AEDT - TOPIC 1

CYLINDERHEAD, CRANK SHAFT & CONNECTING ROD

May/June 2007

1 Name the precession tools \ instruments used for measuring,

(A) oviality, (B) Taper & how it is measured.

- MICROMETER: - It is used for measuring crankshaft rod and main bearing journals & piston.
- TELESCOPIC GUAGE. : - It is used for measuring diameter of cylinder bore for joviality and taper.
- DIALBORE GUAGE:-It is used for measuring diameter of cylinder bore for joviality and taper.
- MICROMETER: - Out side & inside micrometer are precision tools used to measured outer and inner diameter, respectively. The micrometer, which is more precise than the venire caliper.

- PROCEDURE : -
  - outer diameter : -
- The outside micrometer has a frame a movable spindle. The spindle is moved toward or away from the anvil by turning the thimble .The thimble has screw threads that cause the thimble to move when it is turned
- Hold the rod outside mike to and turn the ratchet stop of the thimble until the spindle touches the rod .The ratchet stop on the end of the thimble keeps you from applying excessive force on the mike. When the spindle touches the rod, the ratchet stop slips and clicks so no further force can be applied.

  - Inner diameter : -
- If the inside measurement to be made is greater than the basic mike can measure, an extension can be added. An out side mike and a telescope gauge can be used to measure inside diameter .the telescope gauge is adjusted to the diameter .Then out side mike is used to measure the gauge setting.

- Procedure for inspection by measurement crankshaft :-**154 rbg**

- procedure for inspection by measurement piston :-

* INSPECT PISTON DIAMETER AND OIL CLEARANCE:-

- Using a micrometer, measure the piston diameter at a right angle to the piston pin whole center line, the indicated distance below the skirt bottom edge.
  - Measure distance : 14 mm
  - Piston diameter : 94.94 – 94.97 mm
- Measure the cylinder bore diameter in the thrust directions and subtract the piston diameter measurement from the cylinder bore diameter measurement
  - Standard oil clearance : 0.05 – 0.07 mm
  - If the clearance is not within specification, replace the piston. If necessary, replace the cylinder liner.
- Inspect piston ring groove clearance .Using a feeler gauge measure the clearance between the new piston ring and the ring land.
  - Piston ring groove clearance : No. 1 Ring 0.08 -0.012 mm
  - No. 2 ring 0.04 – 0.08 mm oil ring 0.03-0.07 mm

*inspect PISTON RING AND GAP

- Insert the piston ring into the cylinder.
- Using a piston, push the piston ring a little beyond the bottom of the ring travel.[150 mm from top surface of cylinder block]

- Using a feeler gauge, measure the end gap.
  - Standard piston ring end gap : - No 1 ring 0.30-0.57 mm
  - No. 2 ring 0.35-0.67mm Oil ring 0.35 – 0.67 mm
  - Maximum piston ring end gap :- No 1 ring 1.37 mm
  - No 2 ring 1.47 mm Oil ring 1.47 mm
- If the gap exceeds the specified maximum, replace the piston ring.
- If the gap exceeds the specified maximum even with a new piston ring, replace the cylinder liner.

- TELESCOPIC GUAGE: - Generally it is used with outside micrometer to use with outside micrometer to measure inside diameter of a small cylinder. The telescopic gauge is adjusted to the diameter then the outside mike is used to measure the gauge setting.

**DIALBORE GUAGE:-

- The cylinder wear is measured with the help of dial bore gauge.
- The dial indicator is a gauge that uses a dial face and a needle to register measurements. It has a movable plunger or contact arm.

- As the plunger or arm is moved the needle rotates on the dial face to indicates the distance in thousands of an inch (or in hundredths of a millimeter) the dial indicator can be used to measure rend play in shafts or gears.
- Also it can be used to measure taper in engine cyli8nders. When the dial indicator is moved up and down in the cylinder, movement of the needle will show the amount of taper.
- The dial indicator and an out side micrometer can be used to measure the diameter or bore of the cylinder. First, the position of the needle is noted when the dial indicator is in the cylinder .The dial is set to zero and the reading is measured with the mike.

2 Describe the compression & vacuum test of engine.

* COMPRESION TEST

- The cylinder compression tester measures the ability of the cylinders to hold compression. Pressure, operating on a diaphragm in the tester, causes the needle on the face of the tester to move around to indicate the pressure being applied.
- To use the tester, first remove all the spark plugs. A recommended way to do this is to disconnect the wires and loosen the plugs one turn. Next, reconnect the wires and start the engine . Then , run the engine for a few seconds at 1000 rpm.
- The combustion gases will blow out of the plug well any dirt that could fall into the cylinder when the spark plug are removed.
- The gases will also blow out of the combustion chamber any loosened carbon that is caked around the exposed threaded end of the plug .
- This procedure prevents carbon and dirt particles from lodging under a valve and holding it open during the compression test.
- After removing the plugs , block the throttle valve wide open. this is to make sure the maximum amount of air will get into the cylinders.
- Next, Screw the compression – tester adapter into the spark plug hole of no. 1 cylinder. To protect the coil from high voltage , disconnect the primary lead from the negat5ive terminal of the coil.(This is the lead that goes to the distributor) On electronic ignition systems, disconnect the positive lead to the control unit . Then hold the throttle wide open and operate the starting motor to crank the engine through four compression strokes 9eight crankshaft revolution) The needle will move around to indicate the maximum compression pressure in the cylinder.
- Test the other cylinder the same way. The lowest compression reading should be more that 75 percent of the highest.

* VACUUME TEST.

- The engine vacuum gauge is a tester for locating troubles in an engine that does not run as well as it should .This gauge measures intake manifold vacuum. The intake manifold vacuum changes with the load on the engine, the position of the throttle valve, and different engine defects. The way the intake manifold vacuum varies from normal indicates what is wrong inside the engine.
- A steady and fairly high reading on idle indicates normal performance .
- A steady and low reading on idle indicates late ignition or valve timing , or possibly leakage around the pistons.
- A very low reading on idle indicates a leaky intake manifold or throttle body gasket or possible leakage around the throttle shaft. Air leakage onto the manifold reduces the vacuumed and engine power.
- Back and forth movement of the needle that increases with engine speed indicates weak valve springs.
- Gradual falling back of the needle toward zero with the engine idling indicated a clogged exhaust line.
- Regular dropping back of the needle indicates that valves are sticking only part of the time.
- Floating motion or slow back and forth movement of the needle indicates that the air fuel mixture is too rich.

3 What might happen if piston is taken out without removing the ridge ? Give procedure of removing ridge.

- When piston is taken out of the cylinder without removing the ridge then piston ring lands will be break and piston rings also may damaged.
- To remove the ring ridge , use a ring ridge remover. With the piston near BDC , stuff a cloth into the cylinder and install the ridge remover.
- There are several different kinds of ridge removers. Follow the instructions for the ridge remover you use.
- Adjust the cutter blades to take off just enough metal to remove the ridge. Cover the other cylinders to keep cuttings from getting onto them. Rotate the tool to cut the ridge away.
  - *Careful :
- Turn the ridge remover by hand, not with an impact wrench ! Do not remove too much metal. Do not undercut the top cylinder deeper than the material next to the ring ridge . Do not run the cutting tool above the cylinder. This would taper the edge.
- Remove the tool , take the cloth out , and wipe the cylinder clean. Repeat the procedure for the other cylinder.

4 How will You decide that the sharp irregular knock is the cause of "excessive crank shaft end play"? how crank shaft end play is checked ?

5 How piston ring end gap ring groove clearance are checked .

*inspect PISTON RING AND GAP

- Insert the piston ring into the cylinder.
- Using a piston, push the piston ring a little beyond the bottom of the ring travel.[150 mm from top surface of cylinder block]
- Using a feeler gauge, measure the end gap.
  - Standard piston ring end gap : - No 1 ring 0.30-0.57 mm
  - No. 2 ring 0.35-0.67mm Oil ring 0.35 – 0.67 mm
  - Maximum piston ring end gap :- No 1 ring 1.37 mm
  - No 2 ring 1.47 mm Oil ring 1.47 mm
- If the gap exceeds the specified maximum , replace the piston ring.
- If the gap exceed the specified maximum even with a new piston ring , replace the cylinder liner.

6 State the basis on which selection of oversize piston for a six cylinder diesel engine is done.

7 Give causes and their remedies for premature failure of main bearings and explain any one. (rapid wear also)

8 Explain the procedure of checking twist and bend of a given connecting rod.

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9 Explain the method of checking the distortion of the cylinder block and head.

10 Explain the profile of cylinder wear with the help of a neat sketch.

- The above figure shows how wear takes place in the cylinder.
- In this figure , the block line indicates wear.
- From the type of wear it can be decided either cylinder needs boring operation or honing operation.
- For this reason cylinder is measured for wear, taper or out of roundness.
- It is measured with dial gauge inside micrometer or telescope gauge.
- Cylinder bore gauge is used to measure wear at various position in the cylinder.

11 Describe the procedure of inspection of crank shaft.

12 When would you suggest for cylinder honing? Why cutting oil used during honing operation.

13 How will you remove “semi floating” type of gudgeon pin fastening device of piston & connecting rod.

14 How the cracks are are detected in the block and head.

15 What do you understand by "running in period” of the new engine of the vehicle? Explain in brief.

16 What measuring instrument should be used in a service station for following operations?

1. Cylinder bore wear.
2. Crank pin journal wear.
3. Valve tappet clearance.
4. Spark plug gap.
5. Pre. Stroke of F.I. Pump.

- * Cylinder bore wear :-
- Telescope gauge.
- Inside micrometer
- Dial bore gauge.
- *Valve tappet clearance :-
- Feeler gauge.
- *Crankpin journal wear.
- Micrometer
- * Cylinder head warp age :-
- Steel scale and feeler gauge.

17 What is the ill effect of uneven tightening of cylinder head bolts?

18 Why ring gap is provided and what is its magnitude?

(2) **<u>April\May 2006</u>**

19 Describe the procedure of taking a measurement with micrometers

20 What is the specification and how are they used in workshop?

- When the repairing work is carried out in the workshop at that time specifications provide right measurement. This specification under valve setting, ignition timing piston clearance, piston bore, stroke etc.These specifications are decided by Menufacturor Company and a service manual authorised workshop in which these specification are available.

** USE

- A proper & perfect cur service can be done by the use of manual which results in customer satisfaction.
- How much clearance should be kept to set the valve clearance, spark plug gap etc... Is given in manual and by the use of it one can easily set the valve clearance, spark plug gap etc...
- What amount of engine oil gear oil differential oil should be used is also mention in manual.
- Manual specififcation that till what limit should be brake pads & brake shoes can be used and it also be used while adjusting clutch pedal free travel.
- It is also useful while adjusting A/c Compressor belt tension.
- Thus, it makes the mechanics job easy.

21 Explain piston scoring and piston seizure with probable causes.

22 Explain these defects of crank shaft.

23 Explain the method of checking connecting rod alignment.

24 Write in brief :

1. Cylinder honing **2. Valve refacing**

* Cylinder Honing.

- Cylinder hone is an accurate tool which is to be used for correct tapered, out of round cylinders the fast easy way. And it is not have any setup time.
- This consists of graduated adjustment dial for fast and accurate base sizing.

25 State the use of :

1. Ring expands **2. Ring compressor**

3 .Ring groove cleaner **4 Cylinder deg lazing hones**

* Ring expanders:-

- This tool is to be used for installing or removing piston ring without damage of breakage, distortion or other damage.

26 Explain the method for measuring of wear of :

A. Cylinder wears. B. Crank pin and bearing journal

* Cylinder wear

- The cylinder wear is measured with the help of dial bore gauge.
- The dial indicator is a gauge that uses a dial face and a needle to register measurements. It has a movable plunger or contact arm.
- As the plunger or arm is moved the needle rotates on the dial face to indicates the distance in thousands of an inch (or in hundredths of a millimeter) the dial indicator can be used to measure rend play in shafts or gears.
- Also it can be used to measure taper in engine cyli8nders. When the dial indicator is moved up and down in the cylinder, movement of the needle will show the amount of taper.
- The dial indicator and an out side micrometer can be used to measure the diameter or bore of the cylinder. First, the position of the needle is noted when the dial indicator is in the cylinder .The dial is set to zero and the reading is measured with the mike.

27 Explain the operations performed during top over hauling of engine.

28 Explain hydraulic method for crack detection in cylinder head.

- Hydraulic test procedure:-
- First of all air tightening is done to the water jacket of the cylinder head with the help of rubber bush.
- As shown in fig., now connect the pressure gauge & pressure pump to the water jacket of the cylinder head.
- Now, apply pressure to the water stored in water jacket with the help of pressure pump.(50 phi)
- The pressure will the reduce if the crack exists in the cylinder head.
- Finally ,find the location of the crack by drying the cylinder head with the help of dryer machine.
- Crack location can be found by magnetic particle method or dye penetrate method.

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29 Write any four Cylinder truing operations.

30 Explain the compression test results for cylinder wear and piston ring wear.

- The engine manufacturer's specifications tell you what the compression pressure of the cylinders should be.
- If the results of the compression test show that compression is low, there is leakage past the piston rings, valves or cylinder head gasket. To correct the trouble , you must remove the cylinder head and inspect the engine parts.
- Before you do this , however , you can make one more test to pinpoint the trouble .squirt a small quantity of engine oil through the spark plug hole into the cylinder. Then retest the compression .If the pressure increases to a more normal rings. Adding the oil helps seal the rings temporarily so that they can hold the compression pressure pressure better .The trouble could also be caused by rings that are broken or stuck in the piston ring grooves.

- If adding oil does not increase the compression pressure, the leakage is probably past the valves . This could be caused b : -

- Broken valve springs.
- Incorrect valve adjustment.
- Sticking valves.
- Worn or burned valves
- Worn or burned valves seats.
- Worn camshaft lobes.
- Dished or worn valve lifters.

- If may also be that the cylinder head gasket is “blown”. This means the gasket has burned away so that compression pressure is leaking between the cylinder head and the cylinder block. Low compression between two adjacent cylinders is probably caused by the head gasket blowing between the cylinders.
- Whatever the cause – rings, pistons, cylinder walls, valve, or gasket – the cylinder head must be removed so that the trouble can be fixed. The exeception would be if the trouble is due to incorrect valve adjustment. Adjusting the valves does not require head removal.

31 How will you check the warp age of Cylinder head?

* Inspect of cylinder head for warp age.

- Using a precision straight edge and feeler gauge, measure the surface that come into contact with the cylinder block and manifolds for warp age.
- Maximum warp age :
  - Cylinder block side 0.05 mm
  - Manifold side 0.10 mm
- If the warp age is greater than the maximum, replace the cylinder head.

32 Explain the nature of wear and method of measurement of wear for the following points(Any ONE):

(I) Crank and bearing journals.

(ii) Cam and bushing.

iii) Piston and Piston rings.

33 Explain four causes for premature failure of main bearings.

34 Describe the constructional features of portable cylinder boring machine.

35 Explain the magnetic method for Crack detection in Cylinder head or block.

36 Explain the method of Checking, Connecting road bending and twisting.

37 How oil detector is used for checking bearing clearance of main journals and crank pin journals.

(2), (8) **<u>April\may 2005</u>**

38 Explain

(I) Telescopic gauge, (ii) Torque gauge.

39 What is permissible wear? Explain Oversize for piston and under size for crank bearings.

40 Explain the procedure for wear measurement for cylinder bore.

41 Write short note on "cylinder boring"

42 Write short not on "cylinder honing"

43 Explain why and how the "ridge" is formed in cylinder bore?

44 Explain the procedure for the piston ring removing and fitting.

- Removing : -
  - (a) Using a piston ring expander remove the piston rings.
  - (b) Remove oil expander coil by hand.
  - (c) Arrange the rings in correct order.
- Refitting : -
  - (a) Check the piston ring end gap by feeler gauge.
  - (b) Clean the ring groove properly before installing ring.
  - (c) Apply lubricating oil at ring groove & piston before installing rings.
  - (d) Installing oil expander coil by hand.

- (e) Using a piston ring expander, installing the piston rings with the code marks facing upward.
  - CAUTION:-Face the end gap of the oil expander ring in the opposite direction of the coil joint.
- (f) Position the piston rings so that the ring end gaps should be about 120*
  - CAUTION:-Do not align the gaps.

Note: - Be careful that the piston ring does not break when installing piston ring by rings expander.

(3), (1), (5), (6), (7) **October\November 2004**

45 How cast iron cylinder block is tested for distortion.

46 Give causes and remedies for burning of piston crown.

- Operating temp too high.
- Taking operation of piston because of misfiring & knocking.
- Improper (high) efficiency of compression.
- Bad or low joviality material used for piston.
- Detonation.
- Manufacturing defects.
- Improper adjustment of valve.

47 Describe the compressors test and give your findings for different test results.

48 How will you check the distorted connecting rod? Give its ill effects on engine.

* Checking.

- To accurately check rod alignment out of the engine, you need a special alignment fixture. This fixture has an arbor and a faceplate. With the rod in the arbor and the piston pin in the rod, a V block is placed on the pin and the rod is moved back and forth across the face plate. This shows any misalignment.
- If the rod id out of line, check the crankpin for taper. A tapered crankpin can cause the rod to bend. Bent rods should be replaced. They cannot be satisfactorily straightened.
-

*ill effects on engine.

- Combustion leak
- power loss
- Blow-by unborn gases.
- As a result deterioration of lubricating oil.
- Troubles like piston seizure and piston slap takes place.
- Failure of bearing.
- Circle failure.

- Noisy operation of engine.

49 Describe the procedure of removing and refitting of cylinder liners.

(2), (16), (21), (11), (48), (41), (42) **March\April 2004**

50 Explain the causes of rapid wear of piston ring.

51 Explain the distortion of crank -shaft bearing.

(46), (23) (35), (31) **May\June 2003**

52 Explain any two

(I) Use of torque wrench (ii) Use of cylinder bore gauge

(iii) Utility of micrometer.

53 State what is specification and how it is useful in the engine shop.

54 State two causes and remedies for crank shaft wear.

55 Write down four safety points to be observed while working in the engine shop.

- While working in engine shop you should have to may full attention on every job you do or else serious injuries may occurs , Thus should be taken : -
- While working with the use of moving machinery or electrical equipments at that time he alert that there should not be any rings, brackets or watches eared on your hand because the car battery may get shot by brackets which can result in producing serious burn.
- There should not be grease oil or any kind of liquid lying on the floor, because a person working may get slip results in serious injuries.
- While working with the use of grinding wheels at that time eye protection equipments like safety goggles and face shield must be used.
- Be sure that the jack is located at the correct position under the car because the jack gets slip than the person working under car will suffer from serious injuries.

56 State two precautions to be taken while assembling the petrol engine.

57 State the use of ... (I) feeder gauge (ii) valve spring compressor.

(49) **October\November 2000**

58 Explain various defects in cylinder block

59 Describe the procedure of reburying the cylinder

60 Explain the causes for damages cylinder head gasket

61 State the reasons for development of cracks on piston crown.

62 Describe the procedure for replacement of big end bearing.

(10) (28) (34) (21) (7) **April\may 2000**

63 Explain the causes for wear in big end bearing.

- Bearing failure due to lack of oil.
- Fatigue failure of bearing.
- Bearing scratched by dirt in the oil.
- Bearing failure due to tapered journal.
- Bearing failure from radius ride.
- Bearing failure from improper seating.
- Berating failure from ridging.

64 Explain the defects likely to occur in camshaft.

- The habit or bronze bearings in the cylinder block on which the camshaft turns will wear because of poor lubrication & dirt.
- Camshaft journals damage due to poor lubrication & dirt.
- Rough cam.
- Wear of cam.
- Misalignment of the camshaft.
- Improper clearance between camshaft & bearing.

(Note: - Clearance should be between 0.0185 mm to 0.0875mm)

- Improper camshaft end play

(Note: - It should be between 0.050mm to 0.200mm)

65 Explain the reasons for breaking of crankshaft.

(2) (34) (35) (33, 16, 26) (31) (8) (37) **October\November 1999**

66 Explain how would you check side clearance and end clearance while fitting new piston rings.

- ** SIDE CLEARANCE : -
- Install the new rings in the ring grooves, using a piston – ring expander and check whether the rings are check moving freely or not.
- If not moving freely than remove the darts and carbons or other foreign particles from the grooves by scraping method.
- The piston rings are moving freely in the grooves then measure the side clearance with the help of feeler gauge.
- The clearance should be at least 0:001 inch (0.025mm) and not more than 0.004 inch (0.01 mm)
- Check the shop manual for the specifications on the engine you are servicing.

- **END CLEARANCE :-

October\November 2000

67 Explain (me) utility of dial bore gauge. (ii) use of feeler gauge.

Topic 2

Valve

(1) Explain how will you check

- Valve steam straightness
- Valve spring tension

ANS: Remaining

(2) What is the remedies of ridge surface on flywheel & how the flywheel ring is renewed.

ANS: remaining

(3) State the effect of excessive backlash of timing gears.

- Humming sound arise from the timing gear.
- Wear of timing gear.
- Improper working of engine takes place because of excessive backlash.
- The gear doesn't mesh properly because of increased contact area.
- Valve will not open and close at proper timing. Thus valve stucks.
- As a result engine backfires.

(4) Give causes and remedies of burnt valve.

CAUSES	REMEDIES
1. High temperature & high pressure gas leakage due to improper valve seating.	1. Reset the valve
2. Distorted valve seat.	2. Replace the valve.
3. Excessive carbon & varnish deposition.	3. Clean it.
4. Engine overheating	4.Check cooling system.
5.Lean air-fuel mixture.	5. Adjust as prescribed.

(5) Explain the procedure for removing the valves from cylinder head of side valve type of arrangement.

ANS: REMAING

(6) Explain the effect of

- **Weak valve spring**
- **Bend valve stem on running the engine**

(7) Explain the procedure of tappet setting of multycylinder engine

Note:- Inspect and adjust the valve clearance after engine has reached normal operating temperature.

- Remove cylinder head cover.
- Set NO.1 cylinder to TDC/compression:

  Set NO.1 cylinder to TDC/compression.

  Allignthe groove on the pulleywith the timing pointer by turning th crankshaft clockwise with a wrench.

  Check that the rocker arms on the NO.1 cylinder are loose & rocker arms on the NO.4 cylinder are tight .If not, turn the crankshaft one revolution(360 deg) & allign the mark as above .

- Inspect & adjust valve clearance

  Measure only those valves indicated by arrows.Valve clearance (HOT): Intake 0.20 Exhaust 0.36

  (1) Using a feelergauge,measure the valve clearance between valve stem and rocker arm. Loosen the locknut and turn the adjusting screw to set the proper clearance.
  (2) Hold the adjusting screw in position and tighten the locknut.
  (3) Recheck the valve clearance . The feeler gauge should slide with a very slight drag.

a) Turn the crankshaft one revolution (360 deg) & allign the tming marks as above. Adjust only the valves indicated by arrows.

(8) Explain in short the symptoms of indication for decarbonizing job. Give all symptoms.

- Loss of power in the engine.
- Poor pick-up
- Smoky exhaust of the engine.
- Increased fuel consumption.
- Overheating of engine.
- Deterioration of oil or consequently changing of oil before the time.
- Engine lacks power and accelaration.
- Erretic running.

(9) Explain the effect of too large or too small valve clearance on engine performance.

Ans : remaining

(10) What is the effect of chocked silencer on engine performance ? Write procedure of cleaning the chocked silencer.

- **ILL-EFFECTS**
- If the silencer is chocked then it will not let the exhaust gas to flow outwards & as a result the engine will stop running.
- If the engine runs with chocked silencer then it will make the irregular noise.
- Engine may gets overheated.
- The silencer will torn-out.
- Exhaust gas may leak in the intake manifold.

- **CLEANING PROCEDURE**
- The silencer should be checked at regular interval of time.
- Because silencer may be chocked after its prolonged use.
- Thus, silencer can be cleaned with the help of rough wire.
- And if cleaning with rough wire is not possible then cut-off the silencer & clean it and join it by welding procedure.

(11) How & why the fly wheel ring is changed?

Ans : remaining

(12) Explain procedure for valve guide changing & valve seat cutting.

Ans: remaining

(13) Explain the effects on engine performance if valves are not properly set.

Ans: remaining

(14) Explain the defects that are likely to occur in flywheel.

Ans : remaining

(15) What is valve pocketing? How does it affect the engine? How will you remove it?

Ans: remaining

(16) Explain the ill effects of chocked silencer on engine performance.

Ans : Refer Q. 10

(17) Explain the procedure of testing the valve spring.

Ans : remaining

(18) Explain the procedure of tappet setting for 3 cylinder engine.

Ans : Refer Q.7

(19) State causes & remedies for valve sticking.

CAUSES	REMEDIES
1. Gum or carbon deposition on the valve stem.	1. clean it.
2. Excessive valve stem clearance (worn valve guides) causes carbon deposition on the valve &stem.	2. Adjust the clearance.
3. Warped valve stem.	3. Replace valve.
4. An eccentric seat may result in warped valve stems by throwing side force on the valve.	4. Replace valve.
A cocked spring or retainer which tends to bend the valve stem can result in valve sticking.	5. Replace.
6. Insufficient oil.	6. Add oil.

(20) What is meant by burnt valve? Give its causes and remedies.

Valve burning may takes place due to any condition that prevents normal exhaust valve seating. Poor seating speeds up valve heating. If water circulation around the valve seat is clogged, it will cause overheating of valves. Engine overheating or overloading will also heat the valve.

FOR CAUSES & REMEDIES REFER Q.4

(21) State the procedure of testing valve spring.

Ans : remaining

(22) Explain the procedure of correcting the pocueted valve seat.

Ans :remaining

TOPIC 3

Fuel supply system

May\june 2007

1 Explain the reasons for low fuel pump pressure and insufficient fuel supply.

** This could result from low pump presure, which in turn could be due to any of the following .

- Broken, worn – out or cracked diaphragm
- Improperly operating fuel – pump vavles.
- Broken or damaged rocker arm.
- Clogged pump – filter screen or filter.
- Leakage of air into sediment bowl because of loose bowl or worn gasket.

- These are all causes of insufficient fuel delivery due to condition within the pump . In addition , ther are conditions outside the pump that could prevent delivery of normal amounts of fuel . These Include such things as a clogged fuel tank cap vent, clogged fuel line or filter , air leaks into the fuel line , and vapour lock.In the carburator , an incorrect float level , a clogged inlet screen , or a malfunctioning inlet needle valve would prevent delivery of adequate amounts of fuel to the float bowl.

2 How the float level is adjusted in a carburettor .

- Inatall the float and pivot.
- Allow the float to hang down by its own weight
- Using SSTs check the clearance between the float tip and air horn .

Note : -This measurement should be made without a gasket on the air horn.

- Float level : 7.2 mm

- If not within specification , adjust by bending the portion of the float lip.

- Lift up the float and , using SST, check the clearance between the needle valve plunger and the float lip.
  - Float level (Lowered position) : 1.67 -1.99 mm
  - If not within specification , adjust by bending the portion of the float lip.
- After adujusting the float level , remove the float , plunger , spring and needle valve.
- Assemble the pin clip onto the needle valve.

3 Explaine the effect of clogged air filter on the performance of engine.

- Improper air fuel ratio in the cylinder
- Improper combustion of air fuel mixture in combustion chamber due to improper air fuel ratio.
- Because of improper air fuel ratio poor engine performance takes place.
- The rich mixture continues to deliver even after starting (i.e. Over rich mixture)
- Excessive fuel consumption of the engine results.

4 Explain the procedure for idling setting on solex carburettor for Fiat engine (Four cylinder, four stroke & six cyl. four stroke).

(4) **November 2006**

5 Describe the procedure of testing the mechanical fuel pump.

6 Give air fuel ratio by weight for the following operating conditions.

(i) starting **(ii) Idling**

(iii) Maximum power **(iv) Economy.**

- Fuel ratio are as below :-

(i) starting ==> 9 : 1

(ii) Idling ==>12: 1

(iii) Maximum power ==>13: 1

(iv) Economy. ==>15: 1

7 Describe the procedure of oil bath type of air cleaner service.

- after removing the filter element , clean it by sloshing it up an down in clean solvant. dry it with compressed air.Dump the dirty oil from the cleaner body, wash the body with solvent , and dry it .Refill the body to the full mark with SAE 10w-30 engine oil .Reinstall the filter element and air cleaner body on the carburator .
- Air filters that are not installed directly on the carburator must have airtightconnections through flexible hose.The hose must have no tears or punctures that could leak unfiltered air into the carburator.

April\May 2006

8 Explain the method of adjusting the carburettors for correct mixture strength under slow running conditions.

9 What happens if the oil level in the air cleaner is higher ?

- If the oil level in the air cleaner iks higher then it also will go directly to intake carburator manifold with the air.
- If the oil will go to carburator then fuel quality will be affected.
- There will be combination of fuel & oil in combustion chamber.
- Rich mixture will not be available to the engine.
- As a result troubles like carburatior choke up may occurs.
- Mixing oil & fuel results in black smoke.o

10 How the leakage in the valve of mechanical fuel pump is detected?

October\November 2005

11 Write causes and remedies for the carburetor complaint of "difficult starting"

12 Explain the effect of clogged oil bath type of air cleaner as engine performance.

13 Explain the reasons for irregular functioning of

(i) chocke **(ii) throttle**

(iii) accelerating pump **(iv) Float chamber.**

14 Expalin in brief the servicing of mechanical fuel pump.

April may 2005

15 Explain servicing and setting of carburettor.

Ans is 19

16 Explain causes and remedies for

(i) Over flooding in carburettor

(ii) No fuel delivery from feel pump.

17 Explain causes and remedies for

(i) High fuel consumption.

(ii) Starting troubles with engine.

(6) (4) (17) **October\November 2004**

18 Describe the procedure of servicing the wet type of air cleaner.

(17) **March\april 2004**

19 Explain the procedure of servicing of carburettor

- **take a copy from ac 248 to 258**

20 State the defects occure in a mechanical fuel pump.

** When suficient delivery results then defects may be ...

- Broken , worn – out or cracked diaphragm
- Improperly operating fuel pump valves.
- Broken or damaged rocker arm.
- clogged pump – filter screen or filter .
- Leakage of air into sediment boul or worn gasket.
- ** When fuel pump leaks then defects may be : -
- Damaged diapragm.
- **When fuel pump make noises then :-
- Weak or broken rocker arm spring.
- Worn or broken rocker arm pin or rocker arm
- Broken diaphragm spring.

(4) (17) **May\june 2003**

21 Explain

(i) Engine hunting & (ii) Popping back in the carburettor

(19) (16) (14) (13) **October November 2000.**

(14) (4) **April may 2000**

22 (i) What happens if oil level in air cleaner is higher ?

(ii) If the spark plug colour is white , what is the defect with Carburettor

(9) **October November 1999**

23 State two reasons for each.

(i) Float chamber flooding (ii) Low fuel pump pressure.

24 How the float level is adjusted in a solex carburetor?

(18) (17) (4) **June July 2008**

Topic 4

FUEL INJECTION SYSTEM

(Q.1) Describe the procedure of calibration of fuel injection pump.

OR

Describe calibration and phasing.

OR

Explain the calibration of in-line plunger type F-I. pump.

Phasing & Calibration:-

The essential functions of the injection pump when fitted to the engine are to ensure that an accurately metered quantity of fuel shall be injected into each cylinder and at exact point in the stroke at which the engine requires it. The latter point is the first for which adjustment is made, and this of course, will affect the timing of the pump to the engine.

It is essential, therefore, during adjustment of pump, to ensure that the subsequent pumping elements commence to inject at exactly the correct interval in the camshaft degree after No.1 element. Assuming that the injection sequence of a 6-cylinder pump is 1, 5, 3, 6, 2, 4, then No.5 element must commence injection 60 degree after No.1 pump and No.3 at the same interval after No.5 and so on. The interval on all types of pump is 360 degree camshaft angel divided by the No of elements in the pump. This adjustment for correct timing interval is known as “phasing” or adjusting the phase angle of the pump.

Point of port closure:-

It is next necessary to determine the point to which the adjustment has to be made. This is generally referred to as “the point of port closure” which occurs shortly after commencement of plunger stroke, when the rising plunger closes the port through which the fuel has entered the element barrel. The actual commencement of injection occurs after this point of port closure, the interval depending mainly upon the plunger diameter, cam profile, pipe length and the starting of the injector spring.

Finally, adjustment is made for the balance of fuel output, or in other words, the pump is calibrated.

Calibrating the injection pump:-

This carried out by slackening the screw which clamps the quadrant to the sleeve, and moving the sleeve with plunger into the required position. This adjustment is accurately carried out at factory when pump is new, and a line is scribed across the quadrant and sleeve to indicate the correct setting. Wear on the elements etc., may necessitate some slight alteration to this setting after several hundred of hours of running, but in no circumstances should the setting deviate more than a few millimeters from the original adjustment. It is consequently advisable before testing to see that these calibration markings are lined up as this will certainly reduce the amount of adjustment to be made.

(Q.2) Write the procedure of setting injection timing for 6 cylinder engine

ANS. REMAINING

(Q.3) **Explain ill-effects of dribbling of injectors**

Ill-Effects:-

- High fuel consumption.
- Excessive wear to piston and combustion chamber.
- Abnormal detonation.
- Back fire.
- Valve burning.
- Engine continues to run after ignition switch is turned off for few seconds.

(Q.4) what is Bleeding of injection system?

OR

How did you remove air from F.I. pump unit?

FIGURE:-

The fuel injection system works correctly only when there is no air bubble in pipe lines. To remove air bubble from pipe line, filters and injection pump is called bleeding. To remove air bubble, there is bleeder screw or air vent screw on the filter and the pump in the fuel gallery. Bleeding is done by opening the bleeder screws**.(Note:-** Whenever the filter or pipe is replaced, bleeding should be done**.)**

(Q.5) How do you set the proper phase angle in a 6 cylinder F.I. pump when one of its reading is 58 degree.

ANS. REMAINING

(Q.6) Explain the method of setting injection pump timing.

ANS. REMAINING

(Q.7) How did you remove air from F.I. pump unit?

ANS. REFER TO Q.4

(Q.8) Explain the terms :-

(a) DRIBBLING

The delivery valves on the injection pump helps to ensure that the injectors will close quickly at the end of each injection. The injectors must close quickly in order to prevent fuel **"Dribble"** which can cause pre-ignition during the next combustion cycle.

(b) CALIBRATION

ANS. REFER TO Q.1

(c) PHASING

ANS. REFER TO Q.1

(Q.9) Explain the testing procedure for fuel injector on test ring.

- **Test oil:-**

  Fill the fuel tank by pouring through the filler cap approximately one liter of calibrating special oil.

- **Air vent:-**

Before operating the outfit, air vent the system by removing air vent screw to allow oil to flow freely for a few seconds. Replace screw while oil is still flowing and operate pump several times until oil flows from pipe.

- Connect complete injector to be tested to the outfit by means of pressure piping. The length and bore of this piping are important and if a new piece is fitted this should be 75 mm approx., between the union nuts, of 2 mm bore.
- Examine the lapped pressure faces of nozzle holder and nozzle when assembling, to ensure that they are perfectly clean, otherwise leakages may occur.
- Close check valve to keep the pressure gauge out of circuit and smartly operate hand lever several times in order to expel all air from the system.
- **Pressure setting:-**

Refer to method-2 of Q.10

- **Seat tightness:-**

Wipe nozzle tip dry and with check valve open, build up the pressure to 20 kg/ (cm*cm) below the opening pressure.

- **Spray form:-**

With check valve closed, operate the hand lever smartly at a speed of 90-100 strokes per minute

- **Pressure gauge:-**

Before removing the nozzle holder from the outfit, close the check valve to prevent damage to the pressure gauge which may result from a sudden drop of pressure

(Q.10) Explain the calibration of an in line plunger type F.I. pump.

ANS .REFER TO Q.1

(Q.11) Explain the procedure of changing fuel filter used in diesel engine.

ANS. REMAINING

(Q.12) How will you set the phase angle for 4 cylinder engine's F.I. pump when one of its reading is 3 degree more than the requirement?

ANS. REMAINING

(Q.13) Explain how will you find out that the injector nozzle required replacement.

ANS. REMAINING

(Q.14) Give four causes & remedies of rough idling of diesel engine.

ANS. REMAINING

(Q.15) Draw the complete diesel fuel system diagram from start to end.

ANS. REMAINING

(Q.16) Explain in brief 4 test of diesel injector.

Pressure test:-

- **Method-1.**
    - Clamp the injector on the tests and operate the tester pump.
    - Note the reading of the dial indicator at which the injector nozzle starts spraying.
    - It gives pressure reading.
    - It should be the same s recommended by the company.
    - If it is less, then tighten the adjusting screw of the injector.
    - If it is more, then loosen the adjusting screw.
    - Repeat the process until the correct pressure reading is obtained.
    - Finally, tighten the lock nut.
- **Method-2.**
    - To set the pressure at which the nozzle should open, slowly move the hand lever downwards and carefully, watch the pressure gauge for the highest recorded pressure before the needle “flicks”, indicating opening of the valve.
    - Any necessary adjustment is effected by loosening lock nut and moving adjusting screw inwards to increase pressure, or outwards to decrease pressure, on the spring, or by changing the total thickness of shims.

Leak-off test:-

Clamp the injector on the tester and build up the pressure about 150 kg/ (cm*cm) by operating the tester pump. Keep this pressure for about 10 seconds. If the pressure drops, it shows that there is leakage in the injector. Check the nozzle seat and nozzle valve needle and nozzle body. Correct the seat and needle by grinding and lapping and after that again do the leak-off test.

Spray test :-

Spray test is also done on the same injector testing machine. While operating the tester pump, see carefully the spray. It should not be like a current of oil, or with drops splitting away, but it should be fully atomized.

(Q.17) Explain the working of anti dribbling device given in delivery valve with line diagram.

- The delivery valves on the injection pump helps to ensure that the injectors will close quickly at the end of each injection. The injectors must close quickly in order to prevent fuel **"Dribble".**
- When the pump plunger completes pumping the fuel for that cycle the pressure drops, causing the delivery valve to be pushed down by the spring.
- The relief valve therefore, closes off the fuel passage, then continues moving downward until the valve face is pressed lightly against the valve seat.
- Fuel trapped below the relief valve is drawn back into the delivery valve from the time the relief valve closes off the fuel passage until the end of the operating stroke.
- This ensures a sudden drop in pressure (caused by the expansion of the chamber above the delivery valve) and allows the injection nozzle to snap shut, thus eliminating the fuel **"Dribble"**.

(Q.18) Ex-plain in brief the pre-stroke.

ANS. REMAINING

(Q.19) Explain the fuel "Injection Timing".

Fuel from the injection pump must be injected at a particular crankshaft angle before T.D.C. of the compression stroke of piston. When injection timing for No. 1 cylinder of the engine is set 14 degree before T.D.C., for eg., the injection pump is adjust correctly if the plunger in the No. 1 pump element rises and closes off the feed hole of the cylinder at that angle for the start of injection.

The fuel pumping start timing of No. 1 plunger varies depending upon the pre-stroke of the plunger.

(Q.20) Explain the procedure for servicing & setting of injectors

ANS. REFER TO Q.9& Q.16

(Q.21) Give causes & remedies

(A) black smoke from engine

(a) Choke in operation.

(b) Clogged air filter.

(c) Worn out or wrong size jets.

(d) Worn out, stuck or broken piston rings.

(e) Worn out injection plunger.

(B) injectors dribbling

REMAINING

(Q.22) Explain the effects on running the engine if ,

(A) governor is not working properly

REMAINING

(B) delivery valve is leaking

REMAINING

(Q.23) What does a split-cut- off indicate? Give complete procedure of checking spilt-cut-off.

- Every F.I. pump has limited R.P.M. proportional to engine R.P.M. and it rotates ½ the speed of engine R.P.M.
- Suppose the limit is 1000 R.P.M. of F.I. pump than it will provide fuel to engine till engine rotates 2000 R.P.M., at high speed i.e.,< 2000 R.P.M. F.I. pump will not supply fuel. This blocking of delivery of fuel is called **"split-cut-off".**

(Note:- This is adjusted when F.I. pump is send to servicing to calibrate the F.I. pump.**)**

PROCEDURE:- Remaining

(Q.24) Give causes & remedies for noise from one or more cylinder of a diesel engine.

ANS. REMAINING

(Q.25) Explain the procedure of changing fuel filter used in diesel engine.

ANS. REMAINING

(Q.26) What are the effects of defective injection timing on an engine.

ANS. REMAINING

(Q.27) How did you remove air from F.I. pump unit?

ANS. REFER TO Q.4

(Q.28) State 2 causes & remedies of high injector pressure in a diesel engine.

OR

Nozzle opening pressure too high:-

CAUSES	**REMEDIES**
1. Compression screw shifted.	Adjust for prescribed pressure.
2. Needle valve seized up, corroded.	Replace nozzle and needle valve.
3. Needle valve seized up, dirty, sticky.	Clean nozzle.
4. Nozzle openings clogged with dirt or carbon.	Clean nozzle.

(Q.29) Explain dribbling & How can we eliminate the fuel to dribble.

The delivery valves on the injection pump helps to ensure that the injectors will close quickly at the end of each injection. The injectors must close quickly in order to prevent fuel **"Dribble"** which can cause pre-ignition during the next combustion cycle.

Eliminating the fuel to dribble:-

- The delivery valves on the injection pump helps to ensure that the injectors will close quickly at the end of each injection. The injectors must close quickly in order to prevent fuel **"Dribble".**

- When the pump plunger completes pumping the fuel for that cycle the pressure drops, causing the delivery valve to be pushed down by the spring.
- The relief valve therefore, closes off the fuel passage, then continues moving downward until the valve face is pressed lightly against the valve seat.
- Fuel trapped below the relief valve is drawn back into the delivery valve from the time the relief valve closes off the fuel passage until the end of the operating stroke.

This ensures a sudden drop in pressure (caused by the expansion of the chamber above the delivery valve) and allows the injection nozzle to snap shut, thus eliminating the fuel **"Dribble**

(Q.30) Explain the method of setting injection pump timing of 4 cylinder F.I. pump.

ANS. REMAINING

(Q.31) Describe different test carried out for serviceability of injectors.

OR

Explain how leak-off test is performed on injectors.

- **Pressure test:-**

Refer to method-1 of Q.16

- **Leak-off test:-**

Clamp the injector on the tester and build up the pressure about 150 kg/ (cm*cm) by operating the tester pump. Keep this pressure for about 10 seconds. If the pressure drops, it shows that there is leakage in the injector. Check the nozzle seat and nozzle valve needle and nozzle body. Correct the seat and needle by grinding and lapping and after that again do the leak-off test.

- **Spray test :-**

Spray test is also done on the same injector testing machine. While operating the tester pump, see carefully the spray. It should not be like a current of oil, or with drops splitting away, but it should be fully atomized.

(Q.32) Explain in brief about the maintenance of fuel injection system.

ANS. REMAINING

(Q.33) State the reasons for smoky exhaust from diesel engine.

- **If blue smoke is coming out from the silencer, then possible causes are:-**
    - Excessive diesel mixture ratio.
    - Excessive oil in clutch chamber.
    - Crank case oil seals worn out or damaged.
    - Worn out, stuck or broken piston rings.
    - Worn out cylinder bore.
- **If black smoke is coming out from the silencer, then possible causes are:-**
    - Choke in operation.
    - Clogged air filter.
    - Worn out or wrong size jets.
    - Worn out, stuck or broken piston rings.
    - Worn out injection plunger.

(Q.34) (A) How the injected quantity of fuel is increased in F.I. pump with Right Hand helix plunger?

ANS. REMAINING

(B) How do you remove air from F.I. pump.

ANS. REFER TO Q.4

(Q.35) (A) what is pre structure for F.I. pump.

ANS. REMAINING

(B) How the injected quantity of fuel is increased in F.I. pump with Left hand helix plunger?

ANS. REMAINING

Extra

(Q.36) Explain the effects of worn-out injection pump plungers on performance of diesel engine?

- Clearance more, thus resulting in decreased pressure.
- Insufficient pressure, resulting in less power.
- Fuel drip-off.
- Insufficient fuel delivery.
- Engine cannot reach its maximum speed.
- Engine overheating.
- Black smoke.

(Q.37) State the causes of engine hunting of a diesel engine.

- This is the name for a periodic variation in the speed of a governed engine due to inertia, lagh or friction in the mechanism.

CAUSES:-

- Injection control rod not moving freely. The inspection cover must fit properly to prevent dirt getting into the injection pump.
- Worn governor control linkage.
- Idling damper not functioning.

(Q.38) Explain dribbling.

OR

Explain ill-effects of dribbling of injectors.

OR

Eliminating the fuel to dribble.

The delivery valves on the injection pump helps to ensure that the injectors will close quickly at the end of each injection. The injectors must close quickly in order to prevent fuel **"Dribble"** which can cause pre-ignition during the next combustion cycle.

Ill-Effects:-

- High fuel consumption.
- Excessive wear to piston and combustion chamber.
- Abnormal detonation.
- Back fire.
- Valve burning.
- Engine continues to run after ignition switch is turned off for few seconds.

Eliminating the fuel to dribble:-

- The delivery valves on the injection pump helps to ensure that the injectors will close quickly at the end of each injection. The injectors must close quickly in order to prevent fuel **"Dribble".**
- When the pump plunger completes pumping the fuel for that cycle the pressure drops, causing the delivery valve to be pushed down by the spring.
- The relief valve therefore, closes off the fuel passage, then continues moving downward until the valve face is pressed lightly against the valve seat.
- Fuel trapped below the relief valve is drawn back into the delivery valve from the time the relief valve closes off the fuel passage until the end of the operating stroke.
- This ensures a sudden drop in pressure (caused by the expansion of the chamber above the delivery valve) and allows the injection nozzle to snap shut, thus eliminating the fuel **"Dribble"**.

(Q.39) State the possible causes and remedies for:-

- **Nozzle drips on delivery:-**

CAUSES	**REMEDIES**
1. Nozzle leak due to carbon deposit.	Clean nozzle.
2. Sticking needle valve.	Replace needle valve

- **Nozzle opening pressure too high:-**

CAUSES	REMEDIES
1. Compression screw shifted.	Adjust for prescribed pressure.
2. Needle valve seized up, corroded.	Replace nozzle and needle valve.
3. Needle valve seized up, dirty, sticky.	Clean nozzle.
4. Nozzle openings clogged with dirt or carbon.	Clean nozzle.

(Q.40) Explain two methods of setting "injection pressure".

- **Method-1.**
    - Clamp the injector on the tests and operate the tester pump.
    - Note the reading of the dial indicator at which the injector nozzle starts spraying.
    - It gives pressure reading.
    - It should be the same s recommended by the company.
    - If it is less, then tighten the adjusting screw of the injector.
    - If it is more, then loosen the adjusting screw.
    - Repeat the process until the correct pressure reading is obtained.

- Finally, tighten the lock nut.

➢ **Method-2.**

- To set the pressure at which the nozzle should open, slowly move the hand lever downwards and carefully, watch the pressure gauge for the highest recorded pressure before the needle “flicks”, indicating opening of the valve.
- Any necessary adjustment is effected by loosening lock nut and moving adjusting screw inwards to increase pressure, or outwards to decrease pressure, on the spring, or by changing the total thickness of shims.

(Q.41) State four probable causes of racing of diesel engine.

- Maximum speed stop on venturi set too far open.
- Air leak into vacuum system.
- Air leak in induction system.
- Diaphragm spring too strong.
- Idling damper screwed in too far.
- Control rod sticking in maximum fuel position.

Topic 5

Cooling system

(Q.1) Explain service procedure of water pump.

➢ **Removal:-**

- Drain the cooling system.
- Remove the radiator.
- Loose the generator adjusting arm bolt and two generator pivot bolts and relax the tension on the belt.

- Remove the four water pump attaching the bolts and remove the water pump and gasket.

➢ **Inspection and Repair:-**

- Check the impeller of worn or damaged vanes and check the seal seat on the rear face of the impeller to be sure it is in good condition. Install if the seat or vanes are damaged**.**
- Check the individual parts of the bearing, shaft and slinger assembly for nicks, scores, or other damage and the slinger for correct position on the shaft. If the bearing and shaft are undamaged and the slinger is damaged or incorrectly positioned, remove it using care not to damage the shaft.
- Check both parts of pump housing for cracks, fractures or signs of leakage.
- If there are any defective parts, install new ones.

➢ **Installation:-**

- Position a new water pump gasket and place the water pump on to the front of the cylinder block and install the four attaching bolts. Tighten the bolts to the specified torque.
- Position the drive belt and adjust tension. Tighten the adjusting arm bolt and the two generator pivot bolts.
- Install the radiator.
- Fill the cooling system. Run the engine and check of leaks.

(Q.2) Explain the procedure of pressure test for cooling system to detect external and internal leakage.

➢ A cooling system that requires frequent addition of water or anti-freeze solution to maintain the proper level in the radiator should be thoroughly inspected for leaks.

➢ To pressure test the cooling system fill the radiator to one-half inch below the filler neck.

➢ Wipe the filler neck surface. Clean and install the pressure tester.

➢ Operate the pump on the tester until the pressure on the gauge reads 15 psi.

➢ A steady pressure gauge reading indicates that the cooling system is satisfactory.

➢ If the pressure on the gauge drops i.e., external leaks. Now examine the radiator core, engine block, water pump and hose connections for leaks.

- If no external leaks are found, then remove the tester from the radiator and run the engine until operating temperature is reached.
- Re-install the tester and apply a pressure of 7 psi on the cooling system.
- Increase engine speed to approximately half throttle.
- A fluctuating gauge needle generally indicates a leaking head gasket i.e., internal leaks.

(Q.3) Give ill effect of engine performance on the trouble ,thermostate valve stucked open or closed.

ANS. REMAINING

(Q.4) Explain the procedure of adjusting fan belt & give ill effect of too loose or too tight fan belt.

ANS. Procedure remaining.

ILL-EFFECTS

- If the belt tension is too high or too low then following effects will take place:-
  - Improper working of cooling system thus default cooling system.
  - Improper working of cam shaft thus improper valve timing and Valve timing.
  - Improper working of power steering unit.
  - Improper working of air compressor for A.C. driven cars.
  - Improper working of alternator.

(Q.5) Describe causes of improper circulation of coolant.

OR

List different types of troubles that arise in cooling system.

OR

Loss of coolant.

(1) External leakage:-

- Loose hose clips.
- Damaged radiator seams.
- Damaged gaskets.
- Loose core plugs.

(2) Internal leakage:-

- Defective cylinder head gasket.
- Cracked cylinder wall.
- Loose cylinder head bolt.

(3) Water loss:-

- External or internal leakage.
- Restricted radiator or inoperative thermostat.

(4) Poor circulation:-

- Insufficient coolant.
- Inoperative water pump.
- Loss of coolant.
- Inoperative thermostat.

(5) Corrosion:-

- Excessive impurity in water.
- Incorrect anti-freeze mixtures.

(6) Overcooling:-

- Defective thermostat.
- Inaccurate temperature gauge.

(7) Overheating:-

- Poor circulation due to any reason.
- Dirty oil and sludge in the engine.
- Radiator fins chocked.
- Incorrect ignition timing.
- Incorrect valve timing.
- Low oil level.
- Tight engine.
- Engine oil too thick.
- Clogged exhaust system.
- Dragging brakes.

(Q.6) Explain the procedure of testing the thermostat valve.

ANS. REMAINING

(Q.7) Explain in brief REVERSE FLUSHING of radiator & why it is done.

ANS. REMAINING

(Q.8) Radiator Servicing Procedure.

(A) Removal:-

- Drain the cooling system.
- Disconnect the air cleaner hose connection and the headlight and the horn wires, and remove the front sheet metal.
- Disconnect the radiator hose connection at the radiator and slide the clamps toward the middle of the hose.
- Remove the radiator shell attaching bolts and remove the shell having removed the air cleaner previously.
- Remove the attaching bolts and remove the radiator**.**

(B) Inspection and Repair:-

- Remove the fan shroud.
- Check upper tank for leaks.

- Check the fins for being bent or clogged.
- Check the lower tank for leaks.

(C) Installation:-

- To install the radiator, reverse the procedure outlined above, “Removal”.
- Fill the cooling system with coolant and add the proper amount of anti-freeze, depending upon weather conditions (where applicable).
- Run the engine for several minutes and check for radiator leaks.

(Q.9) Explain the method of inspection & repair of water pump of the cooling system.

ANS. REFER TO Q.1

(Q.10) Explain procedure of adjusting fan belt.

ANS. REMAINING

(Q.11) Explain routine maintanence of cooling system.

ANS. REMAINING

(Q.12) How do you check “Radiator pressure cap” for its functioning?

- On sealed cooling systems the radiator pressure cap must seat properly on the filler neck to prevent surge or spill losses and water evaporation.
- Pressure type radiator caps are tested with the same tester employed to pressure test cooling system.
- To test the radiator pressure cap install the adaptor and rubber seal on tester.
- Dip the radiator pressure cap in water and install on the adaptor.
- With the pump apply 12-15 psi to the cap.
- If the cap fails to hold pressure within this range then replace the cap.
- Radiator pressure caps in vehicles equipped with air conditioners should be tested at 15-16 psi.

(Q.13) Give causes and remedies of

(a) high oil consumption

(b) engine overheats

ANS. REFER TOPIC NO. 7 [Q.9 & Q.10]

(Q.14) Give causes and remedies of

(a)loss of coolant

(b)loss of lubricating oil

ANS. REFER TO Q.5

(Q.15) Give effect on engine running of

(a) high blow by

(b) engine vibrates

ANS. REMAINING

(Q.16) Explain the procedure of flushing the radiator & cylinder block.

ANS. REMAINING

(Q.17) Explain the procedure of fitting the repair kit of water pump.

ANS. REFER TO Q.1

(Q.18) Give causes &remedies of overheating of engine & give its ill effect on engine performance.

ANS. FOR CAUSES &REMEDIES REFER Q.10 OF THE TOPIC NO.7 AND ILL-EFFECTS REMAINING.

Extra

(Q.2) Causes of overheating of an engine.

OR

After Boiling.

Refer to Q.1

(Q.3) State effects of the failure of thermostat.

- **Overheating**
- **Overcooling**
- **Poor circulation**

OVERHEATING DUE TO:-

Due to improper functioning of thermostat if does not open at 93 degree Celsius the hot water will not flow from engine cylinder to radiator for cooling.

OVERCOOLING DUE TO:-

Due improper functioning of thermostat if it opens before 93 degree Celsius i.e. suppose at 65 degree Celsius then the cold starting situation will take place.

POOR CIRCULATION DUE TO:-

Any defective component in thermostat assembly.

(Q.4) State precautions that will prevent a coolant.

- **From reaching its boiling point:-**

Thermostat valve should be open at 93 degree Celsius.

- **From reaching its freezing point:-**

- Thermostat valve should be closed.
- Proper amount of coolant i.e. 50:50 coolant: water
- Proper circulation of water pump.

(Q.5) State defects arise in a water pump.

- Worn or damaged vanes.
- Incorrect position of slinger on the shaft.
- Cracks in water pump housing.
- Damaged water pump seal.
- Damaged water pump gasket.
- Dry noise in bearing.
- Damaged or worn out bearing.
- Damaged shaft.

(Q.6) Radiator Servicing Procedure.

(A) Removal:-

- Drain the cooling system.
- Disconnect the air cleaner hose connection and the headlight and the horn wires, and remove the front sheet metal.
- Disconnect the radiator hose connection at the radiator and slide the clamps toward the middle of the hose.
- Remove the radiator shell attaching bolts and remove the shell having removed the air cleaner previously.
- Remove the attaching bolts and remove the radiator**.**

(B) Inspection and Repair:-

- Remove the fan shroud.
- Check upper tank for leaks.

- Check the fins for being bent or clogged.
- Check the lower tank for leaks.

(C) Installation:-

- To install the radiator, reverse the procedure outlined above, “Removal”.
- Fill the cooling system with coolant and add the proper amount of anti-freeze, depending upon weather conditions (where applicable).
- Run the engine for several minutes and check for radiator leaks.

(Q.7) Describe different troubles arise in faulty cooling system.

Refer to Q.1

(Q.8) why it is important to have fan belt correctly adjusted?

- Visually inspect the belt for cracks, cuts, deformation, wear and cleanliness.
- Check the belt for tension.

(Note: Belt tension specification must be 10-15 mm as deflection)

- Belt tension should not be too high or too low. If the belt tension is too high or too low then adjust it to proper tension by adjusting the alternator position.

- If the belt tension is too high or too low then following effects will take place:-

- Improper working of cooling system thus default cooling system.
- Improper working of cam shaft thus improper valve timing and Valve timing.
- Improper working of power steering unit.
- Improper working of air compressor for A.C. driven cars.

- Improper working of alternator.

(Q.9) Explain service procedure of water pump.

- **Removal:-**
  - Drain the cooling system.
  - Remove the radiator.
  - Loose the generator adjusting arm bolt and two generator pivot bolts and relax the tension on the belt.
  - Remove the four water pump attaching the bolts and remove the water pump and gasket.
- **Inspection and Repair:-**
  - Check the impeller of worn or damaged vanes and check the seal seat on the rear face of the impeller to be sure it is in good condition. Install if the seat or vanes are damaged**.**
  - Check the individual parts of the bearing, shaft and slinger assembly for nicks, scores, or other damage and the slinger for correct position on the shaft. If the bearing and shaft are undamaged and the slinger is damaged or incorrectly positioned, remove it using care not to damage the shaft.
  - Check both parts of pump housing for cracks, fractures or signs of leakage.
  - If there are any defective parts, install new ones.
- **Installation:-**
  - Position a new water pump gasket and place the water pump on to the front of the cylinder block and install the four attaching bolts. Tighten the bolts to the specified torque.
  - Position the drive belt and adjust tension. Tighten the adjusting arm bolt and the two generator pivot bolts.
  - Install the radiator.
  - Fill the cooling system. Run the engine and check of leaks.

(Q.10) How do you check "Radiator pressure cap" for its functioning?

- On sealed cooling systems the radiator pressure cap must seat properly on the filler neck to prevent surge or spill losses and water evaporation.
- Pressure type radiator caps are tested with the same tester employed to pressure test cooling system.
- To test the radiator pressure cap install the adaptor and rubber seal on tester.
- Dip the radiator pressure cap in water and install on the adaptor.
- With the pump apply 12-15 psi to the cap.
- If the cap fails to hold pressure within this range then replace the cap.
- Radiator pressure caps in vehicles equipped with air conditioners should be tested at 15-16 psi.

(Q.11) How to test cooling system for exhaust gas leakage?

A defective cylinder-head gasket may allow exhaust gas to leak into the cooling system. This is very damaging. Strong acids can form as the gas unites with the water in the coolant. These acids corrode the radiator and other cooling-system parts. A test for exhaust-gas leakage can be made with a Bloc-Check tester. It is installed in the radiator filler neck, as shown in fig.

The test is made with the engine running. Squeeze and release the rubber bulb. This draws an air sample from the cooling system up through the test fluid. The test fluid is ordinarily blue. However, if

combustion gas is leaking into the cooling system, the test fluid will change to yellow color. If a leak is indicated, the exact location can be found by removing one spark-plug wire at a time and retesting. When a leaking cylinder is firing, the liquid will change to yellow. When non leaking cylinders only are firing, the liquid will remain blue.

Combustion leaks in the valve areas can cause cracked valve seats and cylinder heads. The coolant is forced away from the cracked area during heavy acceleration by the leakage of combustion gases through the leak. This causes excessive heat buildup. When acceleration stops, the diverted coolant rushes back to the overheated area. The sudden cooling of the area can crack the head and valve seat.

(Q.12) Explain the procedure of pressure test for cooling system to detect external and internal leakage.

- A cooling system that requires frequent addition of water or anti-freeze solution to maintain the proper level in the radiator should be thoroughly inspected for leaks.
- To pressure test the cooling system fill the radiator to one-half inch below the filler neck.
- Wipe the filler neck surface. Clean and install the pressure tester.
- Operate the pump on the tester until the pressure on the gauge reads 15 psi.
- A steady pressure gauge reading indicates that the cooling system is satisfactory.
- If the pressure on the gauge drops i.e., external leaks. Now examine the radiator core, engine block, water pump and hose connections for leaks.
- If no external leaks are found, then remove the tester from the radiator and run the engine until operating temperature is reached.
- Re-install the tester and apply a pressure of 7 psi on the cooling system.
- Increase engine speed to approximately half throttle.
- A fluctuating gauge needle generally indicates a leaking head gasket i.e., internal leaks.

Topic 6

LUBRICATING SYSYEM

(Q.1) Give different performance features of lubricating oil on the engine.

ANS. REMAINING

(Q.2)State causes and remedies.

- **Low oil pressure.**
- **High oil pressure.**

- **Low oil pressure:-**

CAUSES	**REMEDIES**
1. Less oil in the oil pan.	Add adequate amount of oil as prescribed.
2. Loose connection in the oil lines.	Tighten the connection.
3. Faulty pressure gauge giving incorrect reading.	Replace pressure gauge.
4. Oil leakage.	Repair as necessary.
5. Oil pump faulty.	Repair or replace.
6. Oil filter clogged.	Replace.
7. Relief valve faulty.	Repair or replace.
8. Defective lubrication system.	Check the lubrication system and repair as necessary.

- **High oil pressure:-**

CAUSES	**REMEDIES**

1. Relief valve faulty.	Repair or replace.
2. Defective lubrication system.	Check the lubrication system and repair as necessary.
3. Oil pump faulty.	Repair or replace.
4. Faulty pressure gauge giving incorrect reading.	Replace pressure gauge.

(Q.3) Describe the procedure of changing engine oil.

- Check the oil level with the help of dipstick.
- Now check the quantity as well as quality of oil. Then check colour and viscosity and if found less or dirty, it means the engine oil is require to change.
- **Condition: -** During changing the engine oil, engine should be in cold situation.
- Remove drain plug of the oil sump and allow the impure oil to draw out.
- During this procedure also check oil filter and if found dirty then replace the filter elements.
- Now close the drain plug.
- Add the adequate amount of engine oil as recommended by manufacture's company.
- Finally, check oil filter and drain plug for leakage and if any leakage is found then tight the oil filter and drain plug.

(Q.4) What care should be taken when commissioning a new engine.

ANS. REMAINING

(Q.5) How & why a pressure relief valve is set.

ANS. REMAINING

(Q.6) Explain step procedure of changing engine oil.

ANS. REFER TO Q.3

(Q.7) Explain why special care is to be taken in removing & installing oil pump with drive gear on pump shaft.

ANS. REMAINING

(Q.8) Explain the method to check the pressure relief valve.

ANS. REMAINING

(Q.9) State causes and remedies of excessive oil consumption

Excessive oil consumption:-

- Loose bearing.
- Tapered or out of round cylinders.
- Excessive clearance in the intake valve guides.
- Worn piston rings.
- Loose connections in oil seal.
- Worn rear camshaft oil seal.
- Excessive oil pressure.
- Clogged oil breather.
- Clogged oil return from the distributor.
- Cylinder distortion due to improper tightening of the cylinder head nuts.

(Q.10) State the causes and remedies for engine lubrication failure.

- **Oil leakage OR Loss of lubrication:-**

CAUSES	**REMEDIES**
1. Cylinder head, cylinder block & sump or oil pump housing damaged or cracks.	Replace
2. Worn out or damaged bearings & loose Connections.	1. Replace bearings. 2. Fit properly the connections.
3. Oil seal faulty.	Replace oil seal.
4. Gasket faulty.	Replace gasket.

- **Low oil pressure:-**

CAUSES	REMEDIES
1. Less oil in the oil pan.	Add adequate amount of oil as prescribed.
2. Loose connection in the oil lines.	Tighten the connection.
3. Faulty pressure gauge giving incorrect reading.	Replace pressure gauge.
4. Oil leakage.	Repair as necessary.
5. Oil pump faulty.	Repair or replace.
6. Oil filter clogged.	Replace.
7. Relief valve faulty.	Repair or replace.
8. Defective lubrication system.	Check the lubrication system and repair as necessary.

- **High oil pressure:-**

CAUSES	REMEDIES
1. Relief valve faulty.	Repair or replace.
2. Defective lubrication system.	Check the lubrication system and repair as necessary.
3. Oil pump faulty.	Repair or replace.
4. Faulty pressure gauge giving incorrect reading.	Replace pressure gauge.

- **Excessive oil consumption:-**
  - Loose bearing.
  - Tapered or out of round cylinders.
  - Excessive clearance in the intake valve guides.

- Worn piston rings.
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- Worn rear camshaft oil seal.
- Excessive oil pressure.
- Clogged oil breather.
- Clogged oil return from the distributor.
- Cylinder distortion due to improper tightening of the cylinder head nuts.

(Q.11) Explain why special care is to be taken in removing & installing oil pump with drive gear on pump shaft.

ANS. REMAINING

(Q.12) Why used oil cannot be used again in engine.

ANS. REMAINING

(Q.13) Exlpain in brief the complete servicing procedure of lubricaying system.

ANS. REMAINING

(Q.14)Give six names of place from where oilk leaks can take place.

ANS. REMAINING

(Q.15)What critical clearances are checked in a gear type lubricating pump for wear?

- Replace the oil pump gears if the clearance between the gear teeth is 0.018 inch or more.
- Replace the driven gear stub axle if it is worn 0.002 inch or more.
- Replace the oil pump body if it is cracked or broken, or if the clearance between the end of the gear teeth and housing is more than 0.0035 inch.
- Replace the bushing, the pump shaft if it is shown wear and the clearance is 0.005 inch or more.
- Replace the bushing in the pump body if they are worn more 0.002 inch.

(Q.16) Why do filter elements have to be replaced?

- The engine oil gradually becomes contaminated with worn metal particles, dirt from the atmosphere, carbon and other foreign materials.
- Out of these, the heavier matter will settle and collect in the oil pan, but the lighter matter will mix with the oil and be sent to various parts of the engine where they will cause wear and overheating.
- Therefore an oil filter is installed in the oil line to remove impurities present in the oil by passing through the oil filter.
- Now due prolonged use of oil filter even the oil filter becomes dirty or contaminated due collecting dirt and dust particles.
- Thus filter elements needs to be replaced at regular interval of time. The oil filter is installed on the outside of the engine to permit easy replacement of the filter elements.

Extra

(Q.1) Why do filter elements have to be replaced?

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- Thus filter elements needs to be replaced at regular interval of time. The oil filter is installed on the outside of the engine to permit easy replacement of the filter elements.

(Q.2) State the causes and remedies for engine lubrication failure.

OR

State four reasons for heavy lubricating oil consumption in a diesel engine.

OR

Explain principle causes for excessive engine oil consumption with their remedies.

OR

State causes and remedies.

- **Low oil pressure.**
- **High oil pressure.**

OR

State causes and remedies of excessive oil consumption.

- **Oil leakage OR Loss of lubrication:-**

CAUSES	**REMEDIES**
1. Cylinder head, cylinder block & sump or oil pump housing damaged or cracks.	Replace
2. Worn out or damaged bearings & loose Connections.	1. Replace bearings. 2. Fit properly the connections.
3. Oil seal faulty.	Replace oil seal.
4. Gasket faulty.	Replace gasket.

- **Low oil pressure:-**

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2. Loose connection in the oil lines.	Tighten the connection.
3. Faulty pressure gauge giving incorrect reading.	Replace pressure gauge.

4. Oil leakage.	Repair as necessary.
5. Oil pump faulty.	Repair or replace.
6. Oil filter clogged.	Replace.
7. Relief valve faulty.	Repair or replace.
8. Defective lubrication system.	Check the lubrication system and repair as necessary.

- **High oil pressure:-**

CAUSES	**REMEDIES**
1. Relief valve faulty.	Repair or replace.
2. Defective lubrication system.	Check the lubrication system and repair as necessary.
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- **Excessive oil consumption:-**
  - Loose bearing.
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  - Worn piston rings.
  - Loose connections in oil seal.
  - Worn rear camshaft oil seal.
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- Replace the oil pump body if it is cracked or broken, or if the clearance between the end of the gear teeth and housing is more than 0.0035 inch.
- Replace the bushing, the pump shaft if it is shown wear and the clearance is 0.005 inch or more.
- Replace the bushing in the pump body if they are worn more 0.002 inch.

(Q.4) Explain how will you decide to change the lubricating oil of an engine, with the process of changing the engine oil.

OR

Describe the procedure of changing engine oil.

OR

Explain step procedure of changing engine oil.

- Check the oil level with the help of dipstick.
- Now check the quantity as well as quality of oil. Then check colour and viscosity and if found less or dirty, it means the engine oil is require to change.
- **Condition: -** During changing the engine oil, engine should be in cold situation.
- Remove drain plug of the oil sump and allow the impure oil to draw out.

- During this procedure also check oil filter and if found dirty then replace the filter elements.
- Now close the drain plug.
- Add the adequate amount of engine oil as recommended by manufacture's company.
- Finally, check oil filter and drain plug for leakage and if any leakage is found then tight the oil filter and drain plug.

(Q.5) Explain the cause of engine oil deterioration.

- **Oxidation**
- **Dilution**
- **Carbon**
- **Water**
- **Lead compounds**
- **Metals**
- **Dust and dirt**

- **Oxidation:-**

Oxidation occurs when a molecules of oxygen from the air attaches itself directly to an original oil molecule to make a more complex compound. A lubricant that is exposed to high temperature and oxygen will eventually oxidize.

- **Lead compounds:-**

During the combustion of lead gasoline lead compounds are formed. These compounds are carried into the crankcase by mixing with the oil that is scraped off the cylinder wall by the piston rings.

- **Metals:-**

As a result of normal wear, lubricating oil is contaminated by powdered metals in varying amounts.

Iron is the most common metal found mixed with the lubricating oil.

- **Water:-**

During the combustion of the air-fuel mixture in an I.C. engine, oxygen in the air combines with the hydrocarbon structure of the fuel to form water, which is present in the combustion chamber as vapour.

- **Dust and dirt:-**

Dust and dirt enters in the engine through the carburetor air intake and through the crankcase ventilation system.

TOPIC 7

ENGINE TROUBLES

(Q.1) Give the causes and remedies of the following:

Vehicle lacks power, acceleration or high speed performance:-

OR

Engine is loosing power:-

CAUSES	**REMEDIES**
1. Defective fuel system.	Check carburetor, choke, filter, air cleaner and fuel pump.
2. Throttle valve not opening fully.	Adjust linkage.
3. Excessive carbon in engine.	Service engine.
4. Defective valve action.	Check with compression, leakage, vacuum.
5. Wrong or bad fuel.	Use correct octane fuel.
6. Heavy oil.	Use correct oil.
7. Defective ignition.	Check timing, distributor, wiring, condenser, coil and plugs.

(Q.2) Give causes of blue smoke & black smoke.

- **Cause of black smoke:-**
    - Choke in operation.
    - Spark plugs not functioning satisfactorily.
    - Clogged air filter.
    - Punctured or incorrectly set carburettor float.

- Worn out or wrong size jets.
- Needle valve stuck open.
- Ignition system erratic.
- Incorrect ignition timing.
- Worn out, stuck or broken piston rings.

➢ **Causes of blue smoke:-**

- Excessive petrol mixture ratio.
- Excessive oil in clutch chamber.
- Crank case oil seals worn out or damaged.
- Worn out, stuck or broken piston rings.
- Worn out cylinder bore.

(Q.3) Give the causes and remedies for petrol engine turn slightly but does not start.

OR

➢ **Engine turns over but does not start:-**

CAUSES	**REMEDIES**
1. Defective ignition system.	Try sparking test; checking timing, ignition system.
2. Defective fuel system.	Prime engine; check accelerator-pump discharge, fuel pump, fuel line, choke, Carburetor.
3. Air leaks in intake manifold or Carburetor.	Tighten mounting; replace gaskets as needed.
4. Defective engine.	Check compression or leakage, valve action timing.
5. Ignition coil or resistor burned out.	Replace.
6. Clogged fuel filter.	Clean or replace.

(Q.4) Give causes & remedies of for high fuel consumption

- **Excessive fuel consumption:-**

CAUSES	REMEDIES
1. Excessive fuel pump pressure or pump leakage.	Reduce pressure; repair pump.
2. Choke partly closed after warm-up.	Open; repair automatic choke.
3. Clogged air filter.	Replace or clean the filter element.
4. High carburettor float level.	Adjust the caburettor float level as prescribed.
5. Dirty or stuck float needle valve.	Clean or free the float needle valve.
6. Worn carburettor jet.	Replace carburettor jet.
7. Idle too rich or too fast.	Adjust as prescribed.
8. Carburettor leaks.	Replace gaskets and tighten screws.
9. Stuck accelerator pump check valve.	Free valve.
10. Short-run operation.	Drive longer distance.

(Q.5) GIVE CAUSES & REMEDIES OF NOISY ENGINE OPERATION.

- **Noisy engine:-**

CAUSES	REMEDIES
1. Worn or broken piston rings.	Replace.
2. Loosely mounted accessories; alternator, horn, oil pan, front bumper, water pump, etc.	Tighten mounting.
3. Worn main bearing and thrust bearing.	Replace.
4. Loose piston pin.	Tighten.
5. Worn connecting rod bearing.	Replace.
6. Worn crankpin.	Replace.

(Q.6) Give causes & remedies of engine stalls after idling or slow speed driving.

Engine stalls after idling or slow speed driving:-

CAUSES	REMEDIES
1. Defective fuel pump.	Repair or replace.
2. Overheating.	Check the cooling system.
3. High carburetor float level.	Adjust the caburettor float level as prescribed.
4. Incorrect idling adjustment.	Adjust as prescribed.

(Q.7) Explain what causes torque to drop off after it reaches to maximum speed.

ANS. REMAINING

(Q.8) Give causes & remedies of for excessive lubricating oil consumption.

ANS. REFER TO Q.9 OF TOPIC NO.6

(Q.9) State probable causes & remedies for

(a) engine knocking

REMAINING

(b) Excessive fuel consumption:-

CAUSES	REMEDIES
1. Excessive fuel pump pressure or pump leakage.	Reduce pressure; repair pump.
2. Choke partly closed after warm-up.	Open; repair automatic choke.
3. Clogged air filter.	Replace or clean the filter element.
4. High carburettor float level.	Adjust the caburettor float level as prescribed.
5. Dirty or stuck float needle valve.	Clean or free the float needle valve.
6. Worn carburettor jet.	Replace carburettor jet.

7. Idle too rich or too fast.	Adjust as prescribed.
8. Carburettor leaks.	Replace gaskets and tighten screws.
9. Stuck accelerator pump check valve.	Free valve.
10. Short-run operation.	Drive longer distance.

(c) Valve and tappet noise:-

CAUSE	**REMEDIES**
1. Weak or broken valve springs	Replace
2. Worn lifter faces.	Replace
3. Lifters loose in block.	Tighten.
4. Rough cams.	Replace
5. Excessive tappet clearance.	Adjust the clearance as prescribed.
6. Defective hydraulic valve lifter.	Repair or replace.
7. Excessive wear of one or more cams of camshaft.	Replace.
8. Excessive push rod-to-guide clearance.	Adjust the clearance as prescribed.
9. Excessive valve steam-to-guide bore clearance.	Adjust the clearance as prescribed.

(d) excessive carbon deposition

REMAINING

(e) Engine cranks normally but does not start:-

OR

Engine turns over but does not start:-

OR

Engine fail to start while cranking:-

CAUSES	REMEDIES
1. Defective ignition system.	Try sparking test; checking timing, ignition system.
2. Defective fuel system.	Prime engine; check accelerator-pump discharge, fuel pump, fuel line, choke, Carburetor.
3. Air leaks in intake manifold or Carburetor.	Tighten mounting; replace gaskets as needed.
4. Defective engine.	Check compression or leakage, valve action timing.
5. Ignition coil or resistor burned out.	Replace.
6. Clogged fuel filter.	Clean or replace.

(Q.10) Give causes & remedies for following:-

(a) Engine cranks normally but does not start:-

OR

Engine turns over but does not start:-

CAUSES	REMEDIES
1. Defective ignition system.	Try sparking test; checking timing, ignition system.
2. Defective fuel system.	Prime engine; check accelerator-pump discharge, fuel pump, fuel line, choke, Carburetor.
3. Air leaks in intake manifold or	Tighten mounting; replace gaskets as needed.

Carburetor.	
4. Defective engine.	Check compression or leakage, valve action timing.
5. Ignition coil or resistor burned out.	Replace.
6. Clogged fuel filter.	Clean or replace.

(b) mechanical fuel pump does not pump the fuel

REMAINING

(c) Engine's one cylinder missing:-

CAUSES	**REMEDIES**
1. Defective spark plug.	Replace.
2. Defective distributor lead or cap.	Replace.
3. Valve stuck open.	Free valve; service valve guide.
4. Defective piston or rings.	Replace.
5. Defective head gasket.	Replace.

(d) excessive oil consumption

REFER TO Q.9 OF TOPIC NO. 6

(e) Engine overheating:-

CAUSES	**REMEDIES**
1. Incorrect ignition timing.	Adjust as prescribed.
2. Loose or broken fan belt.	Tighten or replace.
3. Defective thermostat.	Replace.
4. Clogged water jackets.	Clean water jackets.
5. Defective radiator hose.	Replace.

6. Defective water pump.	Repair or replace.
7. Insufficient engine oil.	Add adequate amount of engine oil as prescribed.
8. Incorrect valve timing.	Adjust as prescribed.

(Q.11) Irregular missing of different cylinder:-

OR

Engine misses different cylinder:-

CAUSES	**REMEDIES**
1. Defective fuel system.	Check fuel pump, fuel line and carburator.
2. Defective valve action.	Check with compression, leakage and vacuum testers.
3. Defective piston rings.	Replace.
4. Overheated engine.	Check the cooling system.
5. Sticking manifold heat control valve.	Free valve.

(Q.12) Give causes & remedies for

(A) excessive carbon deposition in combustion chamber

REMAINING

(B) Engine vibration:-

CAUSES

- Defective ignition.
- Defective carburetion.
- Crankshaft out of balance.

- Clutch out of balance.
- Connecting rods and pistons of unequal weight.
- Maladjusted valves.
- Misaligned engine-transmission-propeller shaft.
- Too stiff engine supports.

(Q.13) State two purpose of engine tune up. Name any two instrument used in tune up procedure

ANS. REMAINING

(Q.14) GIVE CAUSES AND REMEDIES FOR ENGINE DOES NOT START.

- **Engine cranks normally but does not start:-**

OR

- **Engine turns over but does not start:-**

CAUSES	**REMEDIES**
1. Defective ignition system.	Try sparking test; checking timing, ignition system.
2. Defective fuel system.	Prime engine; check accelerator-pump discharge, fuel pump, fuel line, choke, Carburetor.
3. Air leaks in intake manifold or Carburetor.	Tighten mounting; replace gaskets as needed.
4. Defective engine.	Check compression or leakage, valve action timing.
5. Ignition coil or resistor burned out.	Replace.
6. Clogged fuel filter.	Clean or replace.

(Q.15) Describe vaccum test on petrol engine. Explain various observations & their interpretations.

ANS. REMAINING

EXTRA

(Q.16) GIVE CAUSES & REMEDIES FOR FOLLOWING:-

- **Engine's one cylinder missing:-**

CAUSES	REMEDIES
1. Defective spark plug.	Replace.
2. Defective distributor lead or cap.	Replace.
3. Valve stuck open.	Free valve; service valve guide.
4. Defective piston or rings.	Replace.
5. Defective head gasket.	Replace.

- **Piston "SLAP":-**

CAUSES	REMEDIES
1. Worn pistons.	Replace.
2. Misaligned connecting rods.	Replace connecting rod.
3. Collapsed piston skirts.	Replace.
4. Lack of engine oil.	Add oil.

(Q.17) State the causes of the following:

- **Engine backfires:-**
  - Ignition timing off.
  - Spark plug of wrong heat range.
  - Excessive rich or lean mixture.
  - Overheating of engine.
  - Carbon in engine.

- Valves hot or sticking.
- Cracked distributor cap.