12223

4 Hours / 70 Marks Seat No.

Marks

1. **Attempt any FIVE of the following:** 10
    a) Give composition of 45Cr20Si2.
    b) Define creep
    c) State two applications of Knuckle Joint
    d) State any two examples where hollow shafts are used
    e) Explain "bolts of uniform strength".
    f) State two applications of torsion springs
    g) Define "Basic Static Load Rating" of rolling contact bearings

2. **Attempt any THREE of the following:** 12
    a) Explain the term stress concentration and remedies to reduce stress concentration with neat sketch (any four)
    b) Discuss the design procedure of socket and spigot cotter joint.
    c) Explain with neat sketch different types of sunk keys.
    d) Explain self locking and overhauling property of screw.

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3. **Attempt any THREE of the following:**

   a) Explain construction of leaf spring with neat sketch.

   b) Explain with neat sketch different types of radial ball bearings

   c) Design mean diameter and number of turns of a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index 5. The maximum permissible shear stress for spring wire is 420 MPa. and modulus of rigidity is 84 KN/mm^2

   d) Explain selection of ball bearings using manufacturer's catlogue

4. **Attempt any TWO of the following:**   12

   a) A screw jack has to lift a load of 80 kN through a height of 400 mm. The elastic strength of screw material in tension and compression is 200 MPa and in shear 120 MPa. The material for nut is phosphor bronze for which the elastic limit may be taken as 100 MPa in tension 90 MPa in compression and 80 MPa in shear. The bearing pressure between nut and the screw is not to exceed 18N/mm^2. Design the screw and nut. Take Factor of safety = 2.

   b) Design a cast iron protective type flange coupling to transmit 15 KW at 900 rpm from an electric motor to compressor.
   Use following permissible stress.
   Shear stress for shaft, bolt and key = 40 Mpa
   Crushing stress for bolt and key = 80 MPa
   Shear stress for Cast Iron = 8 MPa

   c) Compare the weight, strength and stiffness of a hollow shaft of the same external diameter as that of solid shaft. The inside diameter of the hollow shaft being half the external diameter. Both the shafts have same material and length.

5.   **Attempt any <u>TWO</u> of the following**   12

a) Explain general considerations in machine design.

b) Define "factor of safety" and state the factors affecting on selection of factor of safety for ductile and brittle material.

c) A mild steel bracket as shown in Fig. No. 1 is subjected to a pull of 6000 N acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the cross sectional dimensions of the bracket, if the permissible stress in the material of the bracket is limited to 60 MPa.
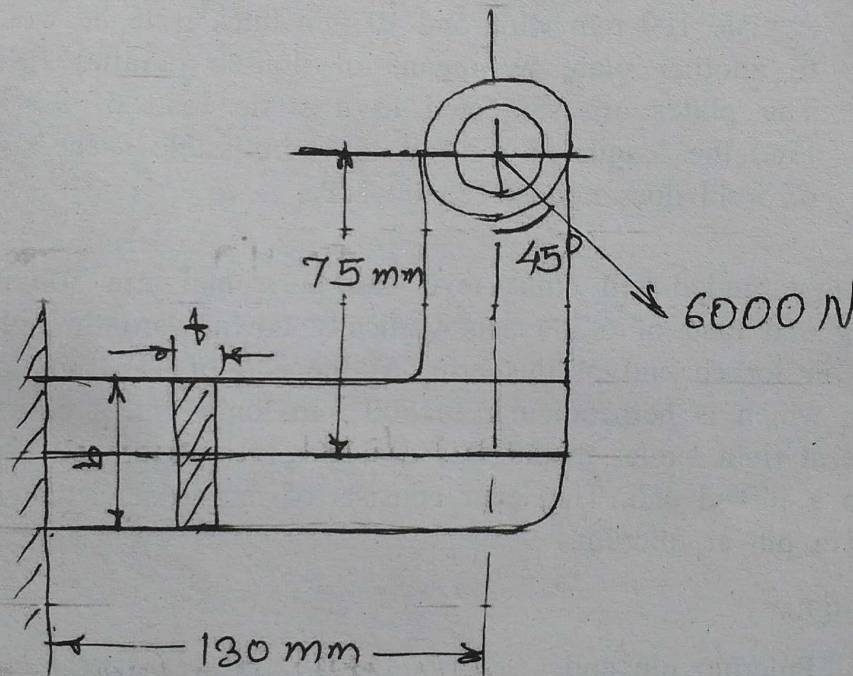

Fig. No. 1

6.   **Attempt any <u>TWO</u> of the following**

a) A closely coiled helical spring is made of 10mm diameter steel wire. The coil consists of 10 complete turns with a mean diameter of 120 mm. The spring carries an axial pull of 200 N. Determine the shear stress induced in the spring neglecting the effect of stress concentration. Determine also the deflection of the spring, its stiffness and strain energy stored by it if the modulus of rigidity of the spring material is 80 KN/mm^2.

b) i)   Define spring rate and spring stiffness

    ii)   A plate 100 mm wide and 10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 90 kN. Find the length of weld if the permissible shear stress of weld does not exceed 60 MPa.

c) A right angled bell crank lever has horizontal arm 500 mm long and load of 5 kN acts vertically down ward through a pin in forked end of this arm. At the end of 150 mm long arm which is perpendicular to 500 mm long arm, a effort P acts at right angles to the axis of 150 mm arm through a pin into a forked end. The lever consists of forged steel material and a pin at fulcrum.

Design

i)   Fulcrum pin and

ii)   The lever.

Take following data for pin and lever material.

safe stress in tension = 80 N/mm^2
safe stress in shear = 60 N/mm^2
safe bearing pressure on pins = 10 N/mm^2

Take rectangular cross section of the lever near fulcrum with b = 3t, where t is thickness and b is depth of lever.

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