22564

23124

4 Hours / 70 Marks   Seat No. ⬚⬚⬚⬚⬚⬚⬚⬚

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1.   Attempt any FIVE of the following: **10**

a) Identify the material and it's composition.

   i)   X10 Cr18 Ni9 Mo4 Si2

   ii)   XT 72 W18 Cr4 V 1

b) Define the following terms of spring

   i)   Solid length

   ii)   Spring stiffness

c) List any four desirable properties of the shaft material.

d) Give the applications of turn buckle (any four).

e) Draw the symbolic representation of following types of weld.

   i)   Weld all around

   ii)   Single U-butt weld.

f) State the significance of "Wahl's factor."

g) State any four application of the rolling contact bearing.

2. **Attempt any <u>THREE</u> of the following.** **12**

   a) Define Endurance limit and draw typical S.-N. curve for steel.

   b) Design knuckle joint to transmit 150 KN. The design stresses may be taken as 75 MPa in tension 60 MPa in shear and 150 MPa in compression

   c) Compare Rigid and Flexible coupling on following points:
     i)   Alignment

     ii)   Shock and vibration

     iii) Deflection

     iv) Suitability

   d) Find the length of the weld run for a plate of size 120 mm wide and 15 mm thick to be welded by means of single transverse weld and double parallel fillet weld when subjected to dynamic loading. Take $\sigma_+ = 75$ N/mm^2 and $\tau = 60$ N/mm^2

3. **Attempt any <u>THREE</u> of the following.** **12**

   a) Write down the steps involved in a general design procedure in any machine design.

   b) A vertical two-start sq. threaded screw at 120 mm mean diameter and 24 mm pitch supports a vertical load of 20 KN. The axial thrust on the screw is taken by a collar bearing of 300 mm outside dia. and 150 mm inside dia. Find the force required at the end of the lever which is 400 mm long in order to lift and lower the load. Co-efficient of friction for screw and nut is 0.18 and for collar bearing is 0.25.

   c) Note on following component with their application.
     i)   Leaf spring

     ii)   Helical compression spring

   d) State four examples of ergonomics consideration in design of a lathe machine.

   e) Explain self locking and overhauling of screws.

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

a) What is stress concentration? Illustrate method of reducing stress concentration with neat sketches.

b) Explain with the help of neat sketches three basic types of lever. State one application of each type.

c) Determine the diameter of hollow shaft having inside diameter is 0.6 of outside diameter. The shaft is driven by 900 mm overhang pulley. The weight of the pulley is 600 N. The overhung is 250 mm and tension in tight and slack side are 2900 N and 1000 N respectively. Assume τ_s = 80 N/mm^2

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

a) Design a cast iron protective flang coupling to connect the shaft in order to transmit 7.3 KW at 500 rpm.

  i)   Allowable shear stress for shaft, bolt and key = 42 N/mm^2

  ii)   Allowable crushing stress for bolt and key = 82 N/mm^2

  iii) Allowable shear stress for C.I. flange = 8 N/mm^2

b) A screw jack carries a load of 25 KN. If the co-efficient of friction between screw and nut is 0.15. Design the screw and nut. Neglect collar friction and column action. Take σ_c = 42 N/mm^2 and τ = 30 N/mm^2 for screw and nut and take τ_{nut} = 20 N/mm^2. The permissible bearing pressure on the nut is 14 N/mm^2. (Use single start thread)

c) Discuss the procedure for selection of bearing from manufacturer's catalogue with suitable example.

Marks

6. **Attempt any TWO of the following.** 12

a) A bracket as shown in fig. (1) supports a load of 30 KN. Determine the size of the bolt, if the max^m allowable tensile stress in the bolt material is 60 MPa. The distances are L_1 = 80 mm, L_2 = 250 mm and L_3 = 500 mm.
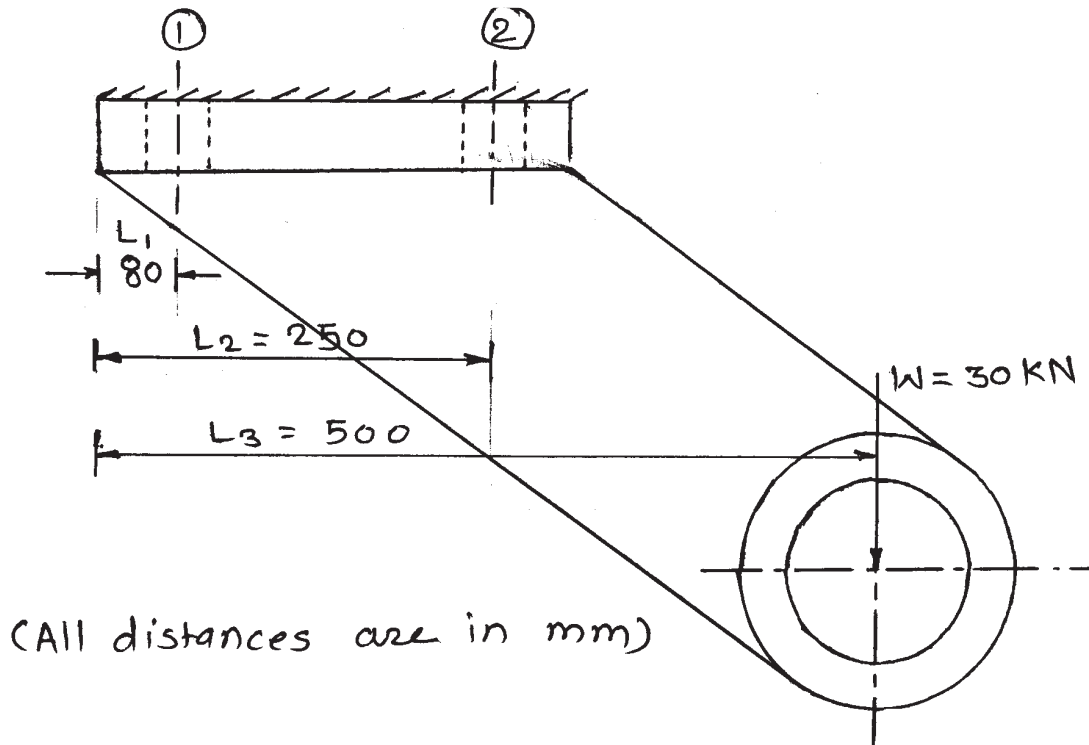
Fig. No. 1

b) A helical valve spring is to be designed for an operating load range of approximately 135 N. The deflection of the spring for the load range is 7.5 mm. Assume the spring index is 10. The permissible shear stress for the material of the spring = 480 MPa and its modulus of rigidity = 80 KN/mm².

Design the spring

Take

Wahl's correction factor = $\dfrac{4C-1}{4C-4} + \dfrac{0.615}{C}$

Where C = Spring index.

Marks

c) Explain following:

    i)   Effect of keyway on the strength of shaft.

    ii)   "Square key is equally strong in shearing and crushing" - prove.

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