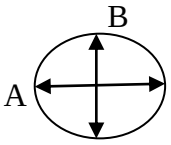
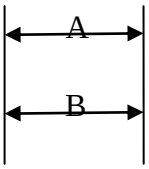
Important Instructions to examiners:
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language 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.

1. A) Attempt any THREE of the following.	**12**
a) State any four equipment required for Auto. Workshop with their functions.	4
Answer: Equipments required for Auto. Workshop with their functions*(Any four-1mark each)* 1) Hydraulic jack or axle stand: To lift the car for work under the car or to change the wheels. 2) Hydraulic Press: To take out the press fitted components. 3) Grease gun: To lubricate the chassis components. 4) Vehicle washer: To wash the vehicle, to remove mud, sand, sticky chemicals etc. 5) Electronic soldering iron: it is used for soldering the electrical and electronic circuits. 6) Portable electric drill: To drill the sheet metal panels and chassis frame. 7) Electric chain block: To lift heavy duty components and to shift from one place to another. 8) Air compressors: To facilitate compressed air supply at various points and pneumatic tool functioning. 9) Nozzle tester: To test and adjust the injection pressure, to test jet sprayed from nozzles. 10) Ridge reamer: It is used for fast ridge removal and it will over cut cylinder bore. 11) Brake tester: To measure brake performance. 12) Battery charger: To charge number of units at the same time. 13) Engine analyzer: To check engine rpm, dwell angle, cylinder leakage, oil temperature, contact breaker point gap, exhaust emission etc. 14) Wheel aligner: To measure turning radius, camber, caster, king pin inclination, toe in 15) Head light beam aligner: To align the headlight beams of motorcycle, LCVs and heavy vehicles.	4

b) What the names of necessary records for Auto. Workshop with its usefulness.	4
Answer: Necessary records for Auto. Workshop with its usefulness *(Any four – 1 mark each)* **1) Vendor service work order:** It contains details of vehicle owner as well as vehicle, job to be done on vehicle, list of spare parts and cost, and labour cost incurred. **2) History sheet:** History sheet is useful for knowing the amount spent on the maintenance of vehicle. In the remark column type of maintenance should be mentioned and reason for such repair should be found out to control the maintenance. **3) Activity file:** It is useful for- a) Analysis of unnecessary jobs. b) Identification of warranty claims. c) Investigation of accident to determine insurance. d) Identification of cases, what type of repair, equipments used. **4) Maintenance instruction manual:** In this, instructions are given which are helpful to carry maintenance of vehicle. It provides information, data, limits and guidelines required for maintenance work. **5) Spare procurement register:** It used to analyze the requirement of spares. **6) Defect register:** Defective items are entered in this register.	4
c) Explain the inspection procedure of cylinder bore for wear and taper.	4
Answer: Inspection procedure of cylinder bore for wear and taper. **Inspection of Oval wear or out of roundness:** • Visually check the cylinder bore for vertical scratches. • Inspect cylinder bore for cracks. • Using cylinder gauge, measure the cylinder bore diameter at top, middle and bottom of bore as well as in the thrust and axial directions. • Take the measurement at A and B with bore dial gauge. • The difference in the reading is ovality =A-B  **Inspection of Taper:** • Move the bore dial gauge top to bottom inside bore. • Note the maximum and minimum reading. • The difference in the reading is taper. • Taper = A - B 	2 2
d) Explain the procedure of servicing the lubrication system.	4
Answer: Procedure of servicing the lubrication system. 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. **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.	4

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.

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.

B) Attempt any ONE of the following: 6

a) State the troubles gearbox with its causes and remedies. 6

Answer: Troubles of gearbox with its causes and remedies (*Any two troubles -with three suitable causes and their remedies- 3 marks each)* 6

1)Noisy gear box

Causes	Remedies
1. Less or no lubricating oil in gear box.	Top up oil to the correct level
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.

2) Slipping out of Gear

Causes	Remedies
1. Weak springs of fork rod.	Replace spring
2. Worn out teeth of sleeve or gears.	Replace
3. Worn out bearing of clutch shaft or main shaft or counter shaft.	Replace bearing.
4. Worn out synchronizer rings.	Replace.
5. Too much play in gear shifting mechanism.	Adjust play correctly.

3) Oil leakage.

Causes	Remedies
1. Too much oil in gear box.	Maintain correct oil level.
2. Loose top cover or any other housing bolt.	Tight it properly.
3. Cracked housing or top cover	Replace.
4. Damaged or improperly installed gaskets or oil seals	Replace or install properly.
5. Loose or defective drain plug/filler plug.	Tight or replace.

4) Hard Gear shifting.

Causes	Remedies
1. Distorted splines of the main shaft.	Replace shaft.
2. Too strong shifter lock spring.	Replace spring.
3. Improper clutch adjustment.	Make proper adjustment.
4. Shifting mechanism out of alignment.	Align properly.
5. Battered gear teeth.	Replace gear.

b) State the troubles for steering system with its causes remedies — 6

Answer- Troubles from steering system (*Any two troubles-with three suitable causes and their remedies- 3 marks each)*

1) **Hard Steering:**

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. 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: Causes and remedies of troubles like Front wheel shimmy, Excessive steering play, front wheel tramp may also be considered)*

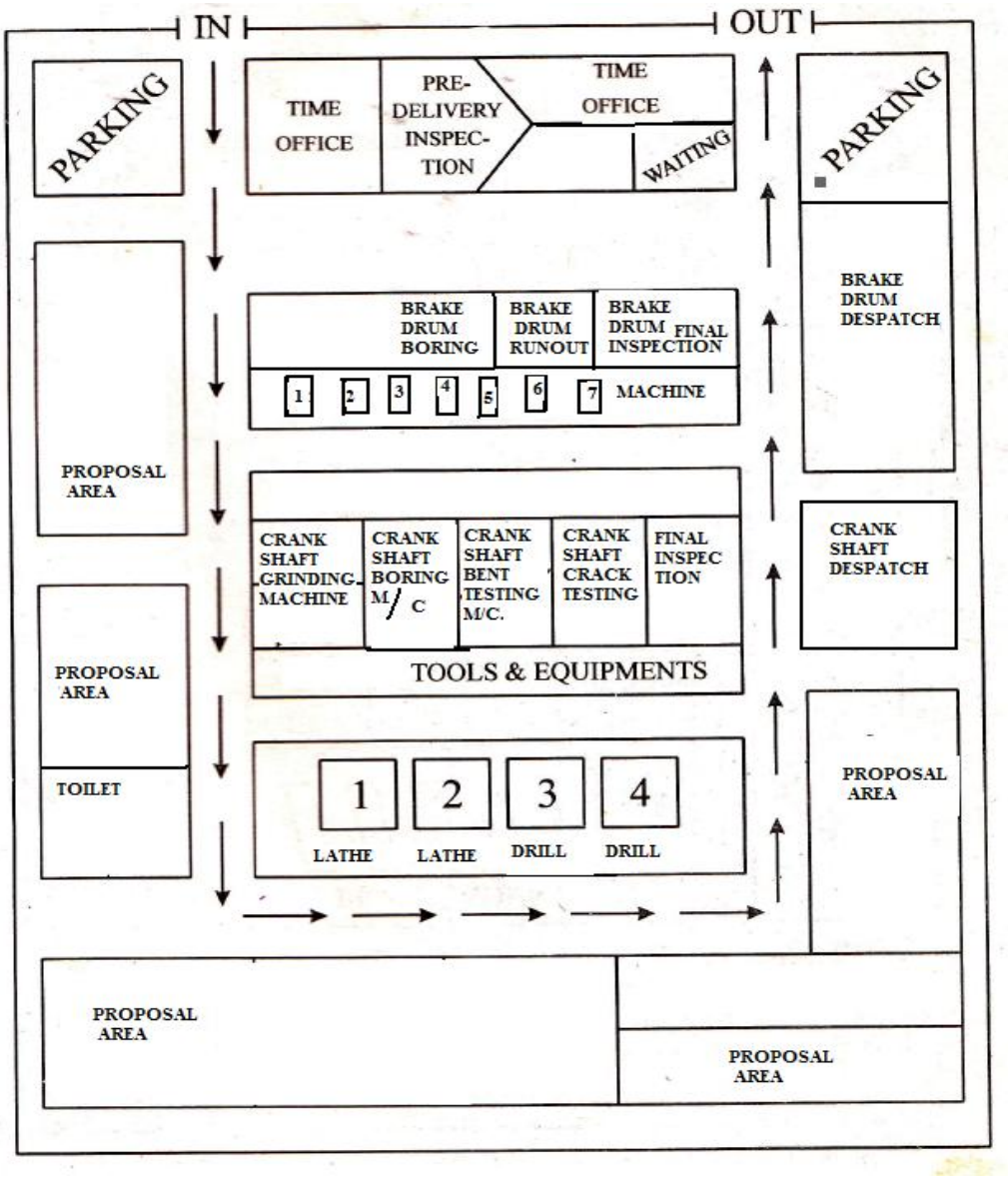
6

2. Attempt any FOUR of the following — 16

a) Draw the layout of an Automobile workshop with any specialized job. — 4

Answer: Layout of an Automobile workshop with a specialized job:

(Credit should be given to any Equivalent layout- e.g. F.I.P Repair, Cylinder Head/Block repair, Brake drum reboring, Crankshaft, connecting rod repair)



Layout of automobile workshop for brake drum boring & Crankshaft repair

4

b) Explain how the preventive maintenance is better than breakdown maintenance. 4

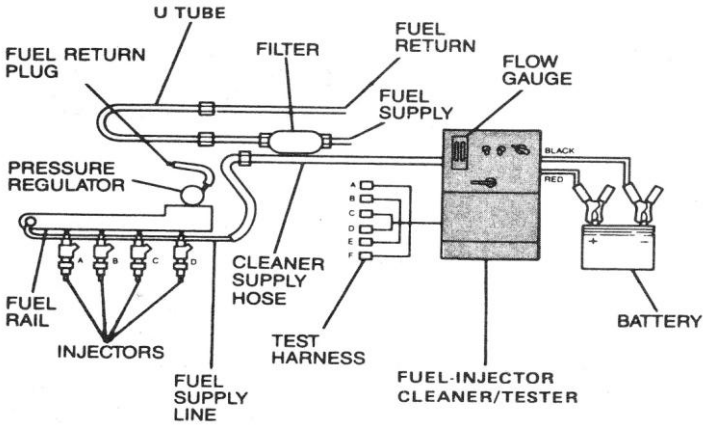
Answer: Preventive maintenance is better than breakdown maintenance.

Preventive maintenance is known as "Planned maintenance" or "Systematic maintenance". It is based on the "Prevention is better than cure".

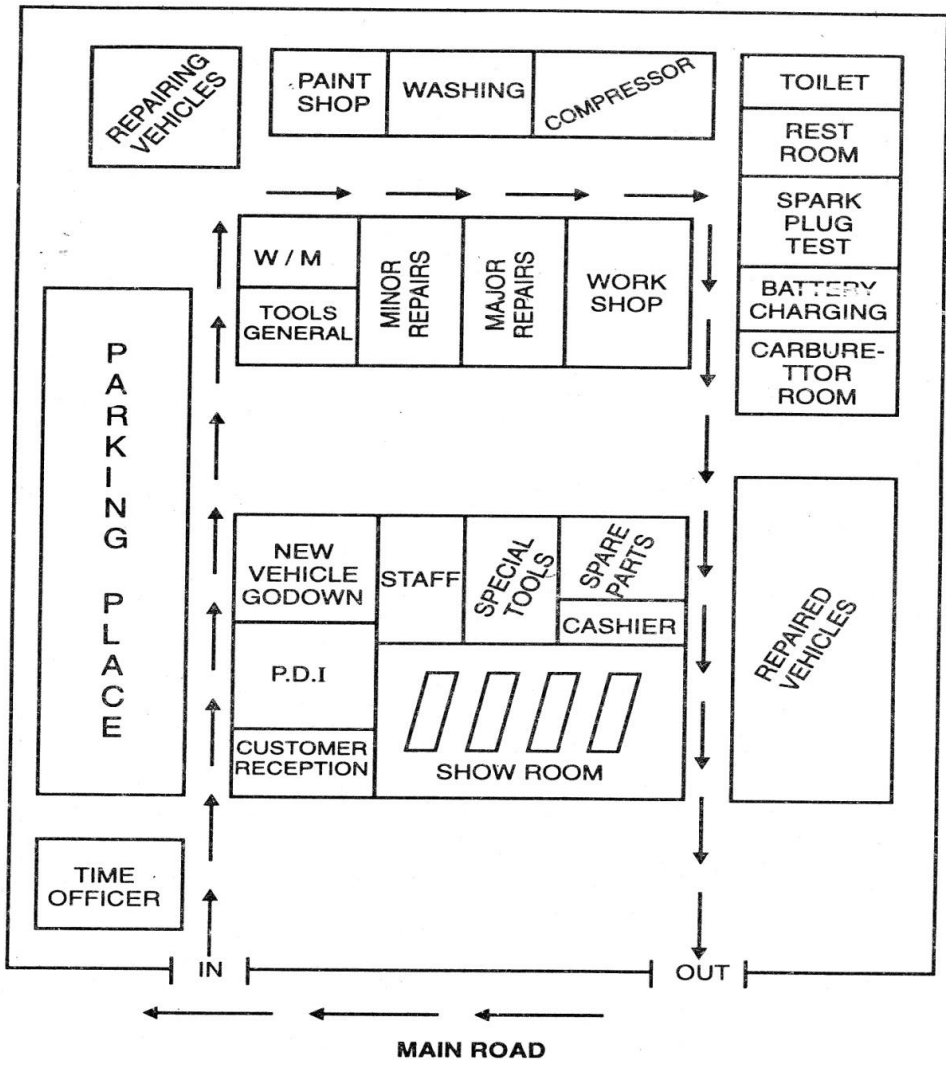
Preventive maintenance helps to find out the reasons leading to breakdown and to rectify them, when they are in minor stage. So we are doing the repair work in its minor stage. It requires lesser time as compared to that of break down maintenance and thus down time is reduced by doing preventive maintenance. By doing preventive maintenance we obtain maximum availability of vehicle by avoiding breakdowns. Due to preventive maintenance we reduce wear and tear of the components of the vehicle and thus increase life time of the vehicle. 4

By preventive maintenance we reduces the maintenance cost, keep the vehicle in good operating condition and increases reliability of the vehicle.

In breakdown maintenance we provide attention when a motor vehicle is stopped due to faults created during running. Breakdown can occur any time so the vehicle can stop at any time, at any place which will waste the time. Also breakdown decreases life of the vehicle.

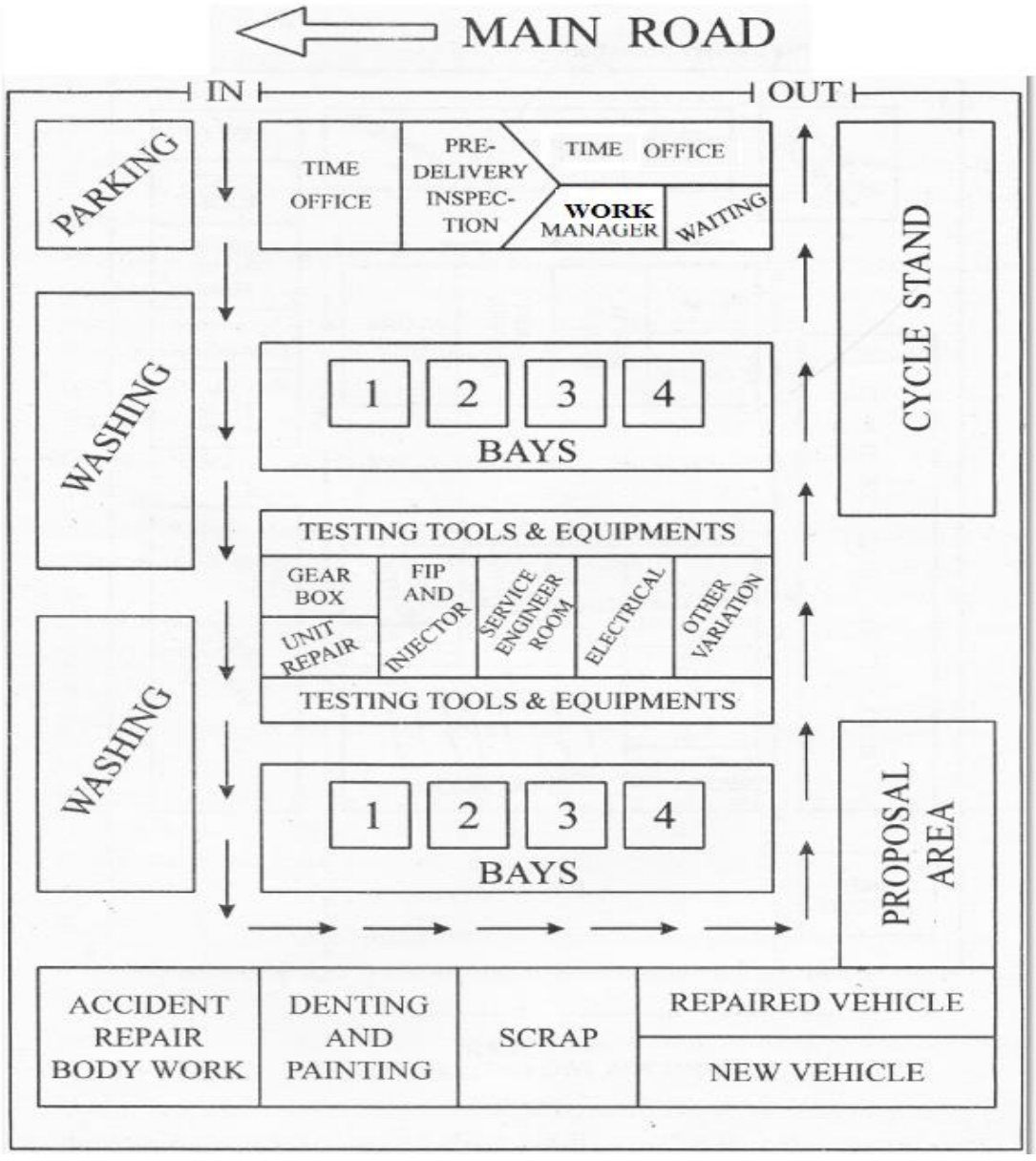
c) Explain any testing procedure for solenoid –operated fuel injector.	4
Answer: Testing procedure for solenoid –operated fuel injector. Three tests may be performed on a solenoid- operated fuel injector. These tests are for resistance, volume or flow and leakage. **1) Injector resistance:** Check the injector resistance with an ohmmeter. Remove the wiring-harness connector from the injector. Connect an ohmmeter lead to each of the injector terminal. Replace the injector if the resistance is not within the manufacturer's specification. **2) Injector flow or volume:** Connect a fuel injector tester to the fuel system. Follow the tester operating instructions. The procedure determines whether the volume of fuel flow through each injector is within specifications.  **Fig. fuel injector tester.** A similar test can be made with an injector balance tester. The test is made with engine off, ignition key on, and the pressure gauge connected to the fuel system. The tester opens each injector for the same length of time. The pressure gauge shows the amount of pressure drop. All injectors should have about the same pressure drop. a partially clogged injector has less pressure drop than a clean injector. Clean or replace any injector that fails this test. **3) Injector leakage**: With the fuel system pressurized, check the tip of each injector for leakage. No fuel should leak out. Clean or replace the injector if it leaks more than specified.	1 2 1
d) Prepare a maintenance schedule for 20 light motor vehicles, Assume a suitable data.	4
Answer: Maintenance schedule for 20 light motor vehicles: Assume – 1. Space Utility- 01 Repair/Service bay - 01 Washing Pit 2. Time Utility – 3 Hrs required for servicing of vehicle. 3. Man power required – Minimum 5 peoples required for particular job, 4. Equipment and machinery and parking area – As may be available. **Check-** **Daily** • Water level or liquid level in radiator. • Oil level of engine. • Tyre pressure. • Braking system • Electrical system • Fuel Level in fuel tank.	1 1

Weekly • Clean the vehicle. • Lubrication of the vehicle. • Tighten the nut and bolts. • Battery electrolyte level • Clean air filter. • Check brake and clutch pedal play. **Monthly** • 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.	1 1
e) Explain the phasing of fuel injection pump.	4
Answer: Phasing of fuel injection pump: 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 as the 'phasing of the pump'. Pump element No. 1 is first kept at its TDS. The setting of the other pump elements is then checked. The gap between the lower end of the plunger and the top of the tappet roller should be 0.5 mm. If the position of the plunger can be raised or lowered in the barrel by means of an adjusting screw. After this gap is made uniform for every plunger , element the phasing should be started The point of port closer in each element should be correctly noted. This is done by gradually lifting the plunger from its bottom position. For this the valve and valve spring are removed from the pump element. As the plunger goes up gradually, the oil coming out of this valve keeps reducing. When the plunger is just closing the two ports, the oil supply from the valve passage stops. This is found out by the attaching a swan neck pipe for the closure point of cut off to the pump barrel. 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. 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

f) Draw the layout for two wheeler dealer. List the required equipment's and tools.	4
Answer: Layout for two wheeler dealer:  	3
Required equipment's and tools: *(Any four)* a) Screw driver: standard, flat, insulated standard, offset, ratchet, and Phillips screw driver. b) Pliers: combination, long nose, round nose, side cutting, adjustable, slip joint pliers. c) Wrenches: open end, box end, ring, tubular, socket wrench. d) Torque wrench. e) Hacksaw f) Pliers. g) Hammer. h) Hydraulic Press. i) Grease gun. j) Vehicle washer. k) Electronic soldering iron. l) Portable electric drill. m) Air compressors. n) Ridge reamer. o) Brake tester. p) Head light beam aligner.	1

3. Attempt any FOUR of the following:	16
a) Draw the layout for garage for cars. List the required equipment's and tools	4

Answer: Layout for garage for cars: *(Note: Credit should be given to suitable layout)*

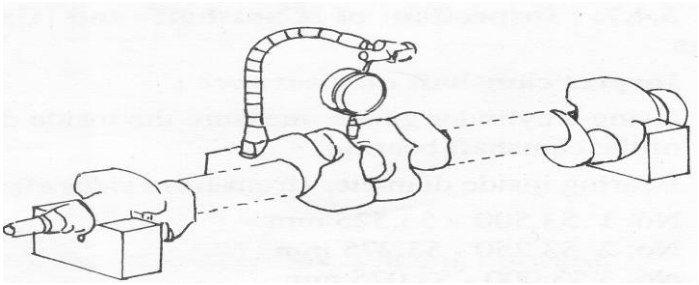
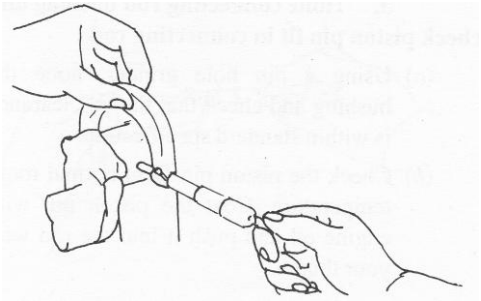
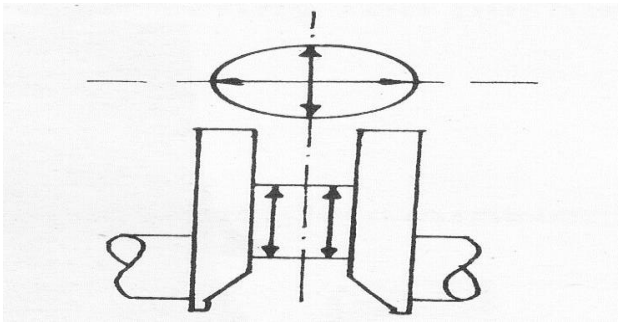


3

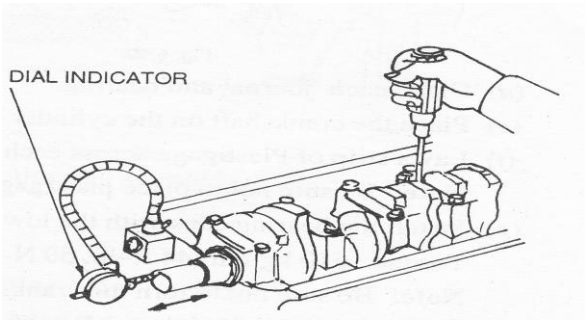
Required equipment and tools: (Any four)

1

a) Screw driver: standard, flat, insulated standard, offset, ratchet, and Phillips screw driver.
b) Pliers: combination, long nose, round nose, side cutting, adjustable, slip joint pliers.
c) Wrenches: open end, box end, ring, tubular, socket wrench.
d) Torque wrench.
e) Hacksaw
f) Pliers.
g) Hammer.
h) Hydraulic Press.
i) Grease gun.
j) Vehicle washer.
k) Electronic soldering iron.
l) Portable electric drill.

m) Air compressors. n) Ridge reamer. o) Brake tester. p) Head light beam aligner. q) Wheel Aligner r) Wheel Balancer	
b) Explain the inspection procedure of a crank shaft for its alignment.	04
Answer: Inspection procedure of a crank shaft for its alignment: *(Note: credit may be given to suitable sketches)* **1) Inspection crankshaft for run out or straightness**  a) Place the crankshaft on V-block. b) Using a dial indicator measure the circle run out at the central journal. Maximum circle run out =0.8 mm If the circle run out is greater than maximum, replace the crankshaft. **2) Inspect Main journals and Crank Pin diameter** Using a micrometer, measure the diameter of the main journal and crank pin.  **3) Check the main journal and crank pin for taper and out of round** Maximum taper and out of round=0.02 mm If taper and out of round are greater than maximum limit, regrind the crankshaft. If necessary replace the crankshaft. 	4

4) Measurement of crankshaft Thrust clearance



Using a dial indicator, measure the thrust clearance while prying back and forth with a screw driver.

If the clearance is greater than service limit, replace the thrust washers as a set.

c) Explain the inspection procedure of piston. 4

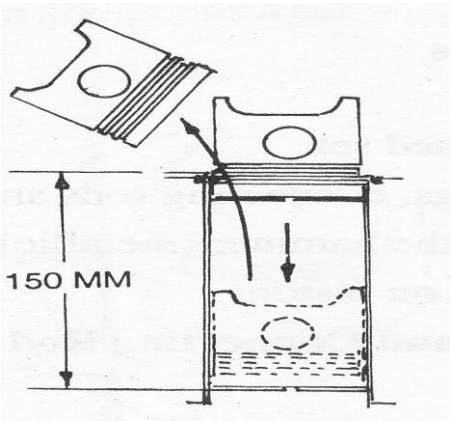
Answer: Inspection procedure of piston:

1) 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

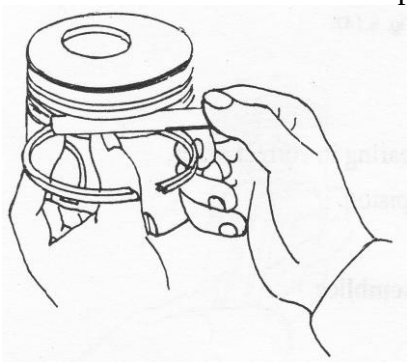
Standard oil clearance =0.05-0.07 mm



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

2) 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.

d) Explain the testing procedure of throttle position sensor with voltmeter.	4

Answer: Testing procedure of throttle position sensor with voltmeter:

(Note: Procedure-03marks, Figure- 01 marks)

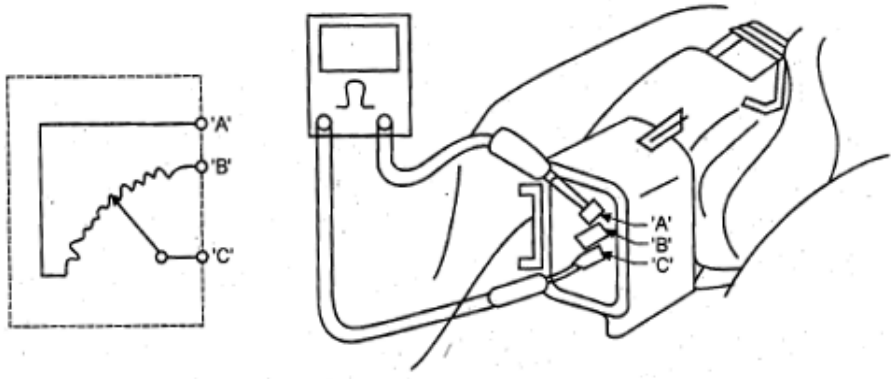
Throttle position sensor detects the position of throttle valve and sending the signals to ECU for controlling the mixture of air fuel.

Procedure:

1) Disconnect negative cable at battery and coupler from TP sensor.
2) Using Ohm meter or multi meter, check resistance between terminals under each condition and compare to the specified value given by manufacturer as given below-

Terminals	Resistance	
Between 'A' and 'B' terminals	2.5 – 6.0 kΩ	
Between 'A' and 'C' terminals	Throttle valve at idle position	0.17-11.4 kΩ
	Throttle valve fully open	1.72-15.50 kΩ

3) There should be more than 1.5 ohm resistance difference between when throttle valve is an Idle position and when it is fully open.
4) If check result is not satisfactory, replace TP sensor.



'A' – Ground Terminal, 'B' – Reference Voltage Terminal, 'C' – Output Voltage Terminal

Figure: Inspection of TP Sensor

OR

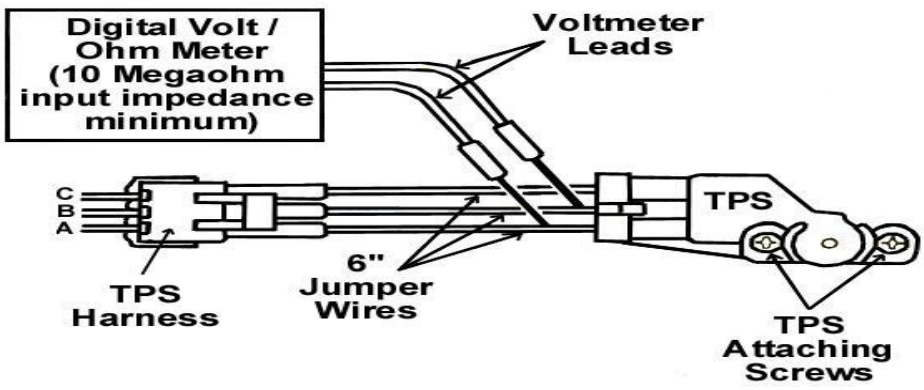
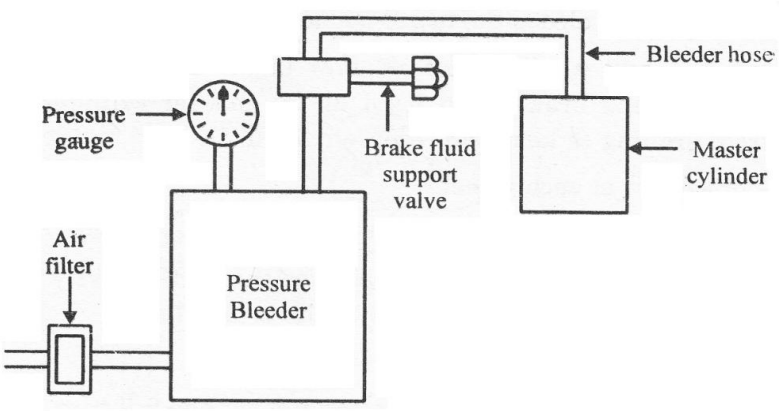
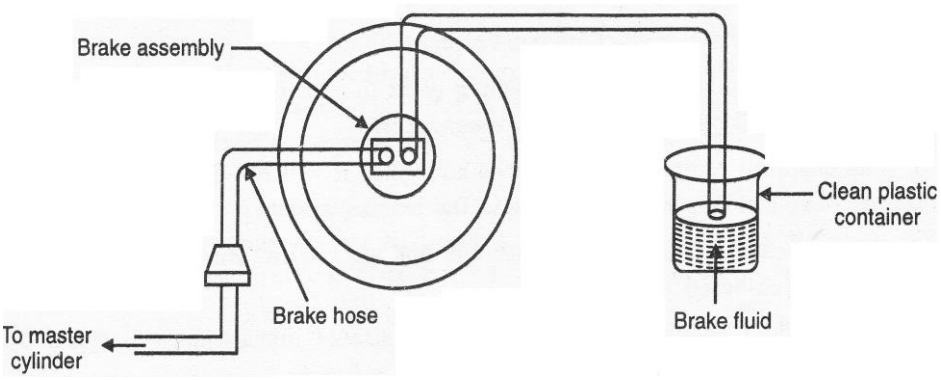


Figure. Connection of TPS to Voltmeter

4

1) Connect the digital voltmeter from the throttle position sensor **(TPS)** connector center terminal (B) to the bottom terminal (A). Make the jumper wires up with #16, #18, or #20 wire approximately 6" long. See Figure given below- **2)** With the ignition "ON" and the engine stopped, position the TPS, so that the voltmeter reads 0.5 to 0.8 volts. **3)** Tighten the TPS mounting screws with the sensor in this position. Recheck the voltmeter reading when the screws are tight to make sure the adjustment did not change. **4)** With the ignition "OFF" disconnect the voltmeter and reconnect all connectors**.**	
e) Explain any one method of bleeding of hydraulic brakes	4
Answer: 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)*  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. **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 a) Attach a bleeder hose to bleeder screw at the wheel cylinder and insert the other end of hose into the clean plastic container which is partially filled with clean brake fluid. b) Loosen the bleeder screw at least one full turn. c) Have an assistant to depress and hold the brake pedal and then tighten the bleeder screw. d) Have your assistant to release the brake pedal. e) 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. f) Repeat this procedure at each wheel.	4



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.

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

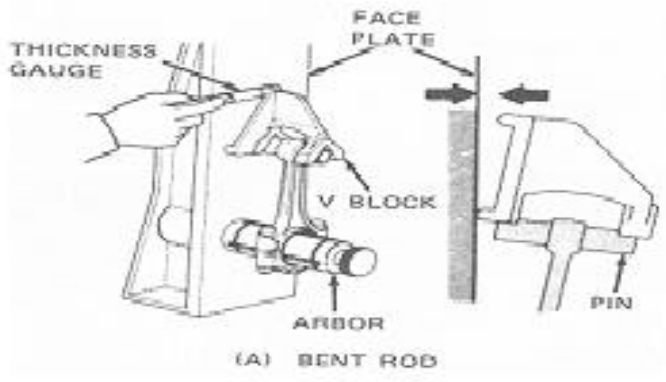
4 a) Attempt any THREE of the following:	12
a) Explain the inspection procedure of connecting rod for its alignment.	4

Answer: Inspection of connecting rod for its alignment: 4

(Note: Credit should be given to any equivalent Figure and suitable explanation)

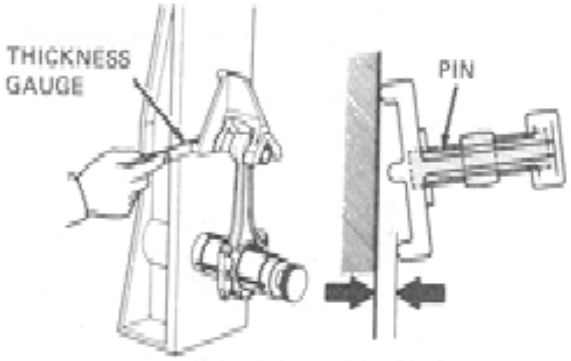
Using a rod aligner, check the connecting rod alignment as shown in figure in which big end of bore of connecting rod is held in self centering spindle of the gauge while angle gauge is placed on the gudgeon pin.

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.

b) Check for Twist



(B) TWISTED ROD

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.

b) State the criterion for deciding whether the automobile components can be repaired or replaced. — 4

Answer: Criterion for deciding whether to repair or replace the automobile components: *(Any four points)* — 4

Sr. No.	Repair	Replace
1	Cost of repair product is less as compared to replaced product	Cost of repair is more as compared to the new product.
2	Repair gives substandard performance	Original new parts give standard performance.
3	Assurance is less.	Assurance is more
4	Warranty is not given.	Warranty is given.
5	Skilled workers are required for repair work	Skilled workers are not required to replace part.
6.	Does not depend upon the material (repair work)	Breakdown situation when replacement parts are not immediately available.
7	Repair is essential, if new parts are not available.	If new parts are readily available with reasonable cost than repair.
8	If safety aspect is not of prime importance.	If safety aspect is of greater concern.

OR

Factors to be considered to decide whether part is repaired or replaced- (Any four – 1markeach)

1) Repairing cost of the spare-parts is more as compare to original cost – Replace.
2) Non -availability of part in the market – Compulsory Repair.
3) Performance after rework i.e. feasibility for retrieval or reclamation is less – Replace.
4) Machinery set up and skilled workers required for repairing available – Repair.
5) Time required for repairing is more – Replace.
6) Life of repaired part as compare to original part is less – Replace.
7) Consider effect of repaired part on sequential failure of other parts – If Yes, Replace.
8) Safety aspects – Replace.

c) State the troubles for petrol engine with its causes and remedies. — 4

Answer: Troubles for petrol engine with its causes and remedies:
(Note: Any two troubles with their suitable causes and remedies)

1) Engine overheating.

Causes	Remedies
1.Lack of coolant	1. Top up coolant as per specified level.
2. Late ignition timing.	2. Adjust ignition timing correctly.
3. Loose or broken fan belt.	3. Tighten or replace
4. Clogged water jackets	4. Clean and refit.
5. Defective thermostat	5. Replace with new one.
6. Insufficient engine oil.	6. Top up engine oil to correct level.
7. Late valve timing.	7. Adjust valve timing correctly.

2) Excessive fuel consumption.

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

3) Engine does not turn over when starting is attempted.

Causes	Remedies
1. Discharged battery.	1. Charge battery
2. Jammed bendix drive	2. Repair
3. Open starting circuit.	3. Repair
4. Defective ignition system.	4. Repair or replace

4) Engine back fire.

Causes	Remedies
1. Defective ignition system.	1.Repair or replace
2. Defective spark plug.	2. Replace
3. Carbon deposited in combustion chamber.	3. Decarburize
4. Over heating of engine.	4. Identify source of trouble and rectify it.
5. Valves hot or sticking.	5. Repair or replace.
6. Excessive rich or lean mixture.	6. Supply proper air fuel mixture to the engine.

4

d) Write the procedure for idle speed adjustment of carburetor. — 4

Answer: Procedure for idle speed adjustment of carburetor:

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 amount of fuel mixture to engine .Use tachometer to correct adjustment of higher speed. The idle 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. — 2

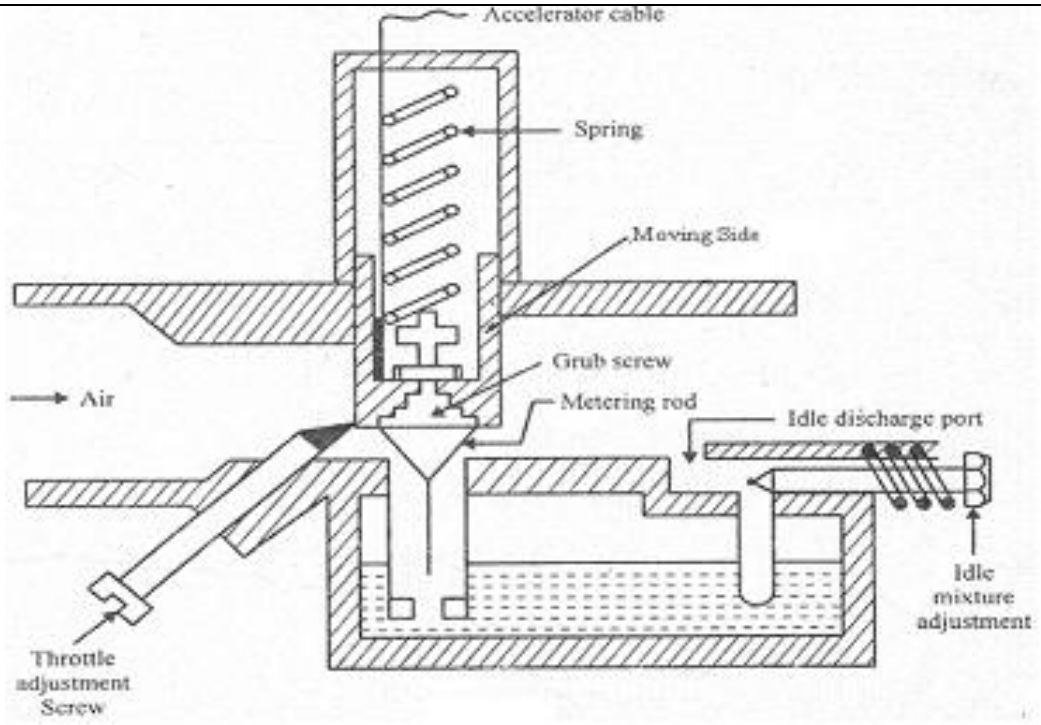


Figure: Idle speed adjustment of a carburetor. — 2

B) Attempt any ONE of the following: — 6

a) State any three troubles for clutch with its causes and remedies

Answer: Troubles for clutch with its causes and remedies: — 6

(Note: Any three troubles – with two causes and their suitable remedies)

1. Trouble :Clutch slip

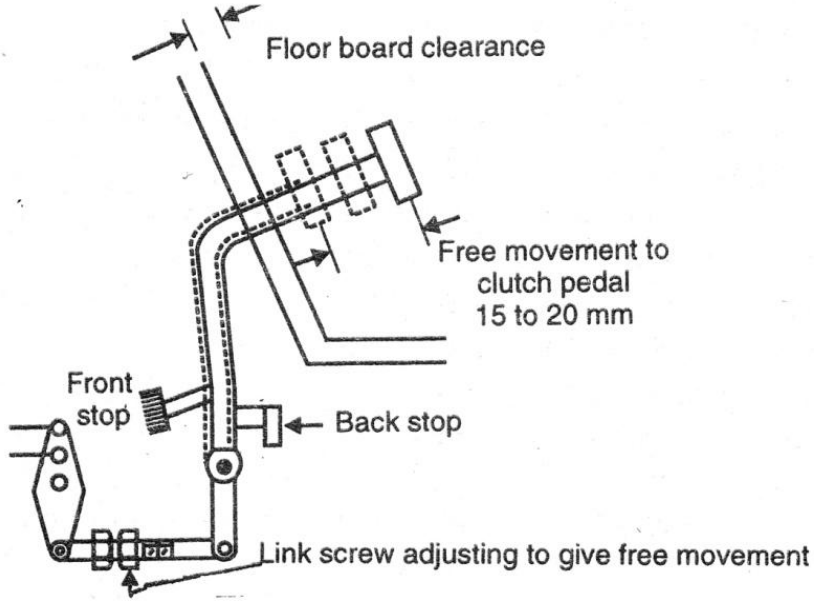
Sr.	Causes	Remedies
	Oil or grease on the driven plate facings	Fit new plate and eliminate oil leak
2	Binding of clutch pedal mechanism/ Incorrect pedal adjustment.	Make Free and lubricate joints./ Adjust the pedal.
3.	Weak pressure springs.	Replace with new springs.
4.	Incorrect setting of release levers.	Reset the lever properly.
5.	Improper clutch free play.	Adjust properly.

2. Trouble :Clutch Drag

Sr.	Causes	Remedies
1	Hard pressure springs	Replace with new springs.
2	Incorrect setting of release levers	Reset the lever properly
3.	Improper clutch free play	Adjust properly
4.	Incorrect pedal adjustment	Adjust the pedal
5.	Uneven wear /bent friction plate and pressure plate	Replace friction plate

3. Trouble :Clutch Noise

Sr.	Causes	Remedies
1	Worn out clutch components	Repair/Replace with new one.
2	Excessive free play	Adjust properly.
3.	Weak/Broken pressure spring	Replace
4.	Insufficient clutch pedal travel adjustment	Adjust the clutch pedal
5.	Bent friction/pressure plate	Replace

b) Explain the tyre retreading procedure	6
Answer: Tyre Retreading Procedure: **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. **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. **3. Cementing:** After buffing tyre is sprayed with rubber compound. **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. **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. **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. **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. **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.	6
5. Attempt any TWO of the following	16
a) Explain the clutch adjustment procedure.	8
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.  **Fig : Clutch Adjustments**	2

1) Floor board clearance adjustment: Floor board clearance is the clearance between floor board and the clutch pedal, when the clutch pedal is at fully pressed position. This adjustment can be done by means of a screw located near the lower end of the clutch pedal. This screw 1prevents the pedal arm from resting against the floor board. The screw should be so adjusted as to maintain the proper floor board clearance.	1
2) Clutch pedal travel adjustment: Total travel is the distance between pedal moves from its back (bumper) stop position to its fully depressed position. 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.	1
3) 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 remains in the pedal after the clutch has been engaged. This measurement will vary slightly from model to model but the usual free play specified is 15 to 20 mm. After the correct adjustment is made, both nuts are tightened to effectively lock the adjustment. This adjustment should be done after the correct floor board clearance or clutch pedal has been established. If no free play is kept, it may result in noise and also slipping of clutch and damage of release bearing.	2
4) Clutch release lever adjustment: When the vehicle has been used for long time, the clutch facing gets worn out or when clutch has been used wrongly, facing gets worn out quickly. With the result that the distance between pressure plate and fly wheel dick reduces or in other words, they come closer to each other. This result in, increase of distance between release bearing and clutch fingers. At that time when we press clutch pedal, release bearing cannot press the fingers to the required distance with result that clutch plate disengage fully. To cover up this wear of facing and reduced distance between thrust bearing & fingers, the travel of release is increased by the adjusting rod or release lever.	2
b) Explain the reconditioning procedure for wheel cylinder of hydraulic braking system.	8
Answer: Reconditioning procedure for wheel cylinder of hydraulic braking system. 1. Jack up the vehicle and remove the wheel, hub and drum. 2. Disconnect the brake line at the fitting on the brake shoes at the toe. Remove two screw holding wheel cylinders to the backing plate. 3. Remove rubber dust cover and check condition of rubber dust cover if they are badly worn replace the rubber dust cover with new one. 4. Remove the rubber dust covers on the ends of the wheel cylinder and then the piston, piston cups and spring 5. Wash all the parts in alcohol. 6. Observe the condition of piston and cylinder, if these are pitted, these should be replaced. No attempt should be made to rub off bitting with emery papers 7. Examine the cylinder bore for roughness or scoring. The clearance between cylinder bore and piston should be 0.05mm 8. Check condition of spring used in wheel cylinder; if it is worn or loose replace the spring. 9. Check condition of oil seals and if they are badly deteriorated replace the oil seals. Never use old oil seals while servicing or overhauling of wheel cylinder. 10. Dip spring, piston and cups in brake fluid and reassemble the wheel cylinder. 11. Install the wheel cylinder to the backing plate, connect brake line and install brake shoe return spring. Adjust brake if required.	8

c) Explain the procedure for wheel balancing with its necessity.	8

Answer:

Necessity of Wheel balancing:

When a vehicle is in motion, its wheels are subjected to many forces. These forces vary with the weight and with the speed. These forces may cause adverse effect on vehicle performance. Wheel balancing is performed - 2

1) To avoid wheel assembly bounce up and down.
2) To avoid excessive vibration at steering when vehicle is running.
3) To avoid front wheel wobble and difficult driving.
4) To avoid effects on steering geometry parameters.
5) To increase tyre life.

1) **Procedure of Static balancing:** Once the tyre is removed from the rim after the event of tyre wear, tyre repair or accident, it is necessary to get it rebalance.

- It can be done when vehicle is stationary and wheel jacked up.
- Set it in motion by hand and allow stopping by itself.
- Put the chalk mark at lowest portion of tyre.
- Repeat above procedure 3 to 4 times. 3
- If the same portion of chalk mark always remains lowest position, this portion of tyre is heaviest.
- To balance, attach lead weight to opposite side of heaviest portion of tyre to the rim.

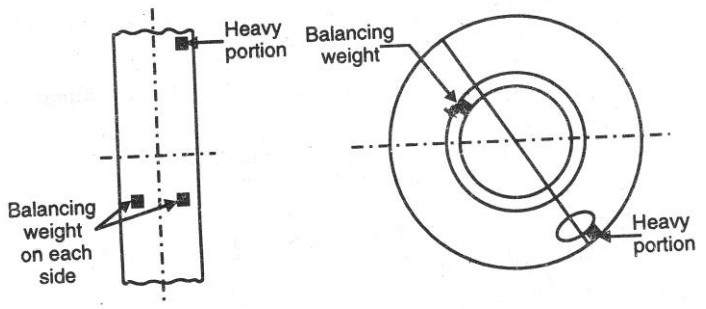


Fig. Static balancing

2) Procedure for Dynamic Balance:

1. Mount the wheel on balancing machine.
2. Rote the wheel at different speeds.
3. Wheel balancer shows how much weight is to be attached and on location.
4. Then clip the required weight on both sides of rim opposite to heavy spot.
5. Recheck the wheel for balancing. 3

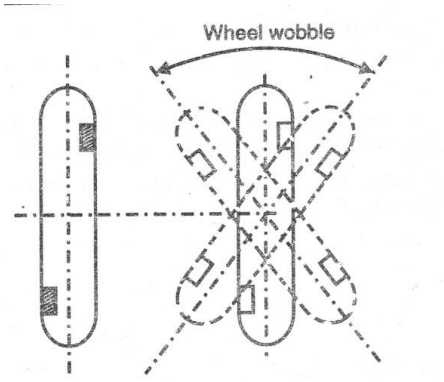


Fig. Dynamic balancing.

6. Attempt any FOUR of the following	16
a) Explain the diesel engine injector testing procedure.	4

Answer: Diesel engine injector testing procedure.

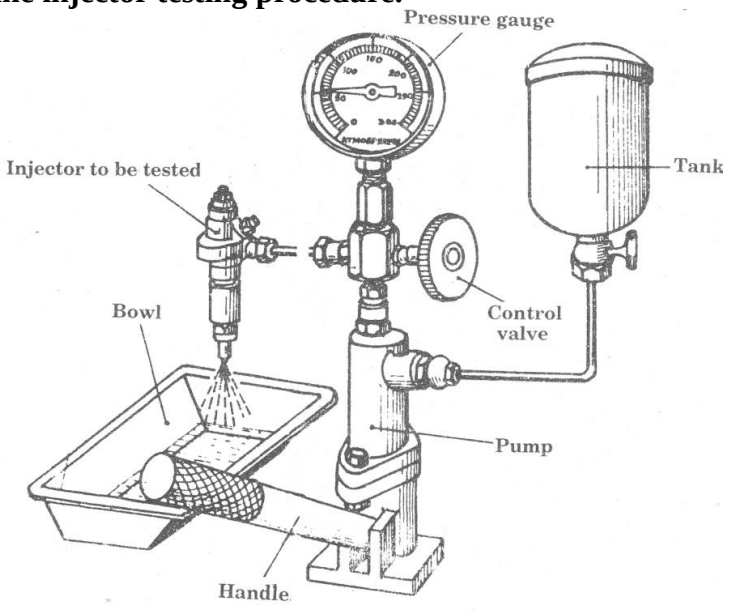


Fig. Injector tester.

Three tests are conducted for testing of diesel engine injector

1) Pressure Test:

1) Fix the injector to be tested to injector pipe of tester as shown in fig.
2) Work the hand pump. Note the opening pressure of spray on gauge provided. If the pressure is less, it is increased by loosening the check nut and tightening the adjusting screw.
3) If it is more than the specified, the adjusting screw is loosened.
4) After adjusting pressure, lock the lock nut and replace the cap.
5) 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/in^2) and keep the pressure for about 10 second without spraying.
3) After 10 seconds check up that there is no drop in pressure and wetness is not felt on tip of nozzle body.

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

i) Dismantle the injector.
ii) Get the seat of nozzle body grounded.
iii) Get the nozzle body seat lapped.

If nozzle valve seat is pitted, it should be replaced or grounded.

4) 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.

b) State the probable troubles of MPFI engine and write the causes and remedies for the same.	4

Answer: Probable troubles of MPFI engine with their causes and remedies:

(Note: Any two troubles with their two causes and suitable remedies- 2 mark each)

1. Hard start, cold or rough idle, cold

Causes	Remedies
1.CTS	1. Check coolant level or replace sensor
2.Fuel pressure bleed down	2. Check for fuel leak or defective fuel pump.
3.cold stat injector	3. Check clod start injector, service or replace as required
4.Leaking manifold gasket or base gasket	4. Replace defective gasket.
5. ACT/MAT	5. Replace defective ACT/MAT sensor
6.Worng PCV valve	6. Replace PCV valve.
7. Warm up regulator	7. Replace warm up regulator.
8. Injector	8. Check injectors for variation in spray pattern, clean or replace injector as required.
9. Mass air flow sensor	9. Check air flow meter fuel pump contacts.
10.Pressure regulator	10. Check pressure regulator for setting and bleed down.

2. Hesitation or surging, hot or cold

Causes	Remedies
1. CTS	1. Check coolant level or replace sensor
2. Low fuel system pressure	2. Check fuel filter and fuel pump service or replace as required
3. Restricted air intake system	3. Check air cleaner and preheat system service or replace as required.
4 TPS defective or not adjusted correctly.	4. Check TPS; adjustment or replace as required.
5. Mass airflow sensor.	5. Check air flow meter, fuel pump contacts
6. ACT/ MAT sensor	6.Replace defective ACT /MAT Sensor
7. Air leak in air intake system	7. Check gaskets, hoses and ducting; service or replace as required.
8. Defective oxygen sensor	8. Replace oxygen sensor.
9.Defective ECU	9. Replace ECU

3. Hard start, hot

Causes	Remedies
1. Bleeding injector	1. Inspect injector for dripping, service or replace as required.
2. Leaking intake manifold gasket or base gasket	2. Replace defective gasket.
3. MAP sensor	3. Check MAP sensor and vacuum hose, service or replace as required.
4. Pressure regulator	4. Check pressure regulator for setting and bleed down; service or replace as required

4

4. Rough idle, hot

Causes	Remedies
1. MAP sensor	1. Check MAP sensor and vacuum hose; service or replace as required.
2. CTS	2. Check coolant level or replace sensor
3.TPS	3. Check TPS; adjust or replace as required.
4.Injector	4. Check injector for variation in spray pattern; clean or replace injector as required.
5.Oxygen sensor	5. Replace oxygen sensor.
6.Defective ECU.	6. Replace ECU.
7.ISC/IAC	7. Check idle speed control device; service or replace as required.

5. Poor Power:

Causes	Remedies
1. Dirty injector	1.Check injector spray pattern; clean or replace injector as required
2. Fuel pump	2. Check fuel pump pressure, replace fuel pump
3. Fuel pump pickup strainer	3.Check strainer; replace as required
4. Fuel filter	4. Check fuel filter; replace as required
5. Pressure regulator	5. Check pressure regulator for setting and bleed down; service or replace as required.

c) Enlist the painting defects. — 4

Answer: Painting defects *(Any eight defects)* — 4

1. Cracking
2. Shrinking and splitting
3. Cratering and crawling
4. Blistering
5. Pin holes
6. Runs and sags
7. Wrinkling.
8. Sand scratches and swelling.
9. Bleeding.
10. Hand or finger prints.
11. Rub through.
12. Fish eye.
13. Corrosion attack.

d) State the probable troubles of Suspension system with its causes and remedies. — 4

Answer: Probable troubles of Suspension system with its causes and remedies: — 4

(Any two troubles with two suitable causes and remedies. Each trouble carry 2 marks)

No.	Troubles	Causes	Remedies
1	Front wheel low speed shimmy	1. Uneven tyre pressure 2.Loose ball joint or king pin 3.Irregular tyre trade 4.loose linkage	1.Inflate to correct pressure 2.Replace 3.Replace 4. Readjust, replace worn joint.

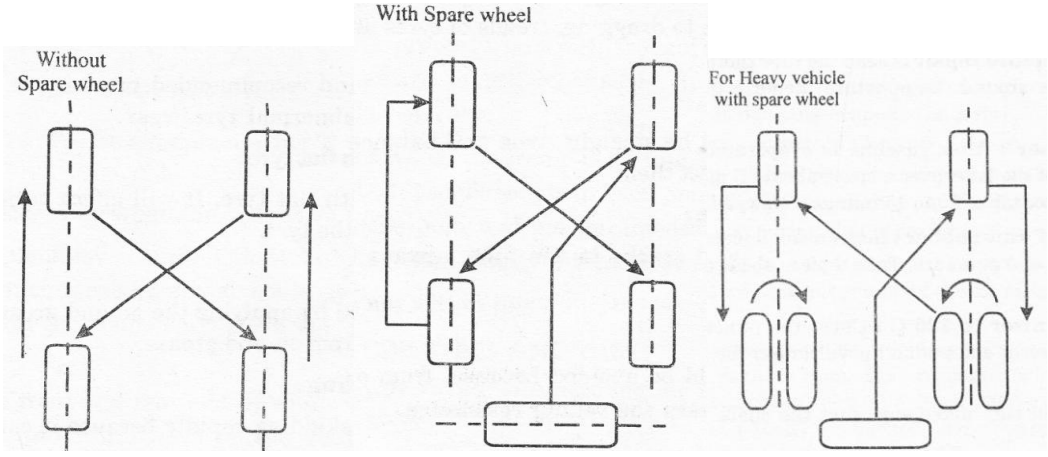
No.	Troubles	Causes	Remedies
2	Front wheel tramp.	1.Wheel unbalanced 2.Excessive wheel run out 3.Defective shock absorber 4.Front spring soft	1. Rebalance 2.Replace 3.Replace 4.Replace
3.	Sagging spring	1.Leaf broken 2.Weak spring 3.Defective shock absorber 4.Short coil spring	1.Replace 2.Replace 3.Replace 4.Install shim or replace
4.	Rough ride	1.Excessive tyre pressure 2.Excessive friction in suspension 3. Defective shock absorber	1. Reduced tyre pressure and correct it. 2.Lubricate parts 3.Replace
5.	Breakage of spring	1.Over loading 2.Loose center bolt 3.Loose U bolt 4.Tight spring Shackle 5. Defective shock absorber	1.Avoid 2.Tighten center bolt 3. Tighten U bolt 4.Loose as necessary 5.Replace

e) Describe with a neat sketch the importance of tyre rotation — 4

Answer: Importance of tyre rotation: (*Any one figure 2 marks and importance 2 marks)* — 2

Tyre rotation is essential -

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.



2

Figure 1 OR Figure2 OR Figure3