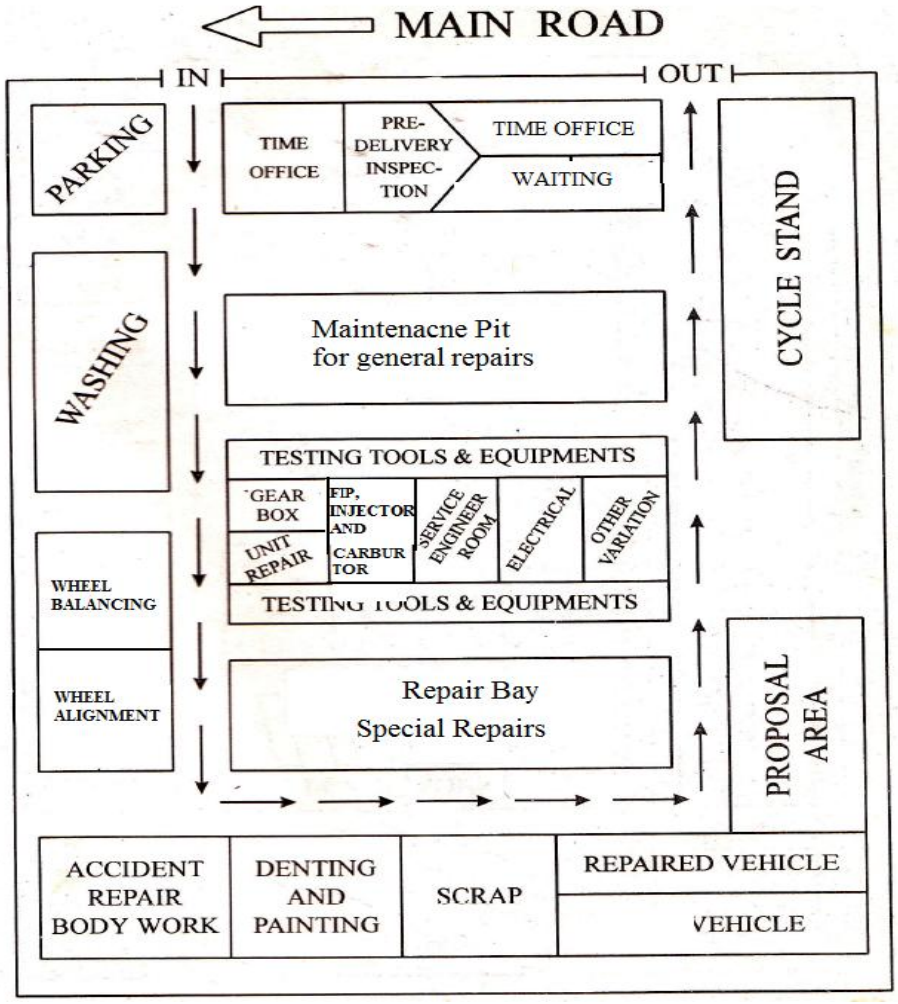
Important Instructions to examiners:
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language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

Model Answer	**Marks**
1. A) Attempt any THREE of the following.	12
a) Write function of following equipments : i) Engine Analyser ii. Valve grinder iii) Wheel balancer iv) Honning Machine	04
Answer :*(Function of each equipment carries 1 mark)* **i) Engine Analyzer:** To check engine rpm, dwell angle, contact breaker point gap, cylinder leakage, oil temperature, exhaust emission, vacuum checking, engine performance, battery charging, engine timing, spark leakage etc. **ii) Valve grinder:** To reface the valve face, valve stem, valve seat, valve angle. **iii)Wheel balancer:** To find imbalance of wheel to locate the position of imbalance and amount of weight to added to balance the wheel. **iv)Honning Machine:** To remove some out of roundness, tool marks.	04
b) State four safety precautions to be followed in auto workshop.	04
Answer: Safety precautions to be followed in auto workshop are as follows: *(Consider any four safety precaution. Each point carries 1 mark)* 1. Keep the tools and equipment at specified place. 2. Don't wear loose clothes 3. Never work under a car when it is supported by screw jack only. Use proper stands before going under. 4. Be careful while working with spring under compression e.g. clutch. 5. Don't clean cloth by compressed air because dirt particle may embed in your skin causes infections.	04

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.	
c) Explain weekly maintenance schedule for two wheeler.	04
Answer: Weekly maintenance schedule for two wheeler. *(Consider any four points. Each point carries 1 mark)* i) Clean and wash the vehicle thoroughly once a week. ii) Lubrication of the vehicle – Lubricate properly clutch and brake levers, control cables etc. iii) Tighten the nut and bolts, if required. iv) Check functioning of all electrical components. v) Clean air filter. vi) Check and ensure proper tyre pressure. vii) Check fuel level.	04
d) Describe the inspection procedure for crankshaft.	04
Answer: Inspection procedure for crankshaft **1) Inspection of crankshaft for run out or straightness-** i)Place the crankshaft on V-block. ii) Using a dial indicator measure the circular 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 -** i) 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 wear-** i) Maximum taper and out of round wear = 0.02 mm ii) If taper and out of round are greater than maximum limit, regrind the crankshaft. If necessary replace the crankshaft. **4) Measurement of crankshaft Thrust clearance:** i) 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. **5) Balancing of Crankshaft** For checking, crankshaft is mounted on balancing machine. It is rotated at different speeds. Unbalance is noted on indicator. For balancing, the metal is removed by drilling from balance weight of crankshaft till it becomes balanced. **6) Check oil holes for clogging and damage by compressed air.** **7) Checking crankshaft bearing oil clearance.** It is checked by using plastic gauge. Keep it on the shell on bearing. Fix up in the bearing cap; tighten the bolt at proper torque. Then remove te cap and measure the flatness of plastic gauge with the help of scale made on paper cover of plastic gauge.	04

B) Attempt any ONE of the following:	06
a) Draw a layout required for servicing 20 passenger cars per day. List special & general tools & equipments required for the same.	06
Answer: A layout for servicing 20 passenger cars per day:  *(Note: Credit shall be given to any other suitable layout)* **General tools:** Spanners (Wrenches), Hammers, Pliers, Screw driver, Files, Chisel, Torque wrench, Hacksaw, Punch, Drill bits, Taps and Dies, Bench Vice etc. **Special tools:** Piston ring compressor, Piston ring expander, Valve spring compressor, Bearing Puller etc. Measuring tools**:** Steel rule or Scale, vernier caliper, Micrometer (Inside & Outside), Depth gauge, Thickness gauge, Wire gauge, Angle checking gauge**,** Level cum angel gauge, Optical gauge, Telescopic gauge, Dial indicator etc. **Equipments:** Computerized wheel aligner, Battery charger, Ignition timing Light, Arbor press, Hydraulic press, Hydraulic Jack, Car Lifts, Electric Drill, Head light aligner, Engine analyzer, Vehicle washer, Fuel injector tester, Wheel balancer etc.	03 01 01 01

b) Describe the scheduled maintenance procedure for heavy vehicle.	06
Answer-Schedule maintenance procedure for heavy vehicle **Check-** **Daily** • Water level or liquid level in radiator. • Oil level of engine. • Tyre pressure. • Braking system • Electrical system • Fuel Level in fuel tank. **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.	02 02 02
2. Attempt any FOUR of the following	**16**
a) List the documents required to be maintained in automobile workshop and show the format for job card.	**04**
Answer: The documents required to be maintained in automobile workshop are- 1) Vendor service work order 2) History sheet 3) Activity file 4) Maintenance instruction manual 5) Spare procurement register 6) Defect register **Format for job card.** *(Credit shall be given to equivalent format of job card)*	01

	03

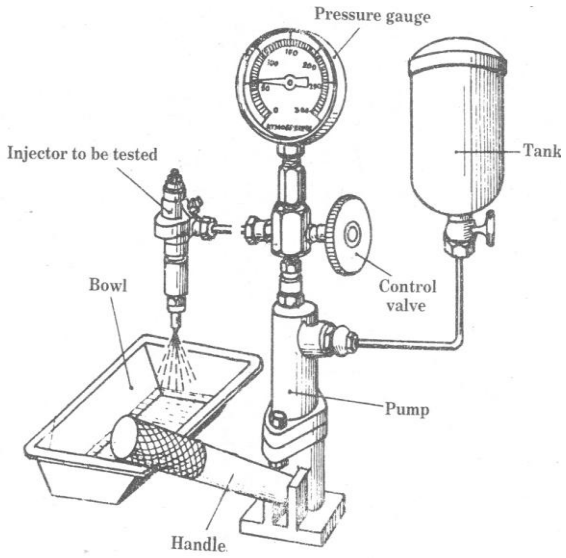
Name Address Pin Phone	Work Order No. Speedometer Reading	Date Veh. No. Ch. No. Engine No.	Reason for check Scheduled ☐ Non-sheduled ☐ Abuse ☐
Work order Written by Approved by Vehicle down time	Fuel reading Check accessories Spare wheel Tool Kit		Remark ☐ Accident ☐ If warranty ☐ Involve
			Damage to vehicle

Spare part list cost			Labour cost			
No.	Parts Description	Price	Work done	Hour	Mech. Sign	Labour charge
1.						
2.						
3.						
4.						
5.						
	Total Cost		Total Labour Cost			

b) Explain the points to be considered to decide whether vehicle component to be replaced or repaired during servicing. — 04

Answer : The points to be considered to decide whether vehicle component to be replaced or repaired during servicing : *(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.

c) List tests to check mechanical fuel injectors and explain leak off test.	04
Answer Three tests are conducted for testing of diesel engine injector 1) Pressure Test 2) Leak off test 3) Spray test	01
Leak off Test:  Fig. Injector tester. 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.	03
d) What will happen if coolant temperature sensor does not work?	04
Answer: If coolant temperature sensor does not work then following cases may be arise- 1) It will send the wrong voltage to the computer. 2) It may not send voltage data at all. 3) If the wrong voltage tells the ECM that the engine is cold when it is at operating temperature, the engine will run rich, meaning it will use more fuel and cause your fuel economy to take a dive. 4) The engine has overheated so that all the water boiled over and out of the system.	04

e) List and explain four causes & give remedies for low oil pressure in engine. 04

Answer: *(Consider any four causes and their suitable remedy, Each point carry 1 mark)* 04

Sr. No	Causes	Remedies
1	Less oil in crank case.	Top up to correct level.
2	Use of low viscosity oil or diluted oil in sump.	Change the oil.
3	Low grade of oil or poor quality of oil.	Use specified oil stated by manufacturer.
4	Worn out main and big end bearing.	Replace bearing.
5	Leaky filter, oil pipe or oil pump.	Replace.
6	Bypass valve spring defective.	Replace.
7	Maladjustment of regulating valve spring.	Make correct adjustment.
8	Defective oil pressure gauge.	Repair or replace.
9	Too much play in oil pump gears.	Adjust play or replace gears.
10	Choked suction strainer of oil pump.	Clean the strainer.
11	Choked oil gallery or suction pipe.	Clean properly.

f) What is 'soot'? Give two causes and suitable remedies for soot formation. 04

Answer: Soot- 02

Fuel and air mixture in diesel engine typically do not mix as thoroughly as they do in gasoline engines. This creates fuel-dense pockets that produce soot when ignited in diesel engine. Rich fuel mixture exists in combustion chamber. High pressure and temperature generated due to combustion make the condition favorable for some fuel molecules to undergo ***thermal decomposition*** and ***dehydrogenation*** resulting in soot formation ***due to lack of oxygen*** in these over rich zones.

Causes and suitable remedies for soot formation.(*Consider any two causes and their suitable remedy, Each point carry 1 mark*) 02

Sr. No	Causes	Remedies
1	Incomplete combustion	Check and adjust related parameter
2	Rich air –fuel mixture	Adjust mixture properly
3	Worn out piston ring/liners	Check and repair/replace
4	Valve leakage	Repair or replace
5	Improper ignition timing	Adjust timing correctly
6	Cold staring	Sufficient warm up the engine before acceleration

3. Attempt any FOUR of the following: 16

a) Write stepwise procedure to carry out the oil pressure testing. 04

Answer: Stepwise procedure to carry out the oil pressure testing. 04

1 If oil pressure is less then engine oil pressure warning light becomes on. Stop driving and turn the engine off.
2 Determine oil is low or full by checking the dip stick (The oil level is at or below the add line, or no oil can be seen on the dip stick. If dip stick shows low oil level engine may be leaking oil, burning oil or both.
3 Oil leaks can occur at valve cover, oil pan, timing cover gaskets or the front and rear crank

shaft oil seals. Inspect the top, sides and bottom of the engine for sign of leakage. Look for greasy stains, heavy accumulation of grease or oil dripping on the ground. Rectify the source of leakage of oil. 4 If outside of engine is clean and there are no oil leaks, and the oil level is low, the engine is potbelly burning oil due to worn piston rings, valve guides or valve guide seal. Repair or replace as necessary to avoid burning of oil. 5 If oil level is between add and full, oil pressure gauge low oil pressure then oil pump may be bad. 6 Oil pressure can check by attaching pressure gauge to the engine where oil pressure sending unit is attached. If oil pressure is within specifications the oil pump is ok. If oil pressure is less than specifications, oil pump may be worn or engine bearing may be worn. 7 If oil level is between add and full, and engine is running normally (no noise) after oil pressure warning light came on, the problem may be defective oil pressure sending unit, oil pressure gauge or warning light switch.	
b) Write stepwise procedure for inspection of lubrication system.	04
Answer: Procedure of servicing the lubrication system. *(Each point carry 1 mark)* 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. **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.	04
c) What is vapour lock in petrol engine? How vapour lock can be removed.	04
Answer: Vapour lock in petrol engine: The combination of increased temperature and lower pressure or partial vacuum in the fuel pump can cause fuel to vaporize. It occurs when the liquid fuel changes state from liquid to gas while still in the fuel delivery system. This produces vapour lock, causes loss of feed pressure to the carburetor. Resulting in transient loss of power or complete stalling. Fuels that have high volatility can also cause vapour lock. **Removal of vapour lock:** **Vapour return line:** The vapour return line is connected to a special outlet in the fuel pump this allows any vapour to return fuel tank. Vapour return line also permit excess fuel being pumped by the fuel pump to return to tank. This excess fuel, in constant circulation helps keep the fuel pump cool. Therefore it prevents vapour from forming.	02 02

Vapour separator- Some cars have vapour separator connected between fuel pump and carburetor.

d) If vehicle is not taking load while climbing steep road give four causes and remedies — 04

Answer: Causes and remedies for vehicle is not taking load while climbing steep road. *(Consider any four causes and their remedy, each point carry 1 mark)* — 04

	Causes	Remedies
1	Engine overheated due to lack of coolant	Cool the engine and add coolant.
2	Improper gear selection	Drive in lower gear.
3	If vehicle is overloaded.	Load within specified limits.
4	Insufficient fuel supply	Fuel supply should be adequate.
5	Slippage of clutch.	Identify the source of trouble and rectify it.
6	Grabbing of clutch	Identify the source of trouble and rectify it.
7	Under inflated tyre	Inflate tyre correctly.

e) Give four causes and remedies for excessive oil consumption of engine. — 04

Answer: Causes and remedies for excessive oil consumption of engine. *(Consider any four causes and their remedy, each point carry 1 mark)* — 04

Sr. No	Causes	Remedies
01	Loose main or connecting rod bearings.	Check and adjust or replace.
02	Tapered or out of round cylinders.	Repair.
03	Worn out piston rings, piston or scored liner.	Replace with new one.
04	Worn oil seals (front and rear main bearings).	Replace with new one.
05	Clogged oil return pipe.	Clean and refit.
06	Worn out rear camshaft oil seals.	Replace with new one.
07	Clogged air breather.	Clean it.
08	Leaky fuel pump vacuum booster.	Check and repair or replace.
09	Excessive clearance in intake valve guide.	Check and repair.
10	Improperly installed oil pan.	Install properly.

4. A) Attempt any THREE of the following: — 12

a) Write inspection procedure for cylinder block. — 04

Answer: Inspection procedure for cylinder block: — 04

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:
   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 cylider block for cracks by sound test, Magnetic crack detection or Hydrostatic testing.	
b) What is tuning of engine? Write tune-up procedure for petrol engine.	04
Answer: Tuning of engine- Engine tuning is the adjustment, modification of the internal combustion engine or modification to its control unit to obtain optimum performance, to increase an engine's power output, economy, or durability. OR A tune-up usually refers to the routine servicing of the engine to meet the manufacturer's specifications. Tune-ups are needed periodically as according to the manufacturer's recommendations to ensure an automobile runs as expected. **Tune-up procedure for petrol engine.** 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 upto 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 worm or defective spark plugs. 6. Inspect and clean the battery, battery terminal cable and hold down brackets. Test the battery, add electrolyte if necessary. If the battery has been over charged or under charged the alternator & regulator should be checked. 7. Check distributor contact points and clean them. Read just the point opening. 8. Check drives belts. Tighten or replace them as required. 9. Inspect the distributor rotor, cap and primary and high voltage. 10. Check the condition of the manifold heat control valve making sure that it is free to operate. 11. Check the intake manifold bolts for tightness to proper specifications. 12. Check fuel lines for tight connections and kinks beads or leaks. 13. Check the cooling system for leaks, wear or collapsed hoses correct coolant level and anti freeze protection. 14. Check and adjust the accelerator linkage if necessary 15. Check crankcase ventilation system 16. Check intake manifold and air injection system 17. Remove carburettor, air cleaner and check choke valve to make sure choke is working normally. Clean or replace air filter element if necessary 18. Check and adjust idle speed and mixture to specification. *Note: Equivalent credit shall be given to any other suitable tune up procedure.*	01 03

c) Write inspection procedure for crankshaft.	04
Answer: Inspection procedure of a crank shaft: **1) Inspection of crankshaft for run out or straightness-** i)Place the crankshaft on V-block. ii) Using a dial indicator measure the circular 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 -** i) 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 wear-** i)Maximum taper and out of round wear = 0.02 mm ii) If taper and out of round are greater than maximum limit, regrind the crankshaft. If necessary replace the crankshaft. **4) Measurement of crankshaft Thrust clearance:** i)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. **5) Balancing of Crankshaft** For checking, crankshaft is mounted on balancing machine. It is rotated at different speeds. Unbalance is noted on indicator. For balancing, the metal is removed by drilling from balance weight of crankshaft till it becomes balanced. **6) Check oil holes for clogging and damage by compressed air.** **7) Checking crankshaft bearing oil clearance.** It is checked by using plastic gauge. Keep it on the shell on bearing. Fix up in the bearing cap; tighten the bolt at proper torque. Then remove te cap and measure the flatness of plastic gauge with the help of scale made on paper cover of plastic gauge.	04
d) List types of clutch adjustments and explain procedure for any one with sketch.	04
Answer: *Note: Types -01 mark, procedure-2 marks, sketch – 1mark* **Types of clutch adjustment:** 1) Floor board clearance adjustment: 2) Clutch pedal travel adjustment 3) Free play adjustment 4) Clutch release lever adjustment **Clutch adjustment procedure:***(Consider any one procedure)* In clutches there are four adjustments to be made, three of which can be made without removing the clutch from the vehicle, and the other should be done after the clutch assembly has been removed. **1) 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	01 02

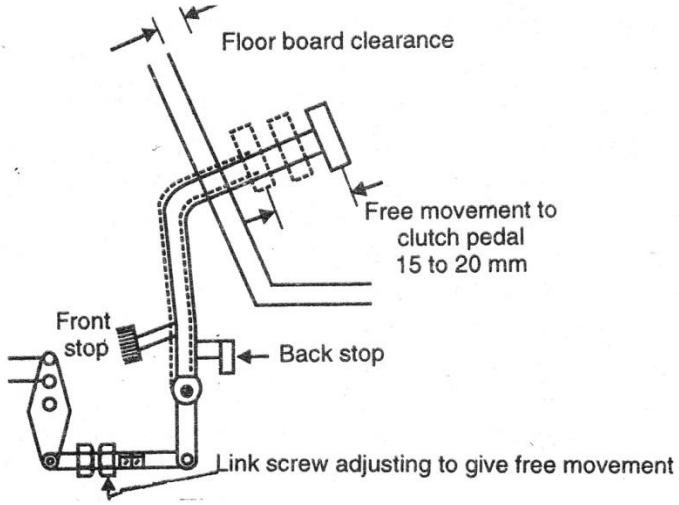


Fig : Clutch Adjustments

01

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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.

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.

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.

B) Attempt any ONE of the following	06
a) What is calibration of FIP? How calibration is carried out on FIP test bench?	06
Answer: Calibration of FIP: FIP is calibrated for efficient delivery, so that quantity of diesel fuel supplied by all the plungers in a given pump is more or less same at any rpm. Calibration of FIP is done on FIP test bench. If these measured quantities differ much, then the quantity of fuel is adjusted by loosening the clamping screw of the toothed quadrant and rotating the plunger by turning the control sleeve of pump.	02

Procedure for FIP calibration:

The FIP is calibrated for efficient fuel delivery. For calibration-

1. Place the pump on a fuel injection test bench.
2. Its engine is then rotated till it attains the speed of 2000 rpm.
3. Measure the quantity of diesel oil supplied by the each pump element in measuring cylinder. — 02
4. If measured quantities are more or less same, it may be said that the pump is delivering properly to all the cylinders.
5. If measured quantity differs much, then the quantity of fuel is adjusted by loosening the clamping screw of the toothed quadrant and rotating the plunger by turning the control sleeve of pump.

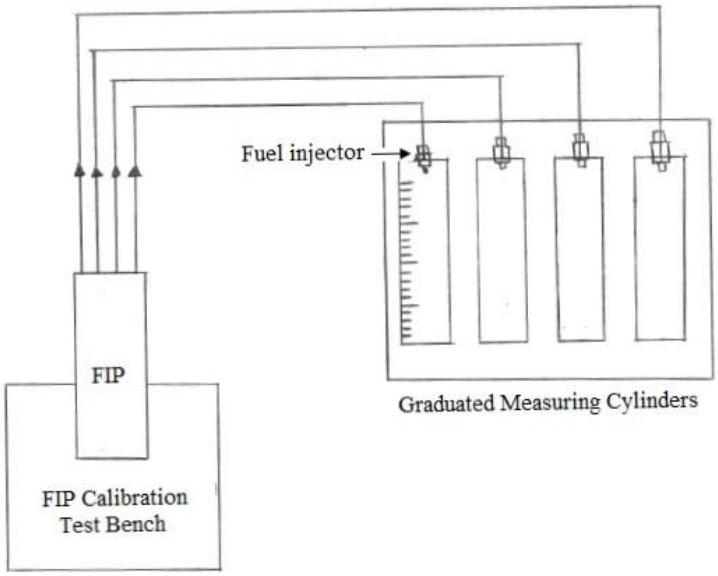


Figure: FIP calibration — 02

b) Write procedure for wheel balancing with neat sketch. — 06

Answer:

1) **Procedure of Static balancing:**

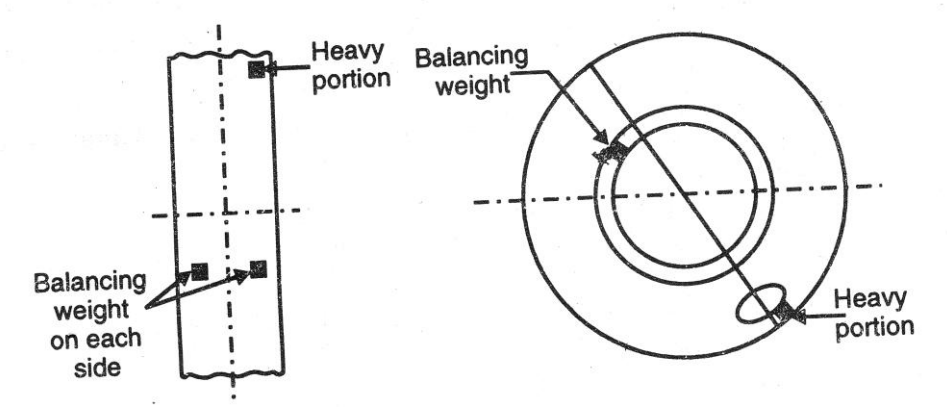


Fig. Static balancing — 03

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.
- 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

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.

03

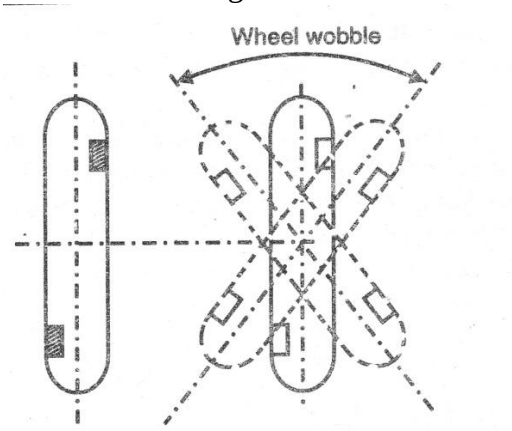


Fig. Dynamic balancing.

5. Attempt any FOUR of the following: 16

a) Give any four causes and remedies for clutch failure. 04

Answer: Causes and remedies for clutch failure: *(Consider any four points, each point carry 1 marks)*

Sr.	Causes	Remedies
1	Oil or grease on the driven plate facings	Fit new plate and eliminate oil leak
2	Binding of clutch pedal mechanism/ Incorrect pedal adjustment.	Make Free and lubricate joints / Adjust the pedal.
3	Incorrect setting of release levers.	Reset the lever properly.
4	Worn out clutch components.	Repair/Replace with new one.
5	Excessive free play	Adjust properly.
6	Weak/Broken pressure spring	Replace with new springs.
7	Insufficient clutch pedal travel adjustment	Adjust the clutch pedal
8	Bent friction/pressure plate	Replace

04

	9	Inadequate cooling of clutch.	Ensure proper cooling media is provided.
	10	Unnecessary riding of clutch pedal driver.	Train/make aware the driver.
	11	Misalignment of clutch with engine shaft.	Properly align it.

b) What is necessity of bearing preload? Write its procedure. — 04

Answer: Necessary of bearing preload:

This is a slight over-tightening of taper bearing used on differential pinion shaft is known as preloading of bearing. Bearing preload is important because of degree of internal clearance within a bearing can influence a variety of factor including noise, Vibration; heat built up and fatigue life. When preload applied correctly - — 02

1. It controls rapid and axial play.
2. Reduces non-repetitive run out.
3. Reduces the difference in contact angle between inner and outer rings at very high speed.
4. It controls balls skidding under very high acceleration.

Procedure of preload:

1. The pinion is held in position in the housing with the help of two bearings are mostly taper rollers bearing.
2. Disconnect the rear end of the propeller shaft by loosening the flange bolts.
3. Remove the lock nut and thrust washer.
4. To remove free play in the bearing usually two methods are employed. By adding or removing shims under the cap of differential pinion housing or by check nut on pinion shaft.
5. In heavy vehicles, over two taper roller bearings one pilot bearing is also used at the front end of the pinion. — 02

c) Write procedure for checking tooth contact between ring gear & pinion in differential. — 04

Answer: Procedure for checking tooth contact between ring gear and pinion:

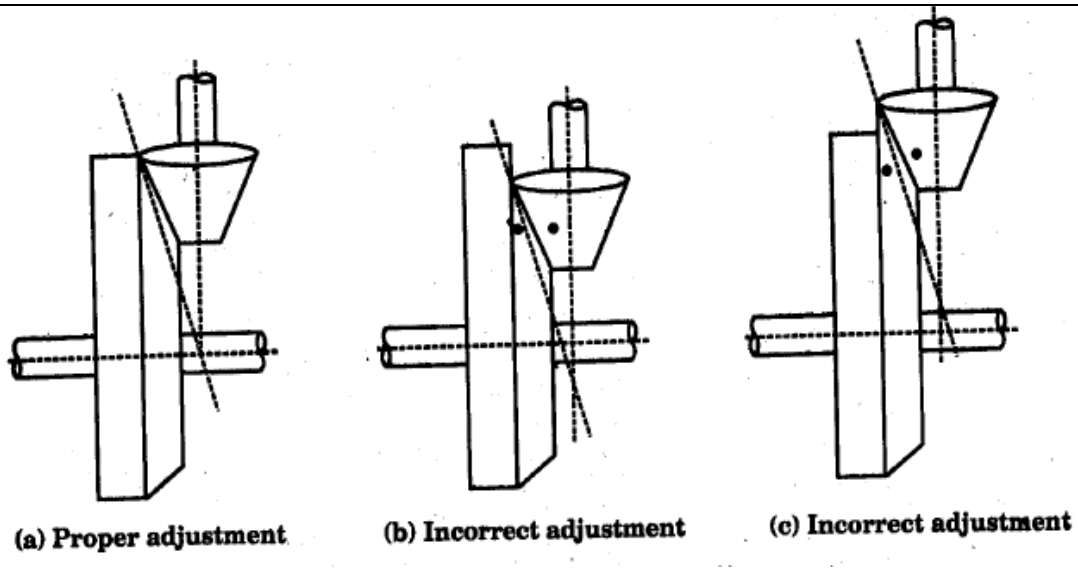
Apply red lead paste on 3 teeth of ring gear as shown in figure. Now rotate the ring gear in the direction of its rotation 4 to 5 times. When these marked teeth pass over the teeth of pinion, it leaves a contact mark as shown in figure (b) & (c). In case correct contact mark is not coming, i.e. it is coming at top or bottom, right or left or in one corner adjust as stated under – — 02

Tooth contact can be adjusted by two methods-

(1) Shifting pinion in or out in the housing.
(2) Shifting the ring gear right or left to pinion.

The pinion and ring gear are so adjusted to a point where the pitch of crown wheel and pinion gear should be same as shown in figure (a).

Suppose crown wheel and pinion ratio is 4:1, bring crown wheel closer to pinion 4 times and bring pinion down by one time. By this method we get identical pitch at desired point.



02

d) Write any four causes and give remedies for 'Hard Gear Shifting' in gear box. 04

Answer: Causes and remedies for 'Hard Gear Shifting' in gear box. *(Consider any four points, each point carry 1 mark)*

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.
6. Selector fork & rod are bent.	Remove bend or replace.
7. Insufficient lubrication	Provide adequate lubrication

04

e) Write stepwise procedure for checking clutch plate for thickness and run out. 04

Answer: Stepwise procedure for checking clutch plate for thickness and run out:

Procedure for checking clutch plate thickness.

1. Remove the clutch assembly from the vehicle and dismantle it properly.
2. With the help of external micrometer measure the thickness of clutch plate and compare it with Manufacturer's specification.
3. If the thickness is less than the recommended value, clutch plate should be relined or replaced.

01

Procedure for checking clutch plate for run out:

a) For checking flat run out:

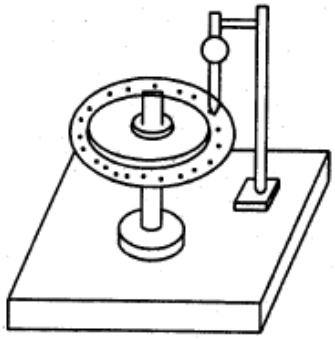
Place the clutch plate on revolving splined shaft as shown in figure. Fix up pointer of dial gauge on lining set the gauge at zero turn the plate slowly. The flat run out should not exceed 0.4mm of it is more replace the same.

01

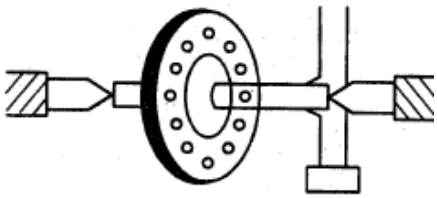
b) **For checking lateral run out**

Fix up the clutch plate in between the two centers as shown in figure. Fix up pointer of dial gauge and set it at zero Now revolve the plate slowly and note the reading the lateral run out should not exceed 0.7 mm if it is more clutch plate be discarded.

01



Checking flat runout of clutch - plate



Checking lateral runout of clutch - plate

01

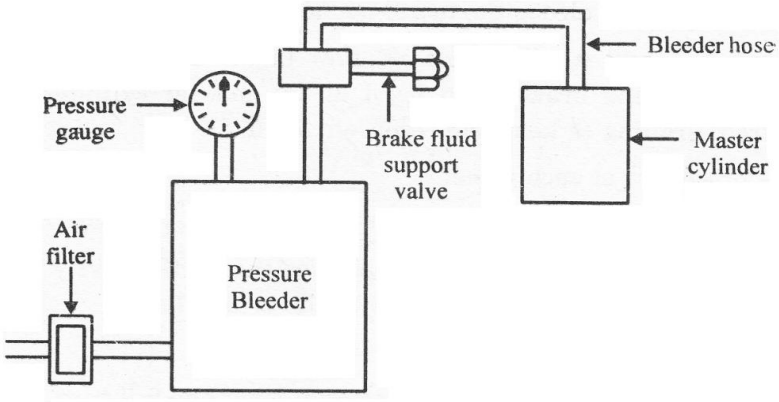
f) What are the types of bleeding? Write procedure for pressure bleeding. 04

Answer: Types of Bleeding are-

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

01

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



01

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.

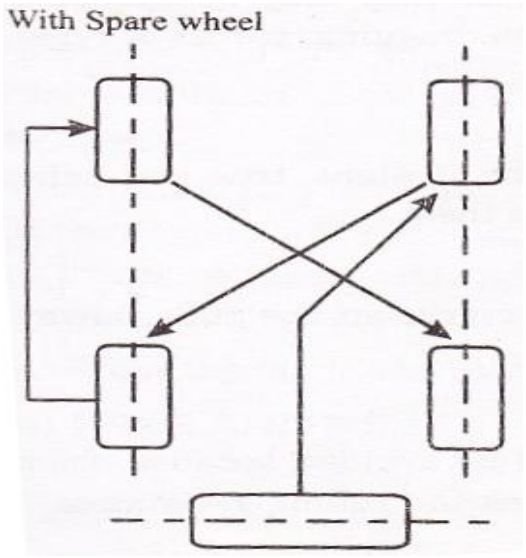
02

6. Attempt any FOUR of the following 16

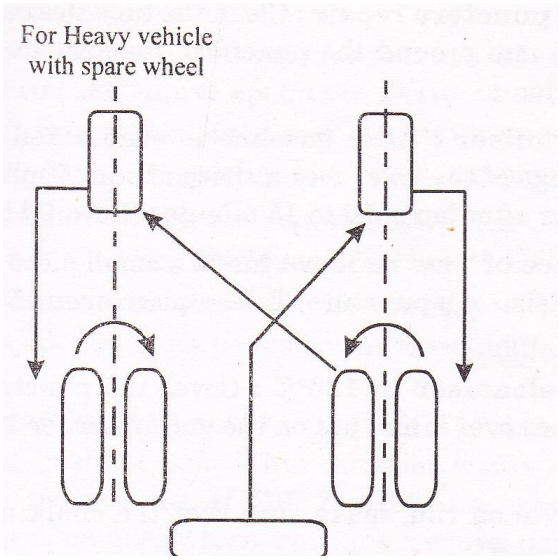
a) Draw sketch showing wheel rotation for
i) Four wheel with spare wheel
ii) Six wheel with spare wheel

04

Answer: *(Consider 2 marks for each)*



i) Four wheel with spare wheel



ii) Six wheel with spare wheel

04

b) List four ways to increase tyre life. 04

Answer: Following are the ways to increase tyre life.*(Consider any four points, each point carry 1 mark)*

1) Avoid overloading.
2) Place the load at centre of the vehicle body.
3) Inflate the tyre to correct pressure.
4) Do not run with flat tyre.
5) Avoid sudden starting acceleration.
6) Avoid sudden braking and cornering.
7) Keep tyre away from oil and grease.
8) Avoid fast running on rough road.
9) Do the wheel alignment and wheel balancing.
10) Avoid road edge driving.
11) Take preventive measures if the vehicle is kept idle for long time.

04

c) Describe adjustments of doors & locks. 04

Answer: Procedure for adjustment of door and lock:

Adjustment of door and lock is necessary for smooth operation of door and security of vehicle.

a) In door adjustment, handles of the door, locks children's safety lock, striker joints are lubricated. When replacing locks, care should be taken to locate the position of the striker which is secured to body by two self tapping screws. If the door does not close well, relocate the striker.

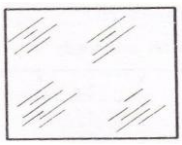
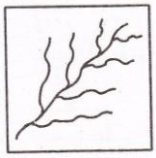
b) Check hinges of doors for loose rivets, noise, corrosion etc.

c) Check rubber weather strip for broken or damage. If weather strip is found damaged or broken, replace with new one.

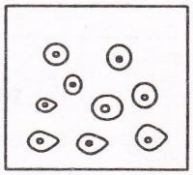
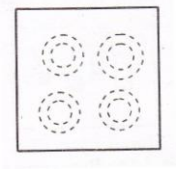
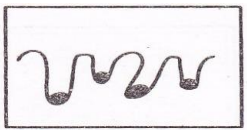
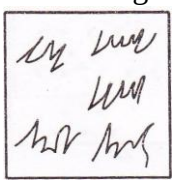
04

d) Check rubber pads for any damage, replace if required. e) 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.	
d) Describe any four denting tools and equipments.	04
Answer: **Denting Tools.** 1) **Hammer:** These are special purpose hammer used for roughing out heavy dent. 2) **Dolly blocks:** These are small set of anvils which are to be held in hand underneath while dent while dent is being hammered. 3) **Spoons:** Used for same purpose as that of dolly blocks but they are made small for dents which are difficult to access. 4) **Files:** These are used to smoothen the rough surface or for removal of excess unwanted material from surface. 5) **Pick Tools:** Picking bars, Hook bar, small pick tools, Pull rods **Denting equipments.** 1. Soldering equipment: Such as blow lamp, Acetylene torch, and Brazing torch etc. 2. Electric and gas welding equipment: used to join the torned sheet metal. 3. Buffing and polishing machines: Used in body preparation work for painting. 4. Drilling Machine: Used for drilling holes. 5. Hydraulic press: Used in press work operation	02 02
e) Describe any four painting defects with neat sketch.	04

Answer*:(Consider any four defect, each point carry 1 mark)*

	Defects	**Description**
1	**Cracking** 	Fine minute cracks in the finish usually only appear on the surface of the paint film. This condition is generally caused by too heavy of film of lacquer top-coat or by sudden temperature changes the surface has to be sanded and refinished.
2	**Shrinking and splitting** 	This condition is caused by the contraction and cracking of the material. This shrinking and splitting is caused by applying material in heavy coats. The putty must be removed in the affecting area and apply as directed

04

3	**Createring and crawling** 	Surface blemishes in a freshly painted surface, where the paint has receded from small area are usually found in the form of small round patches. This condition is caused by oil and moisture in spray line or silicon contamination from products used in some surface operation.
4	**Blistering** 	This condition is caused by oil and moisture in spray line or temperature variation between shop material and surface to be painted or by high humidity conditions.
5	**Pin holes** 	Breaks in dry paint film no longer than the head of a pin, this is due to oil or moisture in equipment or material applied to a cold surface.
6	Runs and sags 	A paint film that has dropped under its own weight and display a thick edge or wrinkle at a lower part. It is caused by to heavy application of paint
7	Rub through 	Burning of lacquer finishes through the primer during the compounding operation is caused by not applying enough material to allow proper compounding.