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.

Q.	Sub Q.	Answer Key/Key element/Particulars	Total Marks
1	(a)	**Attempt any THREE of the following: (3 x4)**	**12**
	(i)	**Write Safety precautions while using following:** **1) FIP Calibration Machine** **2) Valve Grinder**	**04**
Ans.		**Safety Precautions while using FIP Calibration Machine:** (List down any four points mentioned below, each of ½ Marks) [1] Do not allow unauthorized personal to operate service or maintain on this machine. [2] Never attempt to operate the machine or its tools from any position other than seated in the operator's seat. [3] Always check work area for dangerous features like slopes, overhangs, demolitions, fire, drop-off, ditches. [4] Never leave the machine unattended while running condition. [5] Wear insulated rubber gloves, shoes with insulated soles, protective garments and safety face shield while working. [6] Do not wear sandals or open toe shoes. [7] Keep long hair out of machine by wearing a cap. [8] Do not wear rings or bracelet or watches while working around running machine. [9] Observe and strictly follow the safety precautions displayed and instructed on Equipment.	**02**

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		Safety Precautions while using Valve Grinder: (List down any four points mentioned below, each of ½ Marks) [1] Don't wear loose clothes. Make sure your clothes are right for the job. Dangling sleeves or ties can get caught in machine and cause serious injury. [2] Floors must be dry and operator doesn't work with wet hands while operations. Wipe excess oil and grease, or any liquid off your hands and tools; clean it, so that you can get a good grip on tools or parts. [3] Watch out for sparks flying from a grinding wheel because it can set your clothes on fire. [4] Machine should properly ground. Machine tools must have a separate ground lead or be double insulated to guard against shock. [5] Don't leave a running machine unattended. Whenever using a machine and have to leave it for a moment, turn it off. [6] Never try to adjust the tool rest while the grinder is running. Shut down the grinder and wait until the wheels stop moving. [7] Don't touch the rotating wheels, it can take skin and flesh off on contact. [8] Wear insulated rubber gloves, shoes with insulated soles, protective garments and safety goggle or face shield while working. [9] Do not wear sandals or open toe shoes. [10] Do not wear rings or bracelet or watches while working around running machine. [11] Observe and strictly follow the safety precautions displayed and instructed on electrical equipment.	**02**
Q. 1 (a)	**(ii)**	**Write functions of following tools and equipments:** **1. Cylinder Bore Gauge** **2. Depth Gauge** **3. Head Light Aligner** **4. Cylinder Honing Machine**	**04**
Ans.		**Function of Following Tools & Equipments:** (Each of 01 Mark) **[1] Cylinder Bore Gauge:** It is a measuring tool used for measure inside diameter of engine cylinder (bore). **[2] Depth Gauge:** The depth gauge is a type of micrometer which is used to measure the depth of hole. **[3] Head Light Aligner:** It is a device used to check the aiming of head lights or aligning the head light beams of Motorcycles, LCV's and Heavy vehicles. With head light aligner Low beam, High beam is checked as per manufacturer's recommendations. **[4] Cylinder Honing Machine:** It is an accurate machine which is to be used correct tapered, out of round cylinders and remove very fine layers of material from cylinder wall with superfine finishing in fast and easy way. **Or** It is the machine used to remove some out of roundness, taper, tool marks and axial distortion in engine cylinder.	**01** **01** **01** **01**

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Q. 1 (a) (iii)	**State the criterion to decide whether a vehicle component is to be repaired or replaced.**	**04**

Ans.

Criteria to be decided whether a vehicle component is to be repaired or replaced:
(Any four points mentioned as below with brief description, Each of 1 Marks)

S. No.	Criteria to be decided	For Repair	For Replace
1	**Cost of Component**	Repair cost is less as compared to a new part to be replaced	Replacement cost is more
2	**Performance**	Gives substandard performance	Gives standard performance
3	**Availability of Spares**	Essential, if unavailability of new parts	Availability of new parts with reasonable cost then replacement is preferred
4	**Safety Aspects**	If safety aspects is not prime importance, repair is done	If safety aspects is of greater concerns, parts are replaced
5	**Manpower required**	Skilled workers are required	Semi skilled or untrained workers may replace the parts
6	**Life of component**	Less life and gives less assurance	More life and gives proper assurance
7	**Warranty**	Warranty is not given	Warranty is given
8	**Time Required**	More time is required	Less time required
9	**Feasibility**	If the component is within the service limit it can be repaired	Parts that are beyond the service limits must be replaced
10	**Effect of required part on Sequential Failure**	If there is no effect of repaired part on sequential failure then repair is preferred	If there is an effect of repaired part on sequential failure then replacement is preferred

04

Q. 1 (a) (iv)	**What happens if O_2 sensor in MPFI system does not work?**	**04**

Ans.

If O_2 Sensor in MPFI System does not work (becomes inoperative):
(List down any four points, each of 01 Marks)

A bad (inoperative) Oxygen (O_2) sensor will primarily upset the Fuel Injection system. The voltage signal from the sensor represents air- fuel ratio.
[1] If the oxygen sensor produces a false output (incorrect voltage), the computer (ECU) cannot precisely control how much fuel is metered into the engine.
[2] It could results in a rich mixture or lean misfire condition.
[3] Also, it would be drastic decrease of fuel economy or mileage.
[4] Other reasons may include engine hesitation, engine stalling, increased exhaust emission, rough idling and engine pinning.
[5] It leads to lowered performance of the engine and poor fuel efficiency which ultimately decreases vehicle's driveability.

04

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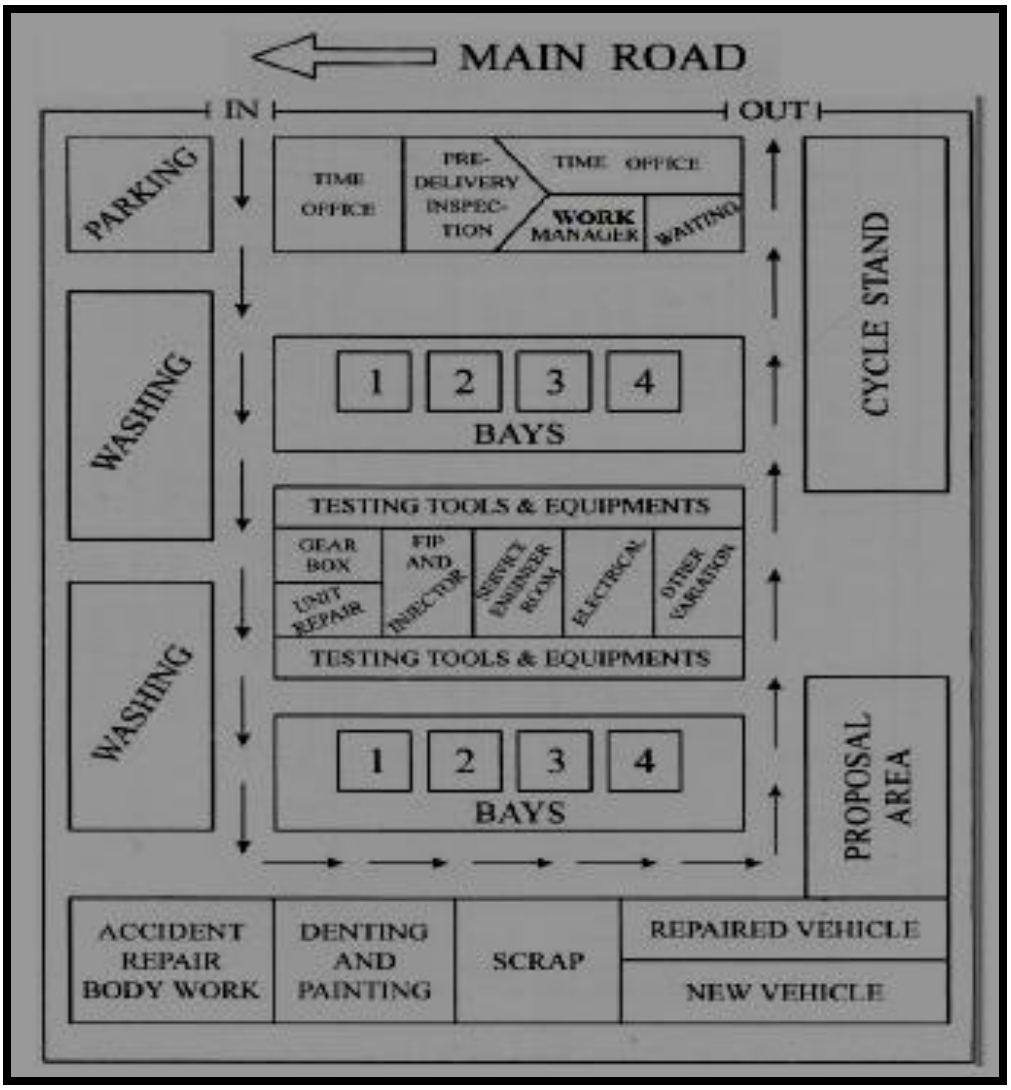
	(b)	**Attempt any ONE of the following: (1 x 6)**	**06**
	(i)	**Draw a layout required for garage servicing 10 commercial vehicles per day. List important generalized and specialized equipment required for this garage.**	**06**
Ans.		**Layout required for Garage servicing 10 Commercial Vehicles/day:** (Credit should be given to suitable layout, 3 Marks for Proper Layout)  **Figure: Layout of Garage servicing 10 Commercial Vehicles/day** **List of important generalized Tools and Equipments required for this garage:** (List down any 3 generalized Tools & Equipments, Each of ½ Marks) [1] Hand Tools (Service Tools) [2] Measuring Tools [3] Shop Power Tools [4] Hydraulic & Arbor Press [5] Shop Cutting Tools [6] Air Compressor & Tyre Inflator [7] Battery Tester [8] Hydraulic Jack, Axle Stands, Creeper & Hydraulic Lift **List of specialized equipment required for this garage:** (List down any 3 specialized Tools & Equipments, Each of ½ Marks) [1] Grease Gun	**03** **1.5**

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	[2] Vehicle Washer [3] Portable Electric Drill [4] Headlight Beam Aligner [5] Brake Tester [6] Electronic Soldering Iron [7] Injector Cleaner & Tester [8] Valve Grinder	**1.5**
Q. 1 (b) (ii)	**Describe scheduled maintenance procedure for light motor vehicle.**	**06**
Ans.	**Schedule Maintenance Procedure for Light Motor Vehicle:** (List down major parameters in any 4 schedule period mentioned below, Each of 1.5 Marks) **[1] Daily Maintenance:** 1. Clean the vehicle and check fuel in the fuel tank. 2. Check water level in the radiator. 3. Check oil level in the oil sump. 4. Check tyre pressure. 5. Check brake pressure warning light. **[2] Weekly Maintenance or at 500 km :** 1. Check engine oil level and fill, if necessary. 2. Check electrolyte level in battery and fill, if necessary. 3. Drain oil from engine sump and replenish. 4. Clean gauge filters in petrol. 5. Check engine mounting nuts. 6. Check cylinder head nuts. 7. Tight inlet manifold and exhaust manifold nuts. **[3] First 1000 Km:** 1. Drain oil in sump to clear it of any impurities in accumulator, refill it with the appropriate grade of lubricant. 2. Drain gearbox by unscrewing the drain plug, now fill it with correct amount of the recommended lubricant. 3. Drain oil from the rear axle; refill it with the recommended lubricant up to the prescribed level. 4. Lubricate the water pump bearing with recommended grease. **[4] Every 1000 km:** 1. Repeat items described under every 500 km with addition of the following. 2. Provide grease to the sliding joint and two needle type universal joints 3. Grease each of the swivel pin with grease gun. 4. Grease gun should be applied to the nipple on the ends of steering rods. 5. Test the tyre pressure. 6. Fill radiator to full level. **[5] Every 2000 Km:** 1. Repeat the items less than 1000 km with addition of the following. 2. Replenish gear box oil. Oil level should not be too high, otherwise it will get into the clutch housing and cause clutch slipping.	**06**

3. Top up the rear axle.
4. Change oil in the sump to remove any impurities that have accumulated.
5. Check the fluid level of the master cylinder by turning back the front floor carpet on driver's side and removing the exposed rubber plug. The fluid should be within 13 mm of the bottom of the filter neck.
6. Apply grease to the nipples on the hand brake cable.
7. Check specific gravity of the battery fluid by taking hydrometer readings.

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

(a) **Describe History sheet with format.** **04**

Ans.

History Sheet:

(2 Marks for Brief Description)

[1] History sheet is useful for knowing the amount spent on the maintenance of vehicle.

[2] It consists of following major parameters shown in below figure.

1. Name , Address and Contact Number of Vehicle Owner
2. Registration Number, Engine Number and Chassis Number
3. Arrival & Departure Time
4. Description of Service and Cost of Repair
5. Sign of owner and Works (Service) Manager

02

[3] In the remark column, type of maintenance should be mentioned and reason for such repair should be found out to control the maintenance.

Format of History Sheet:

(2 Marks for Sample Format of History Sheet)

History Sheet								
Name of vehicle owner								
Address					Contact No.			
Registration No.				Make		Model		
Engine Number				Chassis No.			Colour	
Sr No	Arrival time and date	Departure time and date	Odometer reading	Description of service	Cost of repair	Remark	Sign of Owner	Sign of Works Manager
1								
2								
3								

02

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	(b)	**Describe general servicing procedure.**	**04**
Ans.		**General Servicing Procedure for Vehicle:** (List down any 8 points, Each of ½ Marks) [1] Park the vehicle on the servicing ramp. [2] Place the stopper at the front and rear of the wheel. [3] Drain the Engine oil from engine oil sump and fill up new recommended oil. [4] Check oil level in gear box and differential. If level found less top up to correct level by specified oil. [5] Clean air filter by blow of compressed air. If clogged replace with new one. [6] Check the water level, coolant level and Belt tension of the alternator. [7] Check battery electrolyte level. If necessary top up to correct level. [8] Perform engine tune up, if required. [9] Do the brake and clutch adjustments as required. [10] Check tyre condition and do tyre rotation if required [11] Perform Wheel alignment and wheel balancing if necessary. [12] Wash the vehicle thoroughly and by using grease gun lubricate the points where grease lubricant required.	**04**
2	**(c)**	**What is vapor lock in petrol engine? How vapor lock can be removed?**	**04**
Ans.		**Vapor Lock in Petrol Engine:** (2 Marks for correct significance of Vapor lock) 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 carburettor. Resulting in transient loss of power or complete stalling. Fuels that have high volatility can also cause vapour lock. **Removal of Vapor lock from Vapour Return Line:** (2 Marks for removal procedure of Vapor lock) 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. **Vapour Separator:** Some cars have vapour separator connected between fuel pump and carburetor.	**02** **02**

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(d) If a Truck is not climbing hill section, write probable four causes and remedies. — 04

Ans.

Probable causes and remedies if the Truck is not climbing hill section:

(List down any 4 Probable causes with remedies, Each of 1 Marks)

S. No.	Possible Causes	Remedies
1	Engine overheated due to lack of Coolant	Cool the engine and add proper coolant
2	Improper gear selection	Drive in lower gear
3	If truck 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

04

2 (e) Write procedure of testing fuel injector of MPFI Engine. — 04

Ans.

Procedure of Testing Fuel Injector of MPFI Engine:

(Explain any two testing methods in detail, Each of 2 Marks)

Three tests are conducted for testing of diesel engine injector

[1] Pressure Test

[2] Leak off Test

[3] Spray Test

[1] Pressure Test:

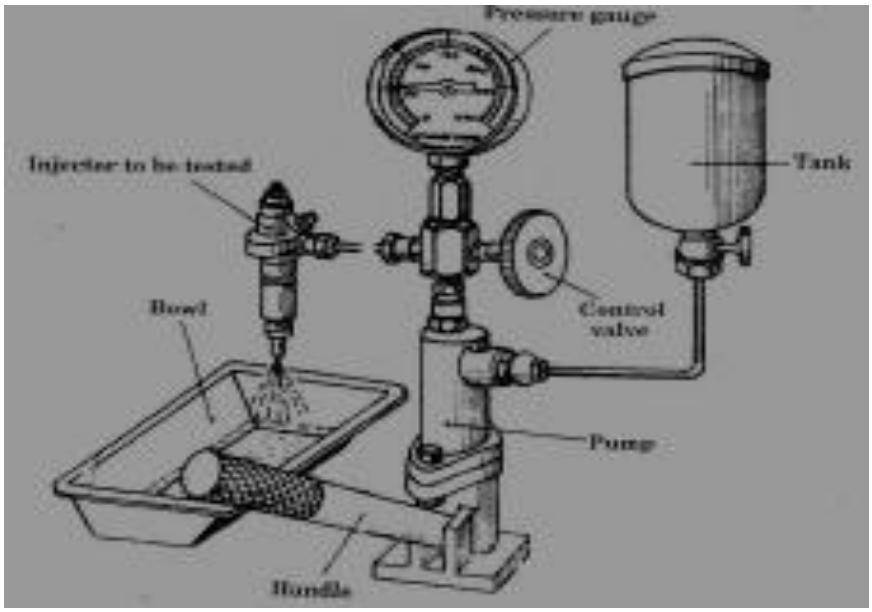

Figure: Injector Tester

1. Fix the injector to be tested to injector pipe of Injector tester as shown in above figure.
2. Work the hand pump.
3. Note the opening pressure of spray on gauge provided.
4. If the pressure is less, it is increased by loosening the check nut and tightening the adjusting screw.
5. If it is more than the specified, the adjusting screw is loosened.
6. After adjusting pressure, lock the lock nut and replace the cap.
7. In some make of nozzles shims are added or removed instead of adjusting screw.

04

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[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.
4. 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.
   (iv) If nozzle valve seat is pitted, it should be replaced or grounded.
5. Fix up the injector again and test it in same manner as prescribed in steps 1 to 3.

[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.

2	**(f)**	**A noise is heard from one or more cylinders of diesel engine. State four probable causes and remedial measures.**	**04**

Ans.

Probable Causes & Remedies for Noisy engine cylinders of Diesel Engine:
(List down any 4 Probable causes with remedies, Each of 1 Marks)

S. No.	Probable Causes	Remedies
1	Worn, leaky or dirty valve lifters	Replace the worn out lifter
2	Extreme bearing wear or damage	Replace the bearing
3	Engine overheating	Cool the engine properly
4	Inoperative EGR Valve	Check, Inspect & Rectify the EGR Valve
5	Carbon build up in Combustion Chamber	Service the engine
6	Increased clearance between pistons and cylinders	Correct and Adjust it properly
7	Low oil pressure	Check and replace the oil
8	Excessive connecting rod or main bearing clearance	Inspect and adjust it
9	Improper Ignition Timing	Check and adjust the ignition timing

04

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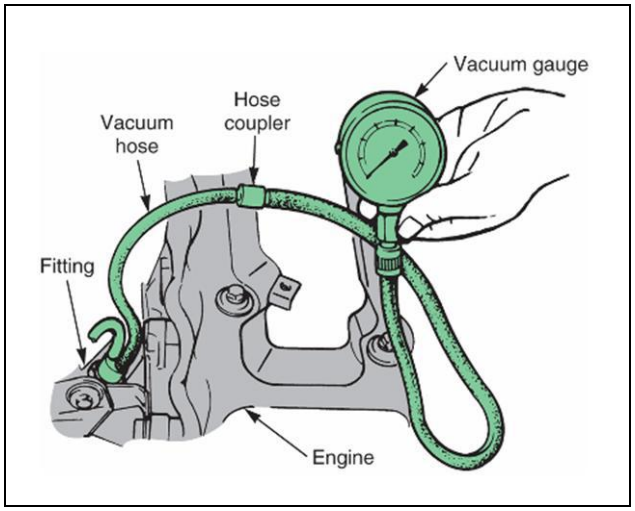
03.	**Attempt any <u>FOUR</u> of the following.**	**16**
a)	**Write stepwise procedure to carry out vacuum test for cylinder with suitable sketch.**	**04**
	Answer : Procedure to be carried out the vacuum test of cylinder: Measuring the amount of manifold vacuum during cranking is a quick and easy test to determine if the piston ring and valves are properly sealing (For accurate results the engine should be warm and the throttle closed). 1. Run the engine so that the water temperature is between 75^0C to 80^0C. 2. Disable the ignition. 3. Connect the vacuum gauge to a manifold vacuum source. 4. Crank the engine while observing the vacuum gauge. 5. Observe the gauge to note the reading. Reading should not be less than 40 cm of Hg. A low vacuum reading if recorded means that leaky cylinder head gasket.  (*Credit should be given any equivalent figure*)	**02** **02**
b)	**In automobile engine, low oil pressure is observed, state any four causes and remedies to rectify it.**	**04**
	Answer*:(Any 4 causes and remedies:1 Mark Each)*	**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.

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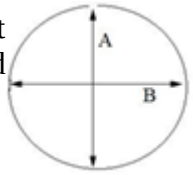
c)	**Write stepwise inspection procedure for radiator leakage.**	**04**
	Answer:- 1. Radiator is mostly fitted in front of engine gets natural draft of air due to forward movement of vehicle. Radiator assembly is made up of upper tank, radiator core, lower tank and radiator cap. 2. Radiator should be inspected for choked radiator core and fins, blocked air passages. 3. Radiator is also inspected for accumulation of rust or scale in tubes. 4. Damaged fins of the radiators obstruct the flow of air. The same may be corrected with pliers or screwdriver. 5. Check hose connection for leaks. Replace inlet and outlet hose pipe of the radiator if found soft, hard, rotted or swollen. 6. Radiator leaks often leave telltale marks because of the dye in the antifreeze. Pressure testing can also help locate leaks. If leaks are found remove the radiator for repair. 7. Make a pressure test of the radiator cap using pressure tester. If the cap cannot hold its rated pressure, replace the cap.	**04**
d)	**Write the procedure for inspection and measurement of cylinder wear.**	**04**
	Answer :- **Procedure for inspection and measurement of cylinder wear.** • 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 	**04**

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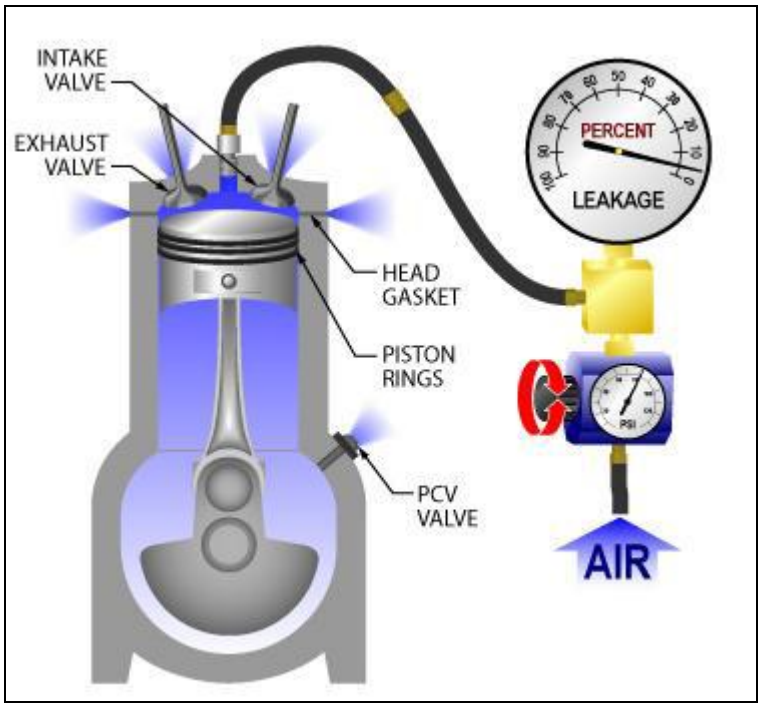
e)	**Write stepwise procedure to carry out the leakage test of cylinder.**	**04**
	1. Engine should be at normal operating temperature. 2. The cylinder being tested must be at top dead centre of the compression stroke. 3. Calibrate the cylinder leakage unit as per manufacturer instructions. 4. Inject air into the cylinder, one at a time rotating the engine as necessity by firing order to test each cylinder at TDC on the compression stroke. 5. Evaluate the result. Less than 10% leakage- Good Less than 20% leakage- Acceptable Less than 30% leakage- Poor More than 30% leakage- Define Problem 6. Check the source of air leakage. 1. If air is heard escaping from the oil filter cap, the piston rings are worn or broken. 2. If air is observed bubbling, out of the radiator there is possible blown head gasket or cracked cylinder head. 3. If the air is heard coming from carburettor or air inlet on fuel injection equipped engines there is defective intake valve. 4. If air is heard coming from the tail pipe, there is defective exhaust valve.  	**03** **01**

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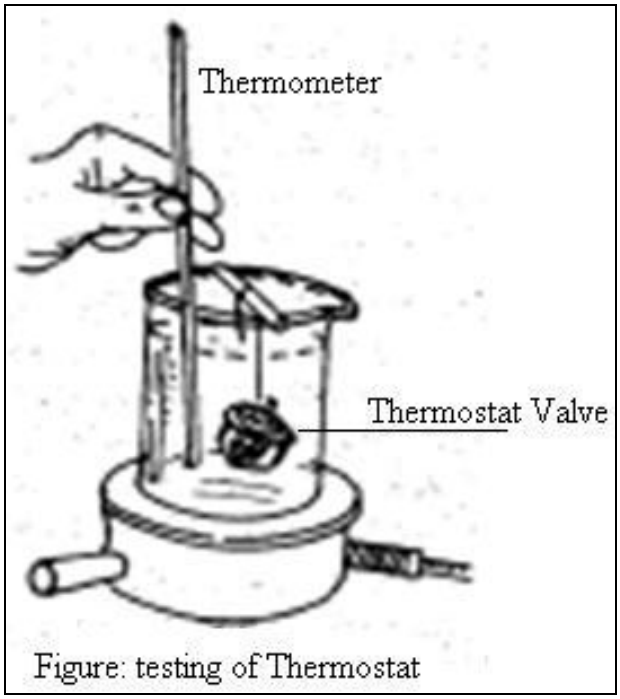
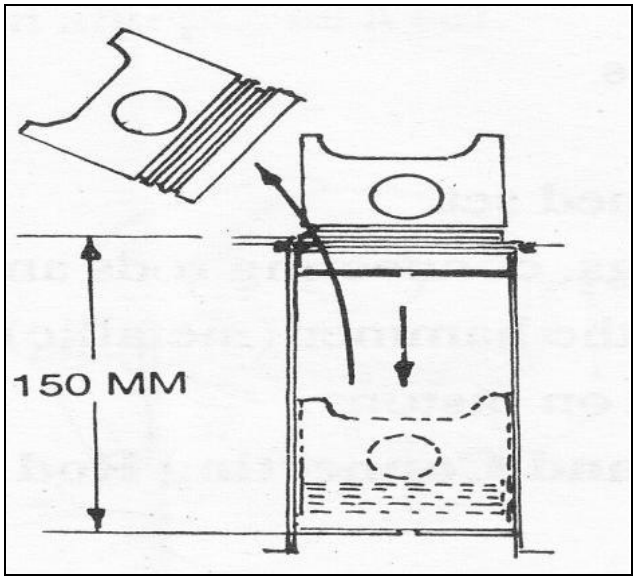
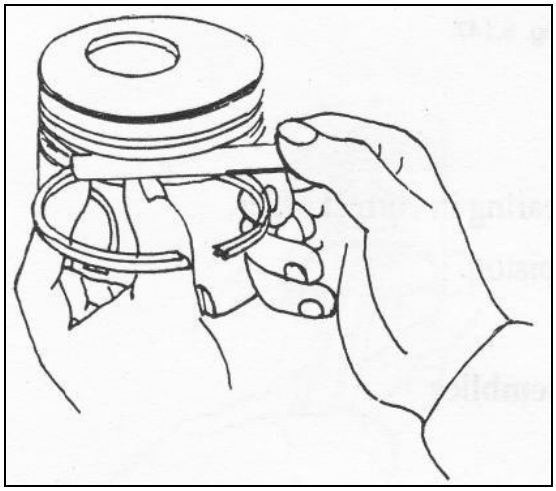
4a)	**Attempt Any <u>THREE</u> of the following.**	**12**
i)	**Write stepwise procedure for checking of thermostat.**	**04**
	Answer:- **Removal:** 1) Disconnect negative cable at battery. 2) Drain the cooling system and tighten the drain plug. 3) Disconnect thermostat cap from thermostat case and remove the thermostat. **Inspection:** 1) Make sure that air bleed valve of thermostat is clear. If it is clogged, engine tends to overheat. 2) Check to make sure that valve seat is free from foreign matters which would prevent valve from seating tight. 3) Check thermostatic movement of wax pallet as follows- • Immerse thermostat in water and heat water gradually as shown in figure. • Check that valve starts to open at specific temperature. • If valve starts to open at temperature substantially below or above specific temperature.  Figure: testing of Thermostat	**03** **01**

ii)	**Write the stepwise procedure for inspection of piston and piston rings.**	**04**
	Answer : Steps taken during servicing and checking piston: **1. Clean the piston:** Using a gasket scrapper removes the carbon from the piston top. Using the groove cleaning tool or a broken ring clean the ring groove. Using a soft brush and solvent thoroughly clean the piston. **2. Inspect piston diameter and oil clearance:** a) Using a micrometer, measure the piston diameter at a right angle to the piston pin whole centre 4 lines, 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.  **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.  **OR**	**04**

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	Checking procedure of piston • Clean the piston to remove dirt, carbon depositions etc. • Check piston diameter and oil clearance. • Check the piston ring groove clearance with the help of feeler gauge. • Inspect the condition of piston skirt for wear. • Check the oil holes in the oil ring grove.	
iii)	**What is engine tune up? Write the procedure for engine tune up with help of block diagram.**	**04**
	Answer :-Tuning of engine: Engine tuning is the adjustment, modification of the internal combustion engine or modification to 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**:*(Credit shall be given to brief description of block diagram)* 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.	**01** **02** **01**

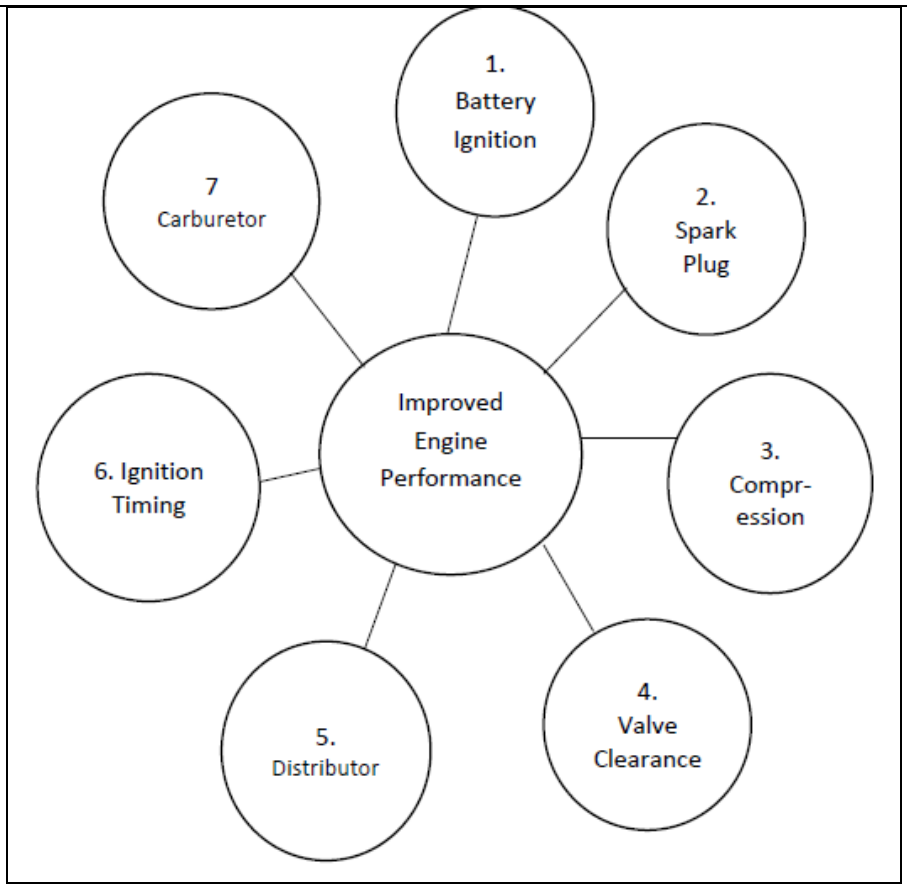

Figure: Engine tune up sequence

4) If the compression ratio is not up to specifications, perform engine services that will eliminate the trouble. If the compression is all right, reinstall the spark plugs.
5) Clean inspect file gap and test the spark plugs replace 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.

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iv)	**Write the four causes and remedies for clutch slipping.**	**04**
	Answer:- *(any four suitable causes and their remedies - 1 mark each)*	**04**

Sr.No.	Causes	Remedies
1	Oil or grease on the driven plate facing	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.

b)	**Attempt any ONE of the following**.	**06**
i)	**What is calibration of FIP? How calibration is carried out on FIP test bench?**	
	Answer: Calibration of FIP:	
	FIP is calibrated for efficient delivery, so that quantity of diesel fuel supplied by all the plungers in a given pump is more or less same at any rpm. Calibration of FIP is done on FIP test bench. If these measured quantities differ much, then the quantity of fuel is adjusted by loosening the clamping screw of the toothed quadrant and rotating the plunger by turning the control sleeve of pump.	**02**
	Procedure to do FIP calibration.	
	1) Place the pump on a fuel injection test bench. 2) Its engine is then rotated till it attains the speed of 2000 rpm. 3) Measure the quantity of diesel oil supplied by the each pump element in measuring cylinder. 4) If measured quantities are more or less same, it may be said that the pump is delivering properly to all the cylinders. **5)** If measured quantity differs much, then the quantity of fuel is adjusted by loosening the clamping screw of the toothed quadrant and rotating the plunger by turning the control sleeve of pump.	**04**

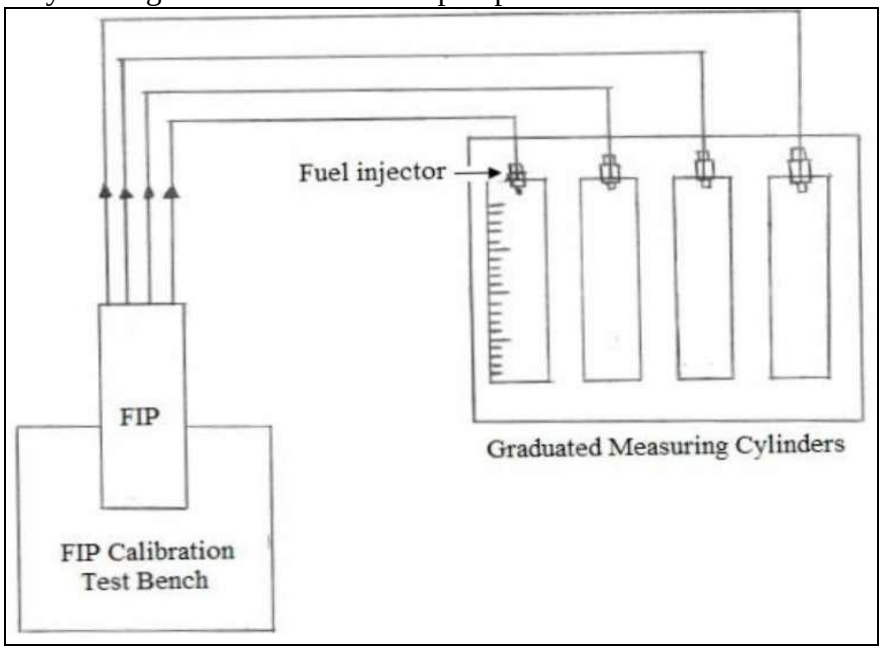


	Figure: FIP calibration	
ii)	**List complaints of frame. Describe the procedure to rectify any one of frame complaints.**	**06**

Answer:- (List of Frame complaints: 1 mark, Procedure of any one 5 marks)

Frame complaints:- **01**

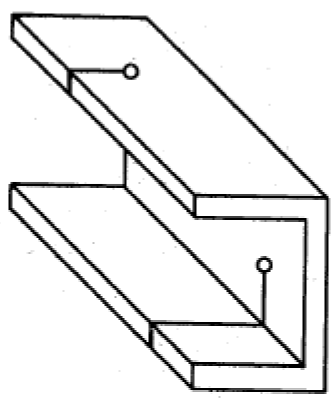
- **a)** Check cracks.
- **b)** Loose rivets.
- **c)** Skewness.

A) Cracks: Cracks can be detected by inspecting the chassis carefully. If it is not visible, wash the chassis first, then coat the surface with a solution of chalk and water. When it becomes dry, tap the area with a hammer then the crack will be visible.

In case, the crack is observed, it should be immediately repaired. In case the repair facilities do not exist, then drill 5 to 6 mm diameter hole at the end of cracks as shown in figure. This drilling of hole will stop further expansion of crack. The holes work like the first aid for the crack.

To repair cracks following procedure is adopted.

1. For welding the chassis make a groove of 2 to 3 mm in the crack at bottom portion and chamfer the upper end of the groove to make a V shape. Weld a groove with at least 3 layers. After welding, it is cooled down, then grid the surface to make it smooth. **05**
2. Considering second case. If crack is more than ½ of chassis cross-section, it will be necessary to reinforce the area, by placing a steel plate and chassis thickness. While welding the plate, never weld it fully on all sides.



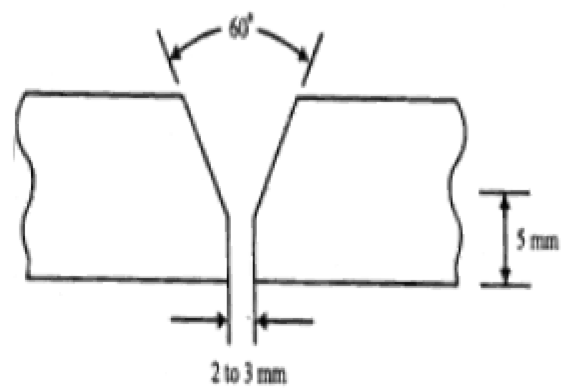


Fig. Drilling hole at the end of crack Figure. Making „V‟ groove for welding

OR

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

For replacement of rivets following procedure is adopted:

1. Cut the rivet head with drill or welding torch; do not use a chisel as it will damage the rivet hole. In case the hole is already damaged, drill a bigger hole and use bigger diameter rivet.
2. The diameter of new rivets should be 1 mm less than the hole diameter.
3. Clean the hole thoroughly, there should be no bur.
4. Heat the rivet, when hot, fix it in the hole and rivet its head.
5. Never fix up a cold rivet, as it will not make a good joint.
6. Do not weld rivet with chassis. If it is loose, remove and fix a new one.

OR

C) Procedure for checking skewness (Misalignment and repair):

a) Place the vehicle on plane levelled ground.

b) Mark the markings on the floor from all the points from which measurements should be taken by dropping the plumb bob directly underneath the point.

c) Move the vehicle away from the layout on floor.

d) Check frame width at front and rear end. If width is corresponds to specification, draw a centre line up to full length of the vehicle half way between marks indicating front and rear width. If frame width is not correct draw centre line through intersections of any two pairs of equal diagonals.

e) With the centre line properly laid out, measure the distance from it to points opposite over the entire length of chassis. If frame is in proper alignment measurement should not be vary.

f) To locate the points at which the frame is sprung measure the diagonals marked in pairs A-B, B-C, C-D. If the diagonals in each pair are within 3.17mm, that part of the frame between the points of measurements is considered as in satisfactory alignment. These diagonals should intersect at centre line.

Repair of Skewness of frame: **05**

Skewed frame can be repaired with two jacks, dolly block, special type of bending tools and localized heating of the particular chassis bend. After repairing of frame check alignment of chassis accurately.

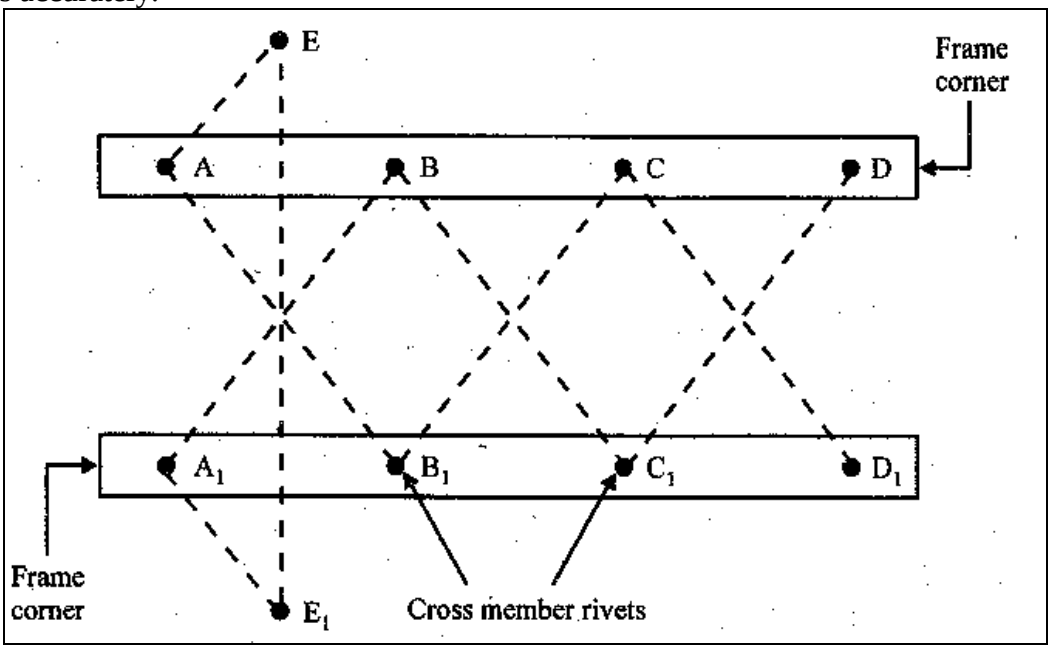


Figure: Checking alignment of frame.

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5	**Attempt any <u>FOUR</u> of the following.**	**16**
a)	**Write stepwise procedure for checking differential ring gear run – out.**	**04**
	Answer: 1. Fix up dial gauge on the differential housing with pointer resting against back of crown wheel. 2. Revolve the crown wheel and check the run out. 3. It should not be more than 0.025 mm. If it is more than it should be checked for distortion loose holding down bolds or the cage for distortion. 4. If they are distorted they should be repaired After the adjustments once again check up that side cage nuts area properly tightened and locked 5. Pinion flange blots and nut are prosperity tightened after this 6. Fix up cover and fill lubricating oil in the housing.	**04**
b)	**A technician has observed a noise in a propeller shaft, state four probable causes and remedies.**	**04**
	Answer:*(Any 4 causes and remedies:1 Mark Each)*	**04**

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

c)	**A technician has observed Hard gear shifting, State four probable causes and remedies.**	**04**
	Answer:*(Any 4 causes and remedies:1 Mark Each)*	**04**

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

d)	**What is necessity of bearing preload? Write procedure to adjust bearing preload.**	**04**
	Answer: Necessity 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 – 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 taper rollers bearings. 2. Disconnect the rear end of the propeller shaft by loosening the flange bolts.	**02**

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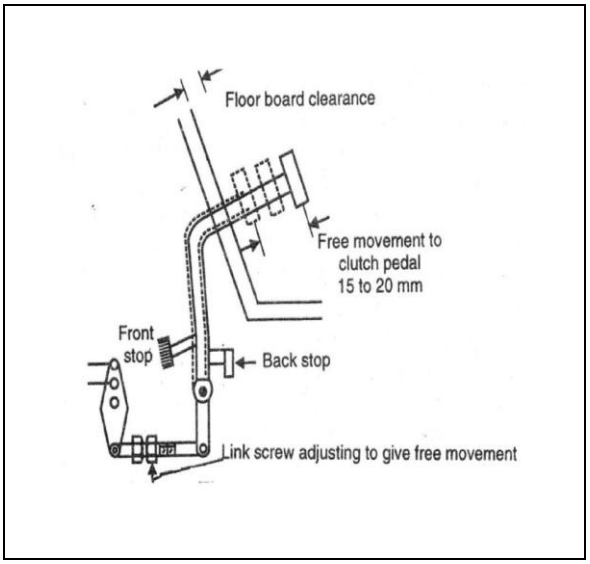
	3. Remove the lock nut and thrust washer. 4. To remove free play in the bearing usually two methods are employed. By adding or removing shims under the cap of differential pinion housing or by check nut on pinion shaft. In heavy vehicles, over two taper roller bearings one pilot bearing is also used at the front end of the pinion.	**02**
e)	**Write stepwise procedure for clutch pedal adjustment with neat sketch?**	**04**
	Answer: Clutch adjustment procedure: In clutches there are four adjustments to be made, three of which can be made without removing the clutch from the vehicle, and the other should be done after the clutch assembly has been removed. 1. **Clutch release lever adjustment**: When the vehicle has been used for long time, due to wear of the clutch facing, the distance between pressure plates and fly wheel reduces. So that, the distance between release bearing and clutch fingers increases. To cover up this increase distance, the travel of release is increased by the adjusting rod or release lever. 2. **Floor board clearance adjustment:** This adjustment can be done by means of a screw located near the lower end of the clutch pedal. This screw prevents the pedal arm from resting against the floor board. The screw should be so adjusted as to maintain the proper floor board clearance. 3. **Clutch pedal travel adjustment:** If the total travel is less than specification, the bumper stop is trimmed until the correct travel is obtained. The total travel of pedal should be 6 to 7 inches. This adjustment should be done before adjustment of free play. 4. **Free play adjustment:** This adjustment can be done by changing the length of link rod located in the clutch linkage. The adjustment should be set, so that the specified amount of free play (15 to 20 mm.) remains in the pedal after the clutch has been engaged. After the correct adjustment is made, both nuts are tightened to effectively lock the adjustment. This adjustment should be done after the correct floor board clearance or clutch pedal has been established.  Figure : Clutch pedal adjustment	Any two procedure **03** mark **Diagram 01**

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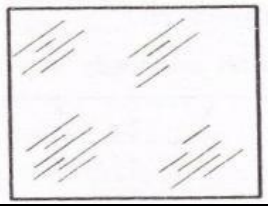
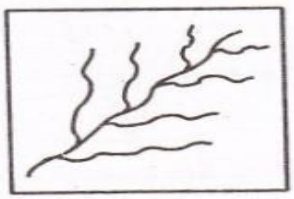
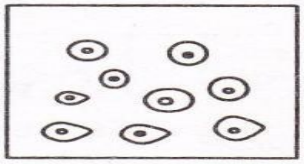
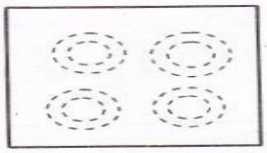
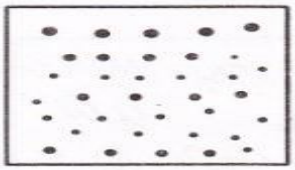
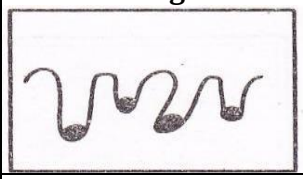
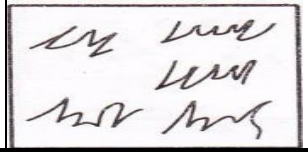
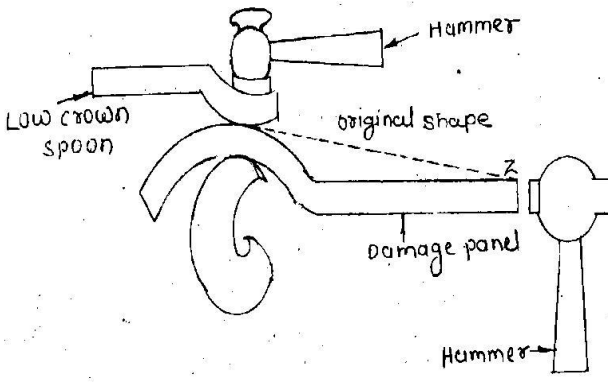
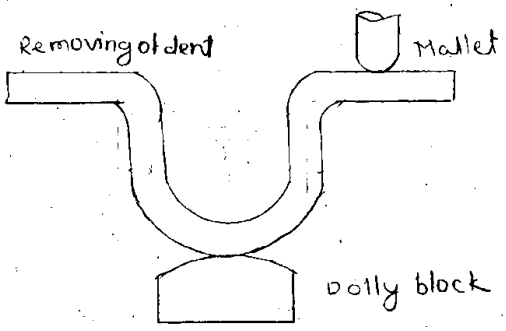
f)	Write any four paint defects with sketch.	04

Answer: Consider any four defect with sketch, 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.
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.

6)	**Attempt any <u>FOUR</u> of the following.**	**16**
a)	**Describe stepwise procedure for removing dent.**	**04**
	Answer: Procedure for removal of dent: Examine the dent carefully and to find out how dent is formed in correct sequence. **1) Preparation of work:** Before starting actual repair it is necessary to clean the dented area thoroughly. Removing paint, road dust & other particles both from top and bottom end of denting area. **2) Ironing of dent:** As shown in figure, identify particular dented area of sheet metal and carry the repair work with dolly block, spoons and hammers to bring it at its original shape.  **3) Welding:** Sometime when impact is sever, the sheet metal torn apart, while filing the sheet metal gets weakened and cracks occurred. Under this circumstance, it is necessary to weld the cracks for permanent joint. **4) Finishing Job:** Final job is to smooth out bumped surface to its original shape or appearance. Slight irregularity or roughness in the surface can be felt by moving the hand over the dented area. Special flexible files are used to remove high spots. Especially adjustable vixen files are used for this purpose.  **5) Metal shrinkage:** Panel and other sheet metal components, which are hammered to bring its original shape, usually stretched during repair, weaken the structure. This stretched area can be shrunked by localized heating with torch flame and hammered with the help of dolly block, to smoothen out. If structure is very weak, then weld it as permanent joint and refinish it. **6) Final step**: A thick paste is applied with a knife edge. After 3/4 hour it becomes dry. After it gets hard, then it is smoothened with file.	**04**

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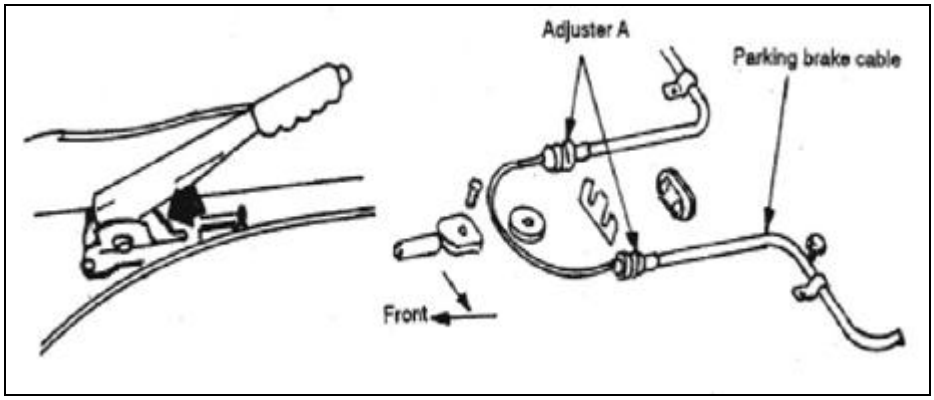
b)	**Write procedure of parking brake adjustment?**	**04**
	1. Pull the parking brake lever by one hand and see that the rear wheels are completely broken and note the notches travelled by hand lever. 2. In case the lever moves more than 3 notches, rear brake shoe requires adjustment. 3. In case after adjusting brake shoe and drum clearance of the parking brake lever still moves by 3 notches and wheels are not braked then adjust the parking brake cable through adjusting nut A as shown in figure.  Figure: Parking brake adjustment	**02** **02**
c)	**Write the procedure of inspection and repair of master cylinder.**	**04**
	Answer: Procedure of inspection and repair of Master cylinder. **Inspection** 1. Check piston for wear 2. Inspect rubber valve seat, Rubber boot, stop washer, primary cup and secondary cup for cracks. 3. Inspect body of master cylinder for wear, corrosion. 4. Inspect spring for tension. 5. Inspect filler plug for wear. 6. Inspect push rod for wear. 7. Inspect circlip for damage. **Repair** 1.Replace the worn out piston 2.Replace the damaged circling 3. Replace the worn push rod 4. Replace the rubber boots 5. Replace the cracked cup	**02** **02**

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d) Describe procedure of Tyre Retreading. **04**

Answer: Tyre Retreading Procedure: **04**

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 thread and it gives perfect bonding of the thread.
7. **Curing**: The tyre is then placed in the hot retreading machine-segmented mould retreading machine. During this processing, the tyre threads 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.

e) A driver has observed steering kick back. State four probable causes and remedial measures. **04**

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

	Causes	Remedies
1	Tyre pressure low or uneven	Inflate to correct pressure
2	Spring sagging	Replace adjust torsion bar
3	Shock absorber defective	Replace
4	Looseness in linkage	Adjust, replace worn parts
5	Looseness in steering gear	Adjust, replace worn parts
6	Improper angle of impact with obstruction	Drive correctly
7	Stiffness & condition of shock absorber not proper	Replace & adjust
8	Heavy speed of vehicle	Drive properly.