Sem VII /CBSGS/Auto/AD/ M-J-17                                    25|05|2017

Q. P. Code : 813101

(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 the types of piston. What are design requirements of piston?

   (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) Explain the utility of the centre bolt, U-clamp, and rebound clip in a leaf spring.

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$^2$
       Indicated mean effective pressure = 0.8 N/mm$^2$
       Mechanical efficiency = 85%
       Fuel consumption = 0.20 kg per brake power per hour;
       Higher calorific value of fuel = $42 \times 10^3$ kJ/kg;
       Speed = 2000 r.p.m.
       Any other data required for the design may be assumed.

   (b) Explain Design considerations of Crankshaft. What are the different types of crankshaft?   05

3. (a) The bore of a cylinder of the four stroke diesel engine is 120 mm. The maximum   10
       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$^2$ .Determine the thickness of cylinder head .The studs which
       are made of steel, have allowable stress as is 50 N/mm$^2$ .
       Calculate (i) number of studs, (ii) nominal diameter of studs, and (iii) pitch of studs.
       Draw the neat diagram for each component.

[TURN OVER]

(b) Determine the dimensions of cross section of a connecting rod for a high speed diesel engine using   10
the following data:

| | |
|---|---|
| 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 | = 2.45 MPa |
| Factor of safety against buckling | = 5 |

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

(b) An automotive single plate clutch, with two pairs of friction surfaces transmits 290 N-m   15
Torque at 1200 rpm.The outer and inner diameter of the friction disc are 300 mm and 200 mm
respectively. The coefficient of friction is 0.30. the normal force on the friction surfaces is exerted
by 8 helical compression springs, so that the clutch is always engaged .The clutch is disengaged when
the external force further compresses the springs. Assume the spring index to be 6 and the number of
active coils as 6.Assume a suitable material for the spring. Design the springs and specify the
dimensions.

5. (a) Specifications for a centre crankshaft for single cylinder vertical engine is as follows   10

| | |
|---|---|
| Cylinder bore | = 125 mm |
| Stroke | = 150 mm |
| (L/r) ratio | = 4.5 |
| Speed | = 2000 rpm |
| Weight of flywheel cum belt pulley | = 1kN |
| Maximum gas pressure | = 3 MPa |
| Total belt pull | = 2 kN |
| Width of hub for flywheel cum belt pulley | = 200 mm |

Draw the force analysis diagram for the following cases:
  i.   Crankshaft at TDC position
  ii.  Crankshaft is at angle of maximum torque

(b) Design an exhaust valve for the petrol engine using the following data:   10

| | |
|---|---|
| Cylinder bore | = 200 mm |
| Stroke | = 300 mm |
| Speed | = 500 rpm |
| Effective length of each arm | = 165 mm |
| Angle between two arms | = 160° |
| Maximum gas pressure | = 3.5 MPa |
| Seat angle of valve | = 45° |
| Mass of valve | = 0.5 kg |
| Mean velocity of gas through port | = 50 m/s |
| Allowable bending stress for valve | = 50 N/ mm$^2$ |

**[TURN OVER]**

6.  (a)(i) Design a propeller shaft for an automotive, whose engine develops 40 kW at 1800 rpm. The          05
lower gear ratio being 3.50 .Assume a suitable diameter ratio and shear stress of 56 MPa for the
material of the shaft

6. (a)(ii) A semi elliptic multi leaf spring is usd for the suspension of the rear axle of a vehicle. It          05
consists of two extra full length leaves and ten graduated length leaves including the master leaf. The
center to center distance between the spring eyes is 1.2 m .The allowable stress for spring material is
$\sigma_{yt}$ = 1500 N/ mm$^2$ and E = 2.1 x 10$^5$ N/ mm$^2$.The factor of safety can be assumed as 2.5.Design the
cross section of the leaves for a maximum force of 40 kN

(b) An automotive, internal expanding double shoe brake is shown in the figure below. The face width          10
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:
i) The actuating force P and
ii) The torque absorbing capacity of the brake.



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