Sixth Semester B.E. Degree Examination, June/July 2011
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. Use of Design data hand book is permitted.
3. Any missing data may be suitably assumed.

PART – A

1 a. Determine the dimensions of the curved bar shown in Fig.Q1 (a). Assume
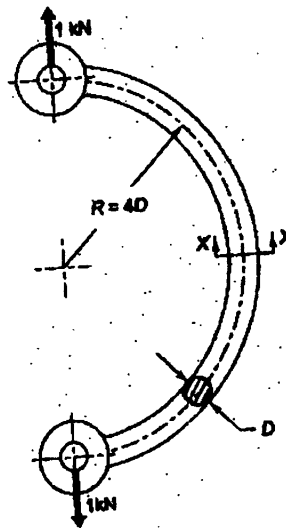$\sigma_{yt} = 400N/mm^2$ and FoS = 3.5. **(12 Marks)**

Fig.Q1 (a)

  b. Briefly discuss about any four types of springs, with simple sketches. **(08 Marks)**

2   A tube, with 50mm and 75mm inner and outer diameters respectively is reinforced by
shrinking a jacket of outer diameter 100mm. The compound tube has to withstand an
internal pressure of 35Mpa. Calculate the shrinkage allowance such that the maximum
tangential stress in each tube has same magnitude. Also calculate the shrinkage pressure and
show the distribution of tangential stresses. Assume E = 207 kN/mm^2. **(20 Marks)**

3 a. Design a helical compression spring for a service load ranging from 2250N to 2750N. The
axial deflection of the spring for the load range is 6mm. Assume a spring index of 5,
permissible shear stress of 420 MPa and modulus of rigidity of 84 kN/mm^2. **(12 Marks)**

  b. A truck spring has 12 leaves, two of which are full length leaves. The spring supports are
1.05m apart and the central band is 85mm wide. The central load is 5.4 kN and the
permissible stress in spring material is 280 MPa. If the ratio of total depth to width of the
spring is 3, determine the thickness & width of the spring leaves and also the deflection of
the spring. **(08 Marks)**

4   A 12 kw motor running at 1170rpm drives a fan through a pair of spur gears (Forged steel
SAE 1030 pinion & CI gear) with a reduction ratio of 3.9:1. Design the gear and check for
dynamic & wear loads. **(20 Marks)**

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PART – B

5   A Pair of straight bevel gears are used to transmit 15kw at 1500rpm input speed. The number of teeth on pinion is 20 and the speed ratio is 5. Design the gears for strength only assuming $14\frac{1}{2}^{\circ}$ full depth form.   **(20 Marks)**

6 a. Determine the dimensions of a simple cone clutch to transmit 20kw at 1000rpm. The minimum diameter is to be 300mm and the cone angle 20^{0}. Assume μ = 0.2 and permissible pressure = 0.1 N/mm^{2}. Also determine the axial force required to engage the clutch.
          (12 Marks)

   b. A differential band brake is shown in Fig. Q6 (b). The width and the thickness of the steel band are 100mm and 3mm respectively and the maximum tensile stress in the band is 50 N/mm^{2}. The coefficient of friction between the friction lining and the brake drum is 0.25. Calculate:

   i) The tensions in the band,
   ii) The actuating force and
   iii) The torque capacity of the brake.
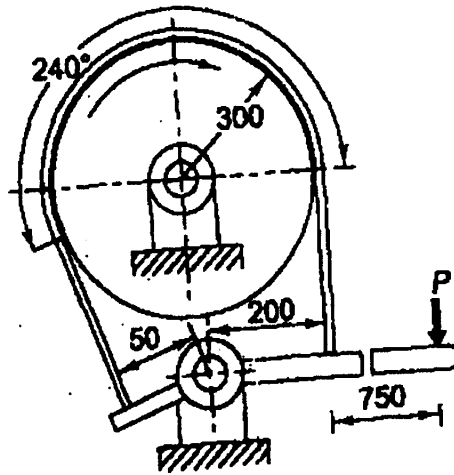   Check whether the brake is self locking.

Fig. Q6 (b)   **(08 Marks)**

7 a. A 75mm long full journal bearing of diameter 75mm supports a radial load of 12kN at the shaft speed of 1800rpm. Assume the ratio of diameter to the diametral clearance as 1000. The viscosity of oil is 0.01 $\frac{N-sec}{m^{2}}$ at the operating temperature. Determine:
   i) Sommerfeld number
   ii) Coefficient of friction and
   iii) Amount of heat generated.   **(12 Marks)**

   b. Derive Petroff's equation for coefficient of friction in journal bearings.   **(08 Marks)**

8 a. Select a wire rope for a vertical mine hoist to lift a load of 55kN from a depth of 300 meters. A rope speed of 500m/min is to be attained in 10secs.   **(12 Marks)**

   b. Select a V-belt drive to connect a 15kw, 2880rpm motor to a centrifugal pump, running at approximately 2400rpm, for a service of 18hrs per day. The center distance should be approximately 400mm. Assume the pitch diameter of driving pulley as 125mm.   **(08 Marks)**

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