention provided when a vehicle is stopped due to faults created during running.	2	It is so reliable that you can practice to your customer to reach safely in time.	Frequent breakdown may lead to bad impression on business hence it is not reliable.	3	Required man power, material, equipment and the availability of vehicle can be scheduled and down time is reduces.	Time required for breakdown and repair is much more	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	7	Proper maintenance reduces running cost	Increase in running cost.	8	It increases the safety of driver and passenger	Breakdown may cause accidents and it is not safe for driver and passenger.	9	Preventive Maintenance System includes; 1) Oil Changes 2) Chassis lubrication 3) Engine Tune up 4) Inspection and testing of various other components. 5) Tyre Service	Breakdown includes: 1) Starting difficulties 2) Tyre puncture 3) Electrical faults 4) Carburetor & Fuel supply faults 5) Curing overheating problems 6) Breakage & Accidents	04
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	(iv)	State any four safety precautions to be followed in automobile workshop	04																														
	Ans.	<p>(Consider any four safety precaution. Each point carries 1 mark)</p> <p>Safety precautions to be followed in auto workshop are as follows:</p> <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. 	04																														



		<ol style="list-style-type: none">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.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.	
	b)	Attempt any <u>ONE</u> of the following.	06
	(i)	Describe the scheduled maintenance for car.	06
	Ans.	<p><i>:(List down major parameters in any 4-schedule period mentioned below, Each of 1.5 Marks</i></p> <p>Schedule Maintenance Procedure for Car:</p> <p>1) Daily Maintenance:</p> <ol style="list-style-type: none">1. Clean the vehicle and check fuel in the fuel tank.2. Check water level in the radiator.3. Check oil level in the oil sump.4. Check tyre pressure.5. Check brake pressure warning light. <p>2) Weekly Maintenance or at 500 km :</p> <ol style="list-style-type: none">1. Check engine oil level and fill, if necessary.2. Check electrolyte level in battery and fill, if necessary.3. Drain oil from engine sump and replenish.4. Clean gauge filters in petrol.5. Check engine mounting nuts.6. Check cylinder head nuts.7. Tight inlet manifold and exhaust manifold nuts. <p>3) First 1000 Km:</p> <ol style="list-style-type: none">1. Drain oil in sump to clear it of any impurities in accumulator, refill it with the appropriate grade of lubricant.2. Drain gearbox by unscrewing the drain plug, now fill it with correct amount of the recommended lubricant.3. Drain oil from the rear axle; refill it with the recommended lubricant up to the prescribed level.4. Lubricate the water pump bearing with recommended grease. <p>4) Every 1000 km:</p> <ol style="list-style-type: none">1. Repeat items described under every 500 km with addition of the following.2. Provide grease to the sliding joint and two needle type universal joints3. Grease each of the swivel pin with grease gun.4. Grease gun should be applied to the nipple on the ends of steering rods.5. Test the tyre pressure.6. Fill radiator to full level. <p>5) Every 2000 Km:</p> <ol style="list-style-type: none">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	06



- 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.

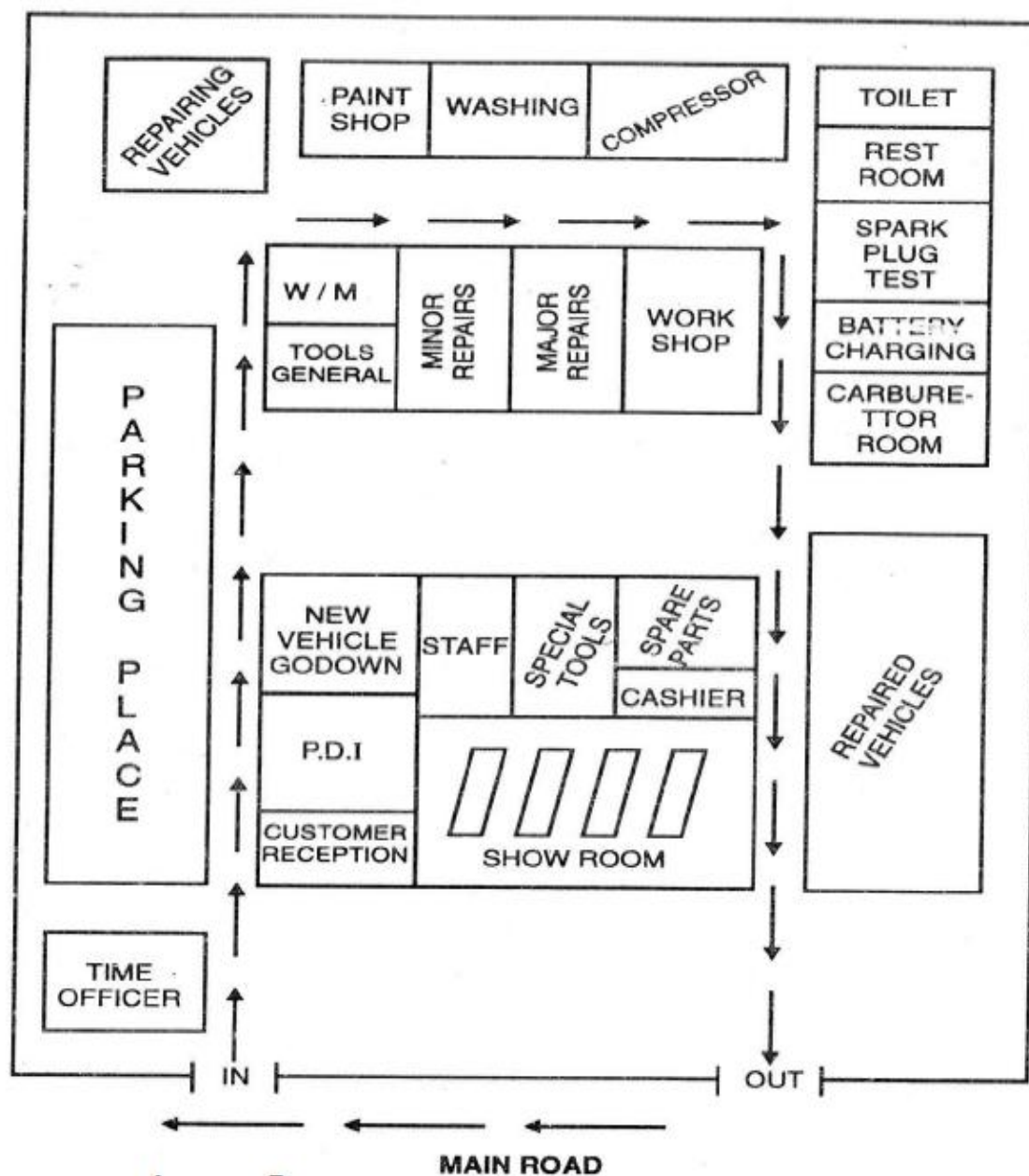
(ii) **Draw a layout required for servicing 100 two wheelers per day. List important generalized and specialized equipments required for the same.**

06

Ans. (layout : 3 marks, equipment list: 3 marks)

Layout required for dealers of servicing 100 two wheeler per day:

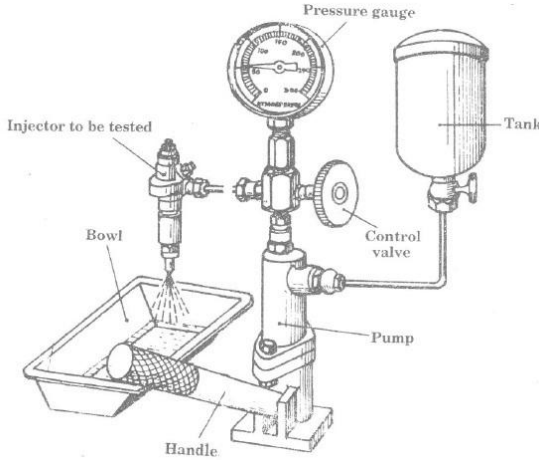
(Credit should be given to suitable layout, 3 Marks for Proper Layout)



03

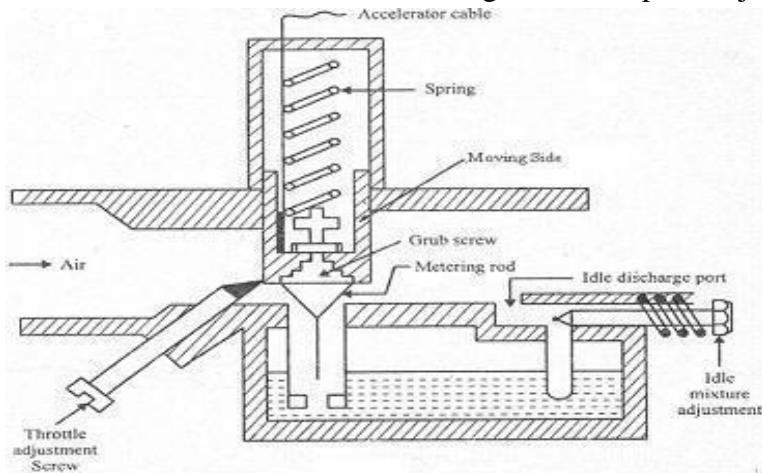


		<p><i>(List down any 3 generalized & Specialized Equipment's, 1.5 Marks each)</i></p> <p>List of Generalized Equipment's:</p> <ol style="list-style-type: none">1. Battery charger.2. Arbor press3. Hydraulic Jack4. Car Lifts5. Engine analyzer6. Electric Drill.7. Vehicle washer.8. Electric soldering iron.9. Grease gun10. Compressor.11. Bench Vice <p>List of Specialized equipment's:</p> <ol style="list-style-type: none">1. Computerized wheel aligner.2. Computerized wheel balancer3. Ignition timing Light,4. Head light aligner,5. Engine analyzer,6. Fuel injector tester7. Hydraulic press.8. Ac Charging Unit.9. Nitrogen filling Station.	03
2		Attempt any <u>FOUR</u> of the following:	16
	a)	Describe general servicing procedure for vehicle.	04
	Ans.	<p><i>(List down any 8 points, Each of ½ Marks)</i></p> <ol style="list-style-type: none">1. Park the vehicle on the servicing ramp.2. Place the stopper at the front and rear of the wheel.3. Drain the Engine oil from engine oil sump and fill up new recommended oil.4. Check oil level in gear box and differential. If level found less top up to correct level by specified oil.5. Clean air filter by blow of compressed air. If clogged replace with new one.6. Check the water level, coolant level and Belt tension of the alternator.7. Check battery electrolyte level. If necessary top up to correct level.8. Perform engine tune up, if required.9. Do the brake and clutch adjustments as required.10. Check tyre condition and do tyre rotation if required11. Perform Wheel alignment and wheel balancing if necessary.12. Wash the vehicle thoroughly and by using grease gun lubricate the points where grease lubricant required.13.	04
	b)	<p>Explain with sketch following test for a diesel injector testing</p> <ol style="list-style-type: none">i) Pressure testingii) Leak test	04

	<p>Ans. (2 Marks for each Testing Procedure. Equivalent Credits shall be considered for appropriate points related to Testing Procedure & line diagram)</p> <p>i) Pressure testing</p> <ol style="list-style-type: none"> 1. Fix the injector to be tested to injector pipe of tester as shown in fig. 2. Work the hand pump. 3. Note the opening pressure of spray on gauge provided. 4. If the pressure is less, it is increased by loosening the check nut and tightening the adjusting screw. 5. If it is more than the specified, the adjusting screw is loosened. 6. After adjusting pressure, lock the lock nut and replace the cap. 7. In some make of nozzles shims are added or removed instead of adjusting screw <div data-bbox="553 617 1089 1073" data-label="Image">  <p style="text-align: center;">Fig: Injector Tester</p> </div> <p>ii) Leak off test</p> <ol style="list-style-type: none"> 1. Fix up injector on tester. 2. Build up pressure of 150 atoms (1 atom = 14.7 lb/in²) and keep the pressure for about 10 second without spraying. 3. After 10 seconds checkup that there is no drop in pressure and wetness is not felt on tip of nozzle body. 4. If there is drop in pressure or wetness is felt on tip of nozzle body: <ol style="list-style-type: none"> (i) Dismantle the injector. (ii) Get the seat of nozzle body grounded. (iii) Get the nozzle body seat lapped. (iv) If nozzle valve seat is pitted, it should be replaced or grounded. 5. Fix up the injector again and test it in same manner as prescribed in steps 1 to 3. 	<p style="text-align: center;">02</p> <p style="text-align: center;">02</p>
<p>c)</p>	<p>Enlist the documents which are to be maintained in automobile workshop</p>	<p style="text-align: center;">04</p>
<p>Ans.</p>	<p>(1mark for each)</p> <p>The documents required to be maintained in automobile workshop are:-</p> <ol style="list-style-type: none"> 1) Vendor service work order 2) History sheet 3) Activity file 4) Maintenance instruction manual 5) Spare procurement register & 6) Defect register 	<p style="text-align: center;">04</p>



	d)	Explain the term FIP phasing and calibration.	04
	Ans.	<p>(2 marks for each)</p> <p>Phasing FIP: 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° 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°. The adjustment of fuel pumps at correct timing intervals is known as the as the “Phasing of the pump”.</p> <p>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.</p>	<p>02</p> <p>02</p>
	e)	Write the inspection procedure for cylinder block	04
	Ans.	<p>Inspection procedure for cylinder block:</p> <ol style="list-style-type: none"> 1) Check the gasketed surface using a straightedge and a thickness gauge for distortion and if the flatness exceeds the prescribed limit of 0.05 mm correct it. 2) Check the passages, openings for wear and blockages etc. 3) Checking of cylinder bore for wear: <ol style="list-style-type: none"> i) Inspect cylinder walls for scratches roughness or ridges which indicate excessive wear. If the cylinder bore is very rough or deeply scratched or ridged rebore the cylinder and use an oversize piston. ii) Using a cylinder gauges measure the cylinder bore in thrust and axial direction at three positions i.e. at top, middle and bottom. If any of following conditions is noted rebore the cylinder. Cylinder measurements at two positions give taper limit. Difference between the thrust and axial measurements gives the out of round limit. 4) Inspect the cylinder block for cracks by sound test, Magnetic crack detection or Hydrostatic testing 	04
	f)	List the tools and equipments required for denting and painting work.	04
	Ans.	<p>Denting Tools.</p> <p>1) Hammer 2) Dolly blocks. 3) Spoons 4) Files 5) Pick Tools</p> <p>Denting equipment</p> <p>1. Soldering equipment 2. Electric and gas welding equipment.</p> <p>3. Buffing and polishing machines. 4. Drilling Machine.</p> <p>5. Hydraulic press</p> <p>Tools and Equipment used for painting</p> <p>1. Spray Booth 2. Air Compressor 3. Automatic pressure Switch</p> <p>4. Air-transformer 5. Hoses 6. Hose Connections</p> <p>7. Blow guns 8. Respirators 9. Infrared backing element.</p>	<p>02</p> <p>02</p>

3	Attempt any FOUR of the following: (4 x 4)	16
a)	Describe procedure for idle speed adjustment in carburetor.	04
Ans.	<p>Procedure for idle speed adjustment in Carburetor: (02 Marks for Procedure, 02 Marks for Figure)</p> <p>The amount of fuel discharge at idle, through idle port is controlled by adjusting needle valve, fixed in the idle port. This needle valve is controlled by turning idle adjustment screw. Turning the screw in reduces the amount of fuel mixture, while turning the screw out increases the speed should be adjusted at least twice the each time of carburetor adjustment i.e. before and after idle mixture is made, while making final idle speed adjustment.</p>  <p style="text-align: center;">Figure: Idle speed Adjustment of a Carburetor</p>	02
b)	Describe inspection procedure for following gear box components: (i) Main shaft (ii) Lay shaft	04
Ans.	<p>Inspection Procedure for Gear Box Main and Lay shaft: (02 Marks for appropriate inspection procedure of each Main and Lay Shaft, Equal weightage to be given for other correct procedure)</p> <p>Inspection of Gear Box Main Shaft:</p> <p>The outer end of the main shaft is held in the housing with the help of bearing. The bearing is held in position by speedometer housing at the output end of the main shaft. In speedometer housing, wheel is fitted on the main shaft. This wheel is in turn meshed with worm from where flexible drive to speedometer is taken. On the main shaft an output flange is tightened from where the power is taken to the propeller shaft. An oil seal is fitted in the speedometer housing which rests on the moving flange. As such, it does not allow the gear box oil to leak past it. To stop oil leakage through main shaft, a small oil seal or felt is used on the release bearing sleeve.</p> <p>[1] Inspect Main Shaft Splines:</p> <ol style="list-style-type: none"> 1. May be twisted from abusive driving 2. Twisted spline prevents drive shaft slip yoke from sliding in and out of transmission 	02



[2] Inspect Drive Gear for VSS or Speedometer:

1. Located on the output shaft
2. Rarely suffers damage
3. A special puller is available to pull these gears

[3] Replace Worn Bearings

1. Use a press and support inside of bearing with bearing separator
2. Reassembling: apply pressure on inside of bearing only

Inspection of Gear Box Lay shaft:

Lay shaft also known as counter shaft, is fixed at lowermost part of the gear box with the help of taper roller bearing on either side. Some makes use only ball bearings. The gear assembly is fixed on this shaft with the help of key.

[1] Inspect the Counter gear Thrust Clearance:

By using a feeler gauge, measure the counter gear thrust clearance.

Standard clearance: 0.10–0.41 mm (0.0039–0.0161 in.)

Maximum clearance: 0.46 mm (0.0181 in.)

[2] Inspect the Counter Rear Bearing, Space Counter and Needle Roller Bearing:

- (a) By using a snap ring expander, remove the snap ring.
- (b) By using SST, remove the rear bearing, spacer, Counter gear and bearing. (SST 09950–40010).

c) State the probable causes and remedies of noise in differential.

04

Ans. Noise in Differential: (Any Four Points, 1 Mark for each)

S.	Possible Causes	Remedies
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

04

d) Describe inspection procedure for piston and piston rings.

04

**Ans. Inspection procedure for Piston and Piston Rings:
(03 Marks for Appropriate Inspection Procedure, 01 Mark for Suitable Sketch)**

[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:

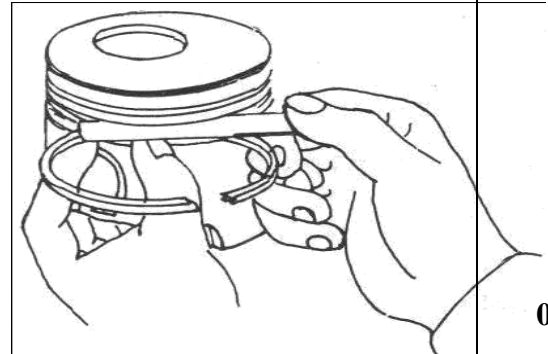
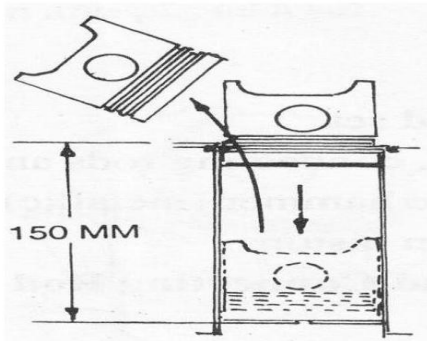
1. Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center 4 line, the indicated distance below the skirt bottom edge.
2. Measure the cylinder bore diameter in the thrust directions and subtract from the cylinder bore diameter measurement [*Standard oil clearance = 0.05-0.07 mm*]
3. If the clearance is not within specifications replace the piston .If necessary, replace the piston.

03

OR

Checking procedure of piston:

1. Clean the piston to remove dirt, carbon depositions etc.
2. Check piston diameter with micrometer and oil clearance.
3. Measure the clearance between cylinder bore and piston. If the clearance is not within specifications replace the piston
4. Check the piston ring groove clearance with the help of feeler gauge.
5. Inspect the condition of piston skirt for wear.
6. Check the oil holes in the oil ring grove.
7. In case piston is scored, cracked, burned spots, scuffed sides and broken ring lands the piston should be replaced.
8. If the piston is serviceable, the old rings must be removed and carbon must be cleaned from the ring grooves prior to the installation of new rings.



01

[3] Piston ring groove clearance:

1. Using a feeler gauge, measure the clearance between the new piston ring and ring land .Piston ring clearance is not within specifications replaces the piston.
2. Check piston Ring end gap.
3. Insert the piston ring into the cylinder.
4. Using the piston push the piston ring a little beyond the bottom of the ring travel.
5. Using a feeler gauge measure the end gap.
6. Standard piston ring end gap.

No.1 -Ring:- 0.30	to 0.51 mm
No.2- Ring:- 0.30	to 0.57 mm
Oil ring	0.35 to 0.60 mm



If the end gap is within specification-

- 1 Check the fit of each compression ring in its piston groove.
- 2 If fit is tight, the groove probably need cleaning.
- 3 If the ring is too loose, check the piston ring side clearance.
4. To check the ring side clearance: Place the ring in the groove, measure the clearance between the ring and groove, with a thickness gauge. The side clearance should be maintained as per manufacturer's recommendation.
5. Visual Inspection of ring for cut and damage.
6. If piston rings are excessively worn-out, damaged, replace set of piston rings with new one.

e) Give four causes and remedies for excessive engine oil consumption.

04

**Ans. Causes & Remedies for Excessive Engine Oil Consumption:
(Any Four points, 1 mark for each)**

S.N.	Causes	Remedies
1	Loose main or connecting rod bearings.	Check and adjust or replace.
2	Tapered or out of round cylinders.	Repair.
3	Worn out piston rings, piston or scored liner.	Replace with new one.
4	Worn oil seals (front and rear main bearings).	Replace with new one.
5	Clogged oil return pipe.	Clean and refit.
6	Worn out rear camshaft oil seals.	Replace with new one.
7	Clogged air breather.	Clean it.
8	Leaky fuel pump vacuum booster.	Check and repair or replace
9	Excessive clearance in intake valve guide.	Check and repair.
10	Improperly installed oil pan.	Install properly

04

4 (a) Attempt any THREE of the following: (3 x 4)

12

(i) Describe stepwise procedure to carry out the leakage test of cylinder.

04

**Ans. Stepwise procedure to carry out the leakage test of cylinder:
(03 Marks for Appropriate Procedure, 01 Mark for suitable sketch)**

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
6. Check the source of air leakage
 - a) If air is heard escaping from the oil filter cap, the piston rings are worn or broken.

03

- b) If air is observed bubbling, out of the radiator there is possible blown head gasket or cracked cylinder head.
- c) If the air is heard coming from carburetor or air inlet on fuel injection equipped engines there is defective intake valve.
- d) If air is heard coming from the tail pipe, there is defective exhaust valve.

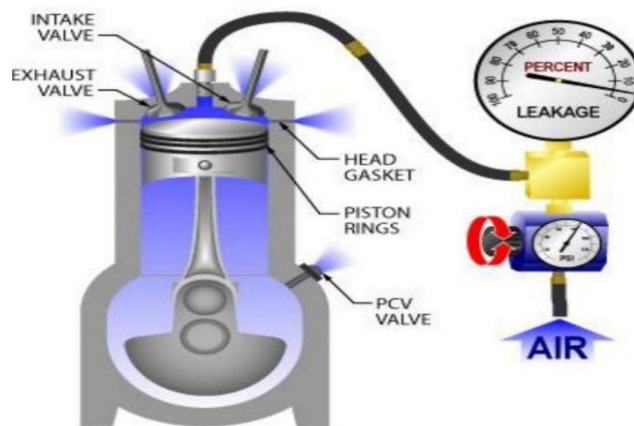


Fig: Cylinder Leakage Test

OR

Procedure of hydrostatic test:

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

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

01

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

04

Ans. Tuning of engine:

(1 Mark for Significance of Tuning, 2 Marks for Procedure of Engine Tune up, 01 Mark for Block diagram)

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.

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.

01

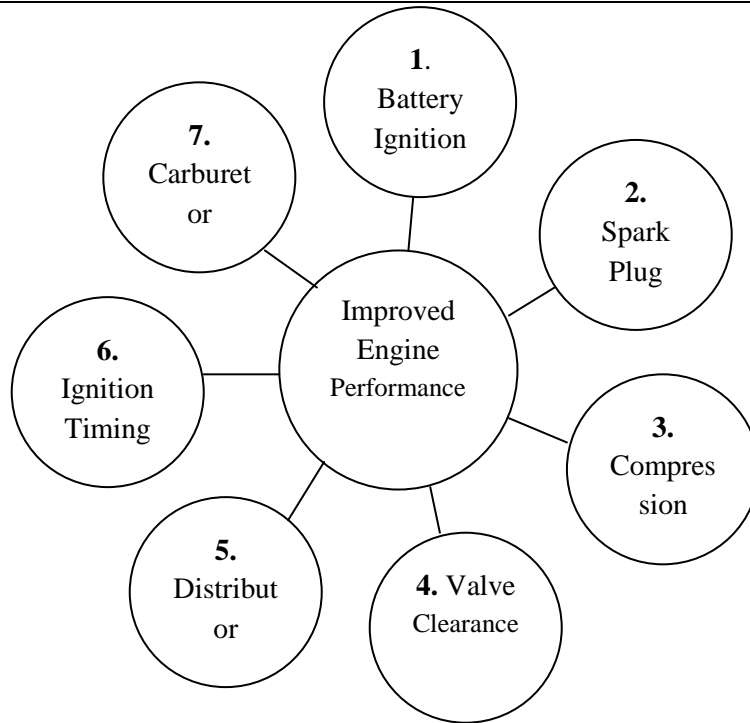


Figure: Block Diagram of Engine Tune up

Tune-up procedure for petrol engine:

1. If the engine is cold, operate it for about 20 minute at 1500rpm or operate until it reaches the operative temperature. If there any operational problems during this warm up time these problems may be noted.
2. Connect oscilloscope and exhaust gas analyzer and perform diagnosis. Check for any abnormal condition and if possible the cylinder in which it appears.
3. Remove all spark plugs open the throttle & choke valve fully Disconnect the distributor lead from the primary oil terminal thus preventing excessive secondary voltage.
4. If the compression ratio is not up to specifications, perform engine services that will eliminate the trouble. If the compression is all right, reinstall the spark plugs.
5. Clean inspect file gap and test the spark plugs replace worn 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.
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.

01

02

15. Check crankcase ventilation system.
16. Check intake manifold and air injection system.
17. Remove carburetor, 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.

(iii) A driver has observed a noise in a propeller shaft, state any four probable causes and remedies.

04

Ans. Noise in Propeller Shaft:
(Any Four points, 1 mark for each)

S.N	Possible 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.

04

(iv) Describe the inspection procedure for connecting rod.

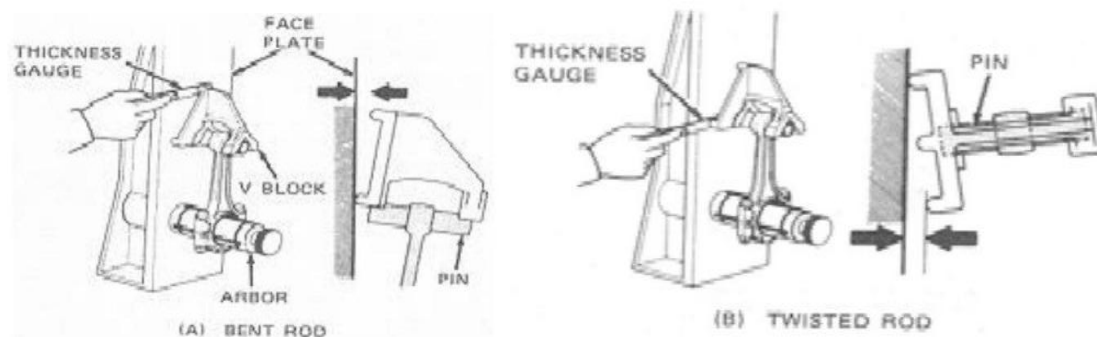
04

Ans. Inspection Procedure for Connecting Rod:
(03 Marks for Appropriate Procedure, 01 Mark for simple suitable sketch)

Align connecting rod.

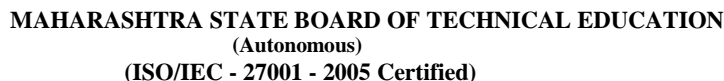
Using a rod aligner, check the connecting rod alignment as shown in figure in which big end of bore of connecting rod is held in self-entering spindle of the gauge while angle gauge is placed on the gudgeon pin.

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.



03

01



4	(b)	Attempt any ONE of the following: (1 x 6)	(06)
	(i)	Explain the procedure for wheel alignment of car. List the tools and equipments used for the same.	06
	Ans.	<p>Procedure for Wheel Alignment of Car: (04 Marks for Procedure of Wheel Alignment, 02 Mark for List of Tool & Equipments)</p> <ol style="list-style-type: none"> 1. For checking and making adjustments for wheel alignments, always use manufacturers manual as there are cars of number of makes and models. So the specification varies in wide range. 2. All alignments check and adjustments should be made with the car on leveled ground, at curb weight, spare tyre in place, normal supply of water, fuel and oil, but with no passengers or load. 3. Check castor, camber and king pin inclination by using combination gauge. 4. Check toe in with toe in gauge provided. 5. If these measurements are not within limit then adjust it as per the manufacturer's manual. 6. Castor and camber are adjusted by adding or removing shims provided, at the upper control arm and inside the frame. For positive castor remove shims from the front and/or add shims from both the front and rear. For positive camber remove an equal number of shims from both the front and rear. 7. For toe in adjustment: loosen the clamps on the tie rod ends and shorten one tie rod and lengthen the other. Adjust equal amount until the steering wheel position is correct. <p>Tools and Equipment used for Wheel Alignment: Sophisticated tools and equipment is available these days to check wheel alignment and various steering angles. Now a day's Computerized Wheel Alignment Equipment is being extensively used for 2/4 Wheel Alignment. The use of such equipment greatly enhances the alignment accuracy. Following are the conventional equipment used in garages/service stations for wheel alignments;</p> <p>Camber – Combination Gauge Castor – Combination Gauge King Pin Inclination – Inclination Gauge Toe in & Toe out – Toe-in/out gauges</p>	03
	(ii)	Give the procedure for cleaning and testing of MPFI injectors.	06
	Ans.	<p>(04 Marks for Appropriate Procedure of Cleaning & Testing, 02 Mark for suitable sketch)</p> <p>Procedure for Cleaning and Testing of MPFI Injectors:</p> <p>Three tests are conducted for testing of diesel engine injector</p> <ol style="list-style-type: none"> 1. Pressure Test 2. Leak off Test 3. Spray Test <p>[1] Pressure Test:</p> <ol style="list-style-type: none"> 1. Fix the injector to be tested to injector pipe of Injector tester as shown in above figure. 	

2. Work the hand pump.
3. Note the opening pressure of spray on gauge provided.
4. If the pressure is less, it is increased by loosening the check nut and tightening the adjusting screw.
5. If it is more than the specified, the adjusting screw is loosened.
6. After adjusting pressure, lock the lock nut and replace the cap.
7. In some make of nozzles shims are added or removed instead of adjusting screw.

[2] Leak off Test:

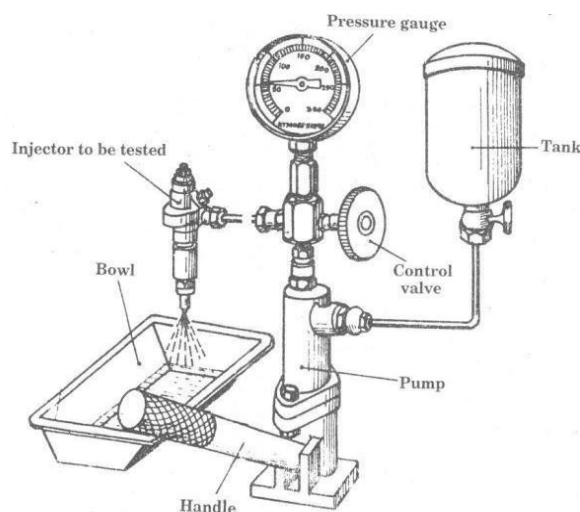
1. Fix up injector on tester.
2. Build up pressure of 150 atoms (1 atom = 14.7 lb/in²) and keep the pressure for about 10 second without spraying.
3. After 10 seconds checkup that there is no drop in pressure and wetness is not felt on tip of nozzle body.

If there is drop in pressure or wetness is felt on tip of nozzle body:

1. Dismantle the injector.
2. Get the seat of nozzle body grounded.
3. Get the nozzle body seat lapped.
4. If nozzle valve seat is pitted, it should be replaced or grounded.
5. Fix up the injector again and test it in same manner as prescribed in steps 1 to 3.

[3] Spray Test:

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





5		Attempt any FOUR of the following	16
	a)	Write the inspection procedure of clutch.	04
	Ans.	<p>1. 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.</p> <p>2. Inspect the lining on the clutch disk for wear.</p> <p>3. The clutch disc has brake pad material on either side of it which is held on by rivets.</p> <p>4. When this lining wears it allows the rivets to contact the flywheel or pressure plate which causes the clutch to slip.</p> <p>5. There should be at least 2mm of friction material remaining above the rivet heads.</p> <p>6. Check the clutch disk for loose rivets, distortion, cracks, broken springs and other obvious damage.</p> <p>7. Check the clutch disk for run out. 8. Verify that the clutch disk slides freely on the drive shaft splines without excessive radial play.</p>	04
	b)	Write the stepwise procedure for inspection of lubricant system.	04
	Ans.	<p>1. Oil level: oil level is checked by dip stick. There is a mark on the dip stick to indicate proper level of oil. If dip stick is not wet up to the mark, more oil has to be added up to correct level.</p> <p>2. Oil change: if the oil is too dark and thin, dirty the same has to change. Usually oil is changed after 10,000 Km. intervals or earlier depending upon conditions of operations or manufacturers instruction. For changing oil, warm up the engine and drain while it is still warm. Light flushing oil should be used for flushing. Run the engine for a few minutes with flushing oil in the sump, then stop the engine and drain the flushing oil. Ensure that drain plug is tight and refill new oil as recommended by the manufacturer.</p> <p>3. Checking the oil pump: the points to be tested in gear pump are clearance between gear teeth, stub shaft wear, bush and oil relief valve. The clearance is measured with feller gauge. If the clearance between the gear teeth is more than 0.5 mm, the gears have to be replaced. If wear on stub shaft is more than 0.5 mm, it should be replaced. The bush in the drive gear or drive shaft has to be discarded if the clearance exceeds 0.1 mm. In the relief valve, the spring is to be tested for stiffness and if not found according to design specifications, is to be replaced.</p> <p>4. Checking oil filter: open the oil filter and inspect the element. If the same is found clogged, the same cleaned and reused or replace with new one.</p>	04
	c)	Explain procedure for : (i) Free Play adjustment (ii) Pedal travel adjustment in clutch	04
	Ans.	i) 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	02

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.

ii) Pedal travel adjustment in clutch: 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

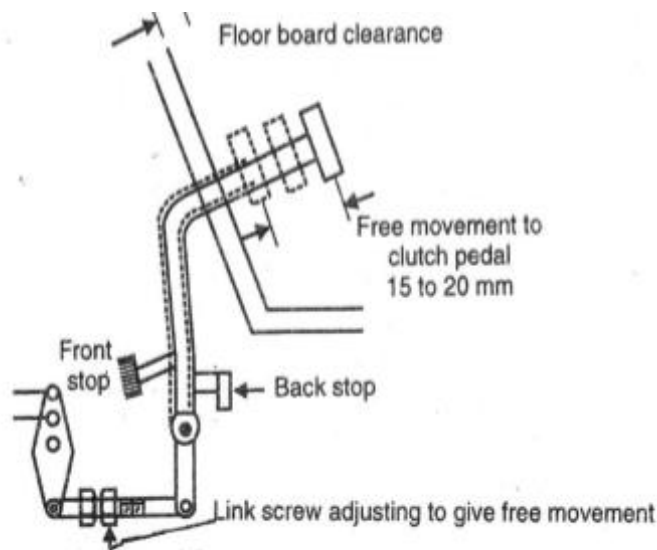


Fig: Clutch Adjustments.

02

d) State the probable causes and remedies of excessive fuel consumption.

04

Ans. Excessive fuel consumption (Any Four points)

04

S.N	Causes	Remedies
1	Excessive fuel pump pressure or pump leakage.	Check and adjust fuel pump pressure or replace
2	Clogged air cleaner	Clean and refit
3	Faulty ignition system.	Repair or replace
4	Loss of engine compression	Repair or replace necessary parts.
5	Faulty fuel supply system.	Repair or replace

e) State any four troubles, causes and remedies of steering system.

04

Ans. (Four troubles with one cause each and its remedies)
1.Hard Steering:

04

Sr. No	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.



5	Tight or jam king pin.	Adjust as necessary
6	Bent steering tube.	Repair or replace
7	Misalignment of caster, camber, toe in, steering axle inclination.	Make correct alignment.
8	Underinflated tyres.	Inflate to correct pressure.
9	Bent front axle.	Repair or replace

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 Centre bolt.	Replace centre 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:

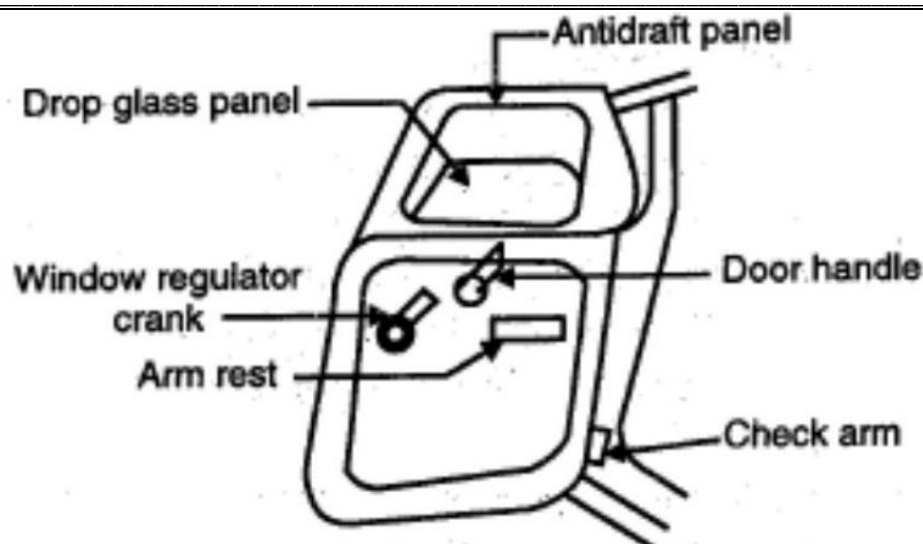
Sr. N	Causes	Remedies
1	One of the front tyre underinflated or worn out.	Inflate to correct pressure or replace
2	Loose U or I bolt of font axle spring.	Tighten
3	Bent steering arm.	Repair or replace
4	Misaligned front axle with rear axle.	Make correct alignment.
5	Bent stub axle.	Repair or replace
6	Misalignment of caster, camber, toe in, steering axle inclination	Make correct alignment.

4.Steering kick back

S.N	Causes	Remedies
1	Tyre pressure low or uneven	Inflate to correct pressure
2	Spring sagging	Replace adjust torsion bar
3	Shock absorber defective	Replace
4	Looseness in linkage	Adjust, replace worn parts
5	Looseness in steering gear	Adjust, replace worn parts
6	Improper angle of impact with obstruction	Drive correctly



		7	Stiffness & condition of shock absorber not proper	Replace & adjust		
		8	Heavy speed of vehicle	Drive properly.		
		Note: (Causes and remedies of troubles like Front wheel shimmy, Excessive steering play, front wheel tramp may also be considered)				
	f)	A technician has observed noise in gear box. Suggest possible causes and remedies.				04
	Ans.	Noisy gear box: (any four points)				
		S.N	Possible Causes	Remedies		
		1	Less or no lubricating oil in gear box.	Top up oil to the correct level	04	
		2	Gearbox housing out of alignment with the engine.	Make proper alignment.		
		3	Worn out or broken gear teeth.	Replace gear.		
		4	Worn out teeth of shifting sleeve.	Replace shifting sleeve.		
		5	Worn out bearings.	Replace bearings with new.		
		6	Worn out/ Defective gear shifting mechanism.	Repair or Replace.		
		7	Excessive backlash in gears.	Replace.		
6		Attempt any FOUR of the following				16
	a)	Explain the procedure for adjustment of doors and locks.				04
	Ans.	Procedure for adjustment of door and locks:				04
		1. Adjustment of door and lock is necessary for smooth operation of door and security of vehicle.				
		2. 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, 4 relocate the striker				
		3. Check hinges of doors for loose rivets, noise, corrosion etc. Check rubber weather strip for broken or damage. If weather strip is found damaged or broken, replace				
		4. Check rubber pads for any damage, replace if required.				
		5. 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				



b) Explain with neat sketch importance of tyre rotation.

04

Ans. Tyre rotation is essential -

04

1. To avoid uneven tyre wear. If all the tyres wear at the same rate, all of them would respond to the driver's input equally maintaining the cornering and handling characteristics.
2. To increase the life of tyre.
3. It is recommended that tyres should be rotated after fixed intervals of distance traveled by the vehicle.

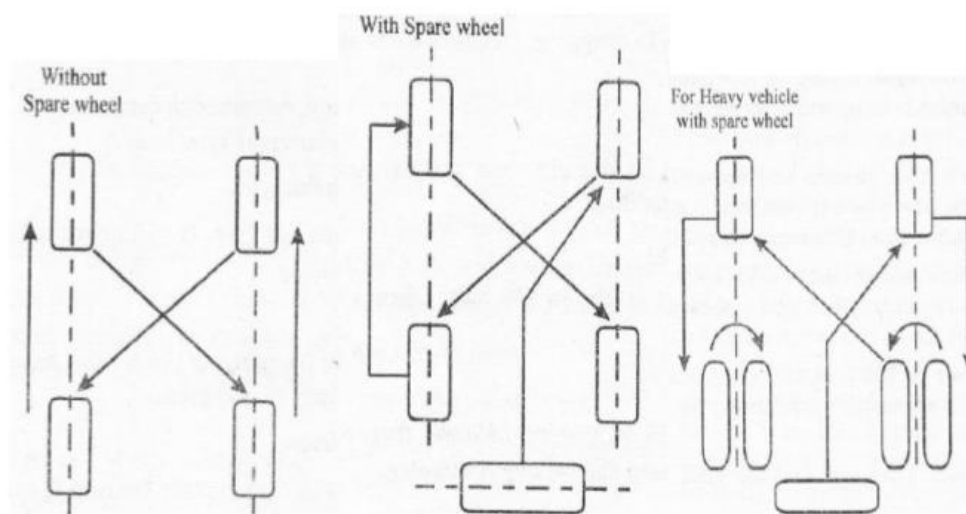


Figure 1

OR

Figure2

OR

Figure3

c) Explain care and maintenance of tyre.

04

Ans. The purpose of inspecting tyres is to determine if they are safe for further use. When defects or improper wear pattern are found, inform vehicle owner for the probable effects and recommend the services to correct the causes of abnormal wear.

04

Tyres have tread wear indicators or wear bars. These are filled in sections of tread grooves that will



show when the treads have worn down to 1.59 mm. A tyre with a wear bar should be considered as worn out and shall be replaced.

Tread depth should be checked using tread depth gauge after running vehicle for every 10000km. Some manufacturers recommend minimum of 0.8 mm tread depth for safe riding.

Also check for bulges in the sidewalls of tyre. Bulges mean plies have separated and the tyre could fail any time. Tyres with separated or broken plies should be replaced. Remove any stone, pieces of glass, metal or other objects wedged in the tread. These could cause air loss in tyre.

Some radial tyres may have slight indentation on the sidewall when inflated. This is a characteristic of some radial tyres and normally does not affect the tyre performance.

A tyre may look OK from outside but may have damaged internally. If any such internal damage noticed, remove the tyre from the rim and inspect the tyre from inside. Repair tyre as required or replace of necessary.

When the tyre is out of the wheel, check the wheel for dent and roughness. Do not attempt to straighten a bent wheel. This could weaken the wheel and cause it to fail earlier.

Clean rust spots from steel wheels with steel wool. Clean aluminum wheels with soap and water. Decorative plastic inserts in wheels can be cleaned using a sponge and soap and water.

File off nicks or burrs. Clean out all fillings and dirt. Replace defective tyre valves.

Tyre rotation is another important part in tyre maintenance and care. Some tyres wear faster than others on the vehicle. This is because front and rear tyres perform different jobs. Also the type of vehicle and style of driving can cause tyre to wear differently.

To equalize tyre wear, perform a tyre rotation periodically or when unusual wear occurs.

A tyre rotation means to switch the wheel and tyre assemblies from one axle position to another. A typical recommendation is to rotate the tyres after first 10000Km running and then after every 20000Km

d) **Describe brake bleeding procedure.**

04

Ans. (Methods-01 mark , Description any one method-2 Marks, Fig.-1 Mark)

04

Method of Bleeding of brakes:

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

(Description any one method-2 Marks, Fig.-1 Mark)

1. Pressure bleeding:

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.

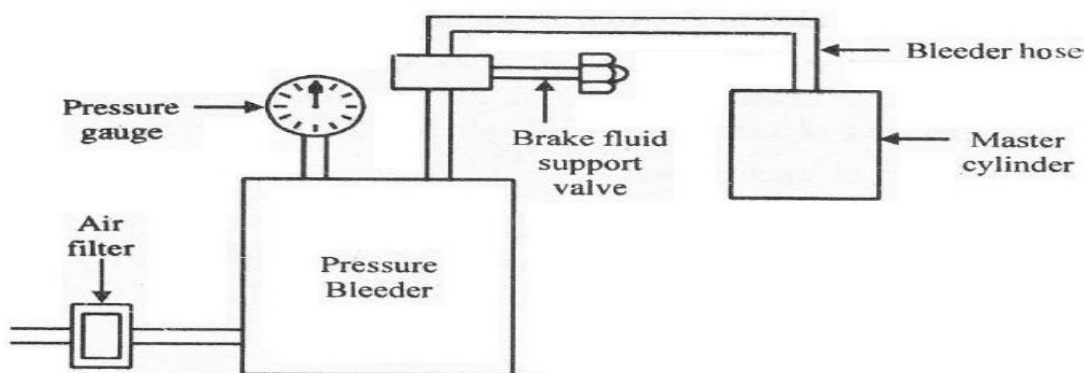


Figure. Pressure brake bleeding

2. 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.

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

3. Manual brake bleeding: (Write procedure of Manual brake 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.

1. 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.
2. Loosen the bleeder screw at least one full turn.
3. Have an assistant to depress and hold the brake pedal and then tighten the bleeder screw.
4. Have your assistant to release the brake pedal.
5. 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.

6. Repeat this procedure at each wheel.

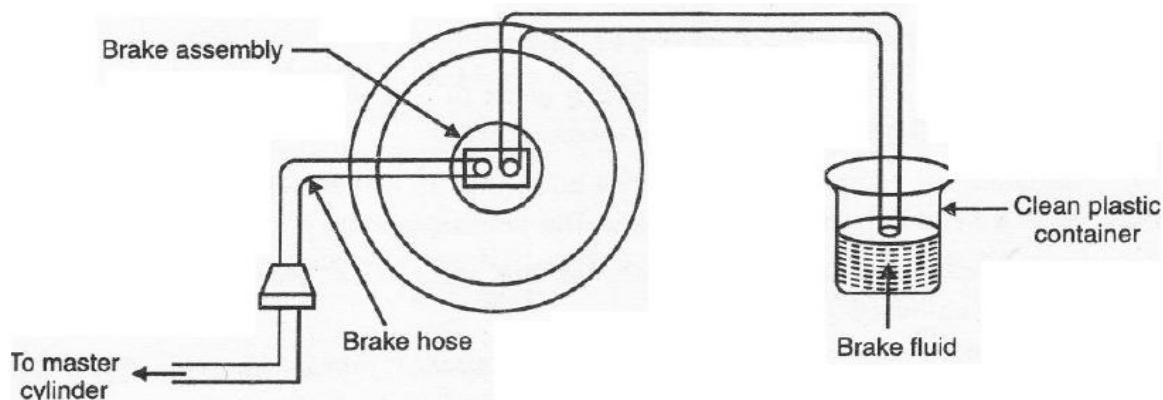


Figure. Manual brake bleeding

e) Write the stepwise procedure for checking of thermostat.

04

Removal:

1. Disconnect negative cable at battery
2. Drain the cooling system and tighten the drain plug.
3. Disconnect thermostat cap from thermostat case and remove the thermostat.

Inspection:

1. Make sure that air bleed valve of thermostat is clear. If it is clogged, engine tends to overheat.
2. Check to make sure that valve seat is free from foreign matters which would prevent valve from seating tight.
3. Check thermostatic movement of wax pallet as follows-
 - Immerse thermostat in water and heat water gradually as shown in figure.
 - Check that valve starts to open at specific temperature.
 - If valve starts to open at temperature substantially below or above specific temperature.

04

