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06ME61

Sixth Semester B.E. Degree Examination, June/July 2013
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO questions from each part.*
2. Missing data, if any, may be suitably assumed.
3. Use of data handbooks is permitted.

PART – A

1 a. Clearly state five assumptions used in determining the stress distribution in a curved flexural member. **(05 Marks)**

b. Fig.Q1(b) shows a frame of a punching machine and its various dimensions. Determine the combined stress at the inner and outer fibres. Also find the maximum shear stress and its location. Take the force as 85 kN. **(15 Marks)**

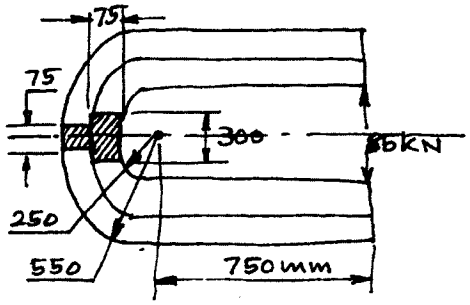

Fig.Q1(b)

2 a. A domestic gas cylinder made of CI has an allowable tensile stress of 45 MPa. If the internal pressure is 1.5 MPa, find the wall thickness of the cylinder. Take cylinder diameter as 300mm. **(05 Marks)**

b. A CI cylinder of ID 300 mm and wall thickness 40 mm carries a fluid under pressure of 6 MPa. Find the tangential and radial stresses across the wall of the cylinder at every 10 mm. Also plot the stress distribution. **(15 Marks)**

3 a. A Belleville spring is made of 3 mm sheet metal with OD 125 mm and ID 50 mm. The spring is dished 5 mm. The maximum stress is to be 500 MPa. Assuming Poisson's ratio = 0.3 and E = 200 GPa, determine (i) safe load carried by the spring (ii) deflection for this load (iii) stress developed at the outer edge (iv) load required to flatten the spring. **(10 Marks)**

b. Determine the complete specifications of a helical compression spring to sustain an axial load of 3 kN. The deflection is 60 mm and the spring index is 6. Shear stress is not to exceed 300 MPa. Take G = 81 GPa. Take clearance a = 0.25y. Assume squared and round ends. **(10 Marks)**

4 Design a pair of spur gears to transmit 12 kW at 1,200 rpm of the pinion. The velocity ratio required is 4:1. The pitch line velocity of the gears is limited to 12 m/s. Take allowable static stress σ_0 = 138 MPa for both gears and pressure angle as 20° full depth involute. Also assume face width is 10 times the module and service factor as 1.5. **(20 Marks)**

PART – B

5 a. A pair of bevel gears transmits 7.5 kW at 300 rpm of the pinion. The pitch diameters of the pinion and gear at their larger ends are 150 mm and 200 mm respectively, and the pressure angle is 20°. Determine the components of the resultant gear tooth force and draw a free body diagram of the forces acting on the pinion and the gear, assuming face width of 40 mm. **(10 Marks)**

b. The following data refer to a worm and worm gear drive that has to transmit 15 kW at 1750 rpm of the worm:

Centre distance = 200 mm	Pitch circle diameter of worm = 80 mm
No. of starts = 4	Axial module = 8 mm
Transmission ratio = 20	Tooth form = 20° FDI.

The work gear has an allowable bending stress of 55 MPa. The worm is made of hardened and ground steel. Determine (i) the number of teeth on the worm gear. (ii) The lead angle (iii) face width of the worm gear based on the beam strength of the worm gear. **(10 Marks)**

6 a. Design a cone clutch to transmit 40 kW at 750 rpm. Also determine the (i) axial force required to transmit the torque (ii) axial force required to engage the clutch. Assume $\mu = 0.4$ and $p = 0.2$ N/mm^2 for the friction material ($\alpha = 12.5°$). Take $D_m/b = 6$. **(10 Marks)**

b. The band brake shown in Fig.Q6(b), uses a V-belt. The pitch diameter of the V-grooved pulley is 400 mm, the groove angle is 45° and the coefficient of friction is 0.3. Determine the power rating of the brake. **(10 Marks)**

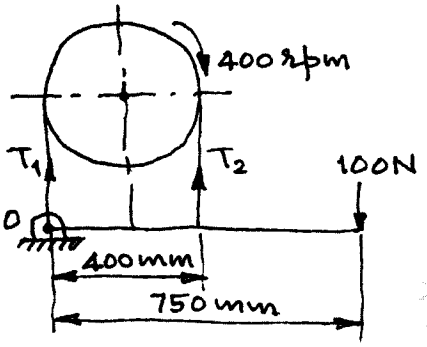

Fig.Q6(b)

7 SAE 20 oil is used to lubricate a hydrodynamic journal bearing of diameter 75 mm and length 75 mm. The journal rotates at 1,200 rpm, the diametral clearance is 0.075 mm, the operating temperature of the oil is 53°C, and the oil enters at 40°C. Determine: (i) the magnitude and location of the minimum oil film thickness (ii) power loss (iii) oil flow trough the bearing (iv) side leakage. **(20 Marks)**

8 a. State three advantages and two disadvantages of a V-belt drive over a flat belt drive. **(05 Marks)**

b. A V-belt is used between two shafts 3 m apart. The driving pulley has 850 mm effective diameter and is supplied with 75 kW at 960 rpm. The driven pulley runs at 480 rpm. Given that the area of belt section = 400 mm^2, weight of belt = 10×10^{-6}N/mm^3, safe working tensile stress = 2.1 N/mm^2, $\mu = 0.27$ and groove angle of pulley = 40°, determine the number of belts required. Also, calculate the initial tension in each belt. **(15 Marks)**

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