

Q. P. Code : 813102

(03 Hours)

[Marks : 80]

- Note: 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 4 X 5 = 20
- (a) Explain Design considerations of cylinder .What are dry and wet Cylinder liners?
  - (b) Why are connecting rods made of I sections? Name the materials used for connecting rod.
  - (c) Name the materials used for crankshaft. What are the design considerations of crankshaft?
  - (d) Prepare a list of brake lining and clutch lining materials used in automotive. Specify their characteristics.
  - (e) What is internal expanding shoe brake? What are the advantages and disadvantages?
2. (a) Design of a cast iron piston for a single acting four stroke engine for the following data: 15  
Cylinder bore = 90 mm;  
Stroke = 130 mm;  
Maximum gas pressure = 5 N/mm<sup>2</sup>  
Indicated mean effective pressure = 0.8 N/mm<sup>2</sup>  
Mechanical efficiency = 85%  
Fuel consumption = 0.20 kg per brake power per hour;  
Higher calorific value of fuel = 42 × 10<sup>3</sup> kJ/kg;  
Speed = 2000 r.p.m.  
Any other data required for the design may be assumed.
- (b) Explain Design considerations of piston. Why piston is made light weight? 05
3. (a) The bore of a cylinder of the four stroke diesel engine is 120 mm. The maximum gas pressure inside the cylinder is limited to 4 MPa .The cylinder head is made of cast iron and allowable tensile stress is 40 N/mm<sup>2</sup> .Determine the thickness of cylinder head .The studs which are made of steel, have allowable stress as is 50 N/mm<sup>2</sup> .  
Calculate (i) number of studs, (ii) nominal diameter of studs, and (iii) pitch of studs.  
Draw the neat diagram for each component. 10

[TURN OVER]

(b) Design a connecting rod for a high speed diesel engine using the following data: 10

Cylinder bore	= 110 mm
Stroke	= 120 mm
Length of connecting rod	= 300 mm
Speed	= 2500 rpm
Mass of reciprocating parts	= 1.5 kg
Maximum gas pressure	= 3.625 MPa
Factor of safety against buckling	= 5

4. (a) Explain the Whipping Stress of connecting rod. 05

(b) Design a centre crankshaft for single cylinder vertical engine using the following data: 15

Cylinder bore	= 120 mm
Stroke	= 140 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  $22^\circ$  from TDC and at this position the gas pressure inside the cylinder is 2.5 MPa. The belts are in horizontal direction.

5. (a) What is the difference between Centre and Overhung crankshafts? Name the materials used for crankshaft. 05

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

Cylinder bore	= 200 mm
Stroke	= 300 mm
Speed	= 500 rpm
Effective length of each arm	= 165 mm
Angle between two arms	= $160^\circ$
Maximum gas pressure	= 3.5 MPa
Seat angle of valve	= $45^\circ$
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  $33^\circ$  before TDC and closes  $1^\circ$  after BDC the valve is to open and close with constant acceleration and deceleration for each half of the lift.

[TURN OVER]

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 2.5. 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. The gearbox should have the following speed ratios approximately:
- First gear = 4.5  
 Second gear = 3.38  
 Third gear = 2.25  
 Fourth gear = 1  
 Reverse speed gear = 5.0

- (b) An automotive, internal expanding double shoe brake is shown in the figure below. The face width of the friction lining is 40 mm and the maximum intensity of normal pressure is limited to 1 MPa. The coefficient of friction is 0.32. The angle  $\theta_1$  can be assumed to be zero. Calculate:
- The actuating force  $P$  and
  - The torque absorbing capacity of the brake.

