

4/12/15

QP Code : 5951

(3 Hours)

[Total Marks : 80

- N. B. : (1) Question No. 1 is compulsory.
 (2) Attempt any Three questions from remaining.
 (3) Use of Design Data Hand book is permitted.
 (4) Assume suitable data if required.

1. Attempt any four of the following

- Explain the design considerations of Piston and Cylinder.
- Design a helical compression spring for a maximum load of 1000N for a deflection of 25 mm. Assuming the value of spring index as 5 and maximum permissible shear stress for spring as 420 N/mm². Take modulus of rigidity = 84kN/mm².
- What are the different materials used in advanced automotive body structures.
- Prepare a list of materials, specifying their characteristic used in automotive brake lining and clutch lining.
- Design a propeller shaft for an automotive engine developing 30kW at 1500 rpm. The lower gear ratio being 3.5 and the diameter ratio 0.55. Assume a shear stress of 56 MPa for the material of the shaft.

2. (a) Design a cast iron piston for a single acting four stroke diesel engine with the following data:

10

- | | |
|-------------------------------|----------------|
| Cylinder bore | = 200 mm |
| Stroke | = 250 mm |
| Speed | = 600 rpm |
| Brake mean effective pressure | = 0.60MPa |
| Maximum gas pressure | = 4 MPa |
| Fuel consumption | = 0.30 kg/KW/h |

l/d ratio for bush in small end in connecting rod may be assumed as 1.5

(b) An automotive engine has an output of 80 kW at 3000 rpm.

10

The mean diameter of the clutch is 200 mm with a permissible pressure of 0.2 N/mm². Friction lining is of asbestos with $\mu = 0.22$. What should be the inner diameter of the disc? Take both the sides of the plate with friction lining as effective. There are 8 springs and axial deflection in spring is limited to 10 mm. Design the spring. Assume $G = 80 \text{ kN/mm}^2$ and $C = 6$

[TURN OVER

3. (a) A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m and the central bend is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 N/mm². Determine the thickness and width of the steel spring leaves. The ratio of the total depth to width of the spring is 3. Also determine the deflection of the spring. 10
- (b) Design a connecting rod for a high speed diesel engine using the following data: 10
- | | |
|-----------------------------------|------------|
| Cylinder bore | = 125 mm |
| Stroke | = 140 mm |
| Length of connecting rod | = 350 mm |
| Speed | = 2000 rpm |
| Mass of reciprocating parts | = 1.5 kg |
| Maximum gas pressure | = 3 MPa |
| Factor of safety against buckling | = 5 |
4. (a) Explain the design consideration of connecting rod. 5
- (b) Design a centre crankshaft for single cylinder vertical engine using the following data: 15
- | | |
|---|------------|
| Cylinder bore | = 125 mm |
| Stroke | = 150 mm |
| (L/r) ratio | = 4.5 |
| Speed | = 2000 rpm |
| Weight of flywheel cum belt pulley | = 1 kN |
| Maximum gas pressure | = 3 MPa |
| Total belt pull | = 2 kN |
| Width of hub for flywheel cum belt pulley | = 200 mm |
- The torque on the crankshaft is maximum when the crank turns through 22° from TDC and at this position the gas pressure inside the cylinder is 2.5 MPa. The belts are in horizontal direction.
5. (a) Why are connecting rods made of I sections? Name the materials used for connecting rod and crankshaft 5

[TURN OVER

- (b) Design the valve gear mechanism for the exhaust valve of a petrol engine using the following data: 15

Cylinder bore	=250mm
Stroke	=300mm
Speed	= 500 rpm
Effective length of each arm	= 165 mm
Angle between two arms	= 165°
Maximum gas pressure	= 3.5 MPa
Seat angle of valve	= 45°
Mass of valve	= 0.5 kg
Back pressure when the exhaust valve opens	= 0.4 MPa
Maximum suction pressure	= 0.03 MPa

The valve opens 33° before TDC and closes 1° after BDC. The valve is to open and close with constant acceleration and deceleration for each half of the lift.

6. (a) A sliding mesh gearbox contains 4 pairs of gears for providing 4 forward speed and a reverse speed. Speed ratio of clutch shaft gear and lay shaft gear is 2. Calculate the number of teeth in all the gears with the assumptions that minimum number of teeth required for any gear to avoid interference is 18. Finally, calculate actual gear ratios. 10

The gearbox should have the following speed ratios approximately:

First gear = 5

Second gear = 3.38

Third gear = 2.25

Fourth gear = 1

Reverse speed gear = 5.5

- (b) A car weighing 1100 kg is moving on a level road at a speed of 65 km/h, when the brakes are applied and the car stops in 4 seconds. Brakes are applied on all four wheels. The radius of tyre is 220 mm. If the weight of each brake drum assembly is 12 kg and specific heat capacity is 460 J/kg °C. Determine. 10

(i) Braking distance

(ii) Torque capacity of each brake

(iii) Total energy absorbed by each brake if K.E. of rotating parts is 10% of K.E. of moving vehicles.

(iv) Temperature rise of brake drum assembly.