17610

Seat No.

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

(2) Answer each next main Question on a new page.

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

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

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

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

(8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. a) **Attempt any TWO of the following:** 12

   (i) What is factor of safety? State its importance in design of machine elements.

   (ii) What is a cotter joint? State any four applications of a cotter joint.

   (iii) A hollow shaft for a rotary compressor is to be designed to transmit maximum torque of 4750 N-m. The shear stress in the shaft is limited to 50 MPa. Determine the inside outside diameter of the shaft if the ratio of inside to outside diameter of the shaft is 0.4.

Marks

b) **Attempt any ONE of the following:** **6**

   (i) 1) What are the factors to be considered for selection of materials for design of machine elements?

        2) Define :
            a) Ductility
            b) Toughness
            c) Creep

   (ii) Design a bushed pin type flexible coupling for connecting a motor shaft to a pump shaft for the following service conditions.

         Power to be transmitted = 40 KW.

         Speed of the motor shaft = 1000 RPM.

         Diameter of the motor shaft = 50 mm

         Diameter of the pump shaft = 45 mm

         The bearing pressure in the rubber bush and allowable stress in the pins are to be limited to 0.45 N/mm^2 and 25 MPa respectively.

2. **Attempt any TWO of the following:** **16**

   a) Design a 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.

   b) (i) State and explain two most important reasons for adopting involute curves for a gear tooth profile.

       (ii) Draw neat sketch of a protected type flanged coupling showing all details.

   c) (i) Why are bushes of softer material inserted in the eyes of levers?

       (ii) Explain the following types of stresses
             a) Transverse shear stress
             b) Compressive stress
             c) Torsional shear stress

Marks

3. **Attempt any FOUR of the following:** 16

    a) Explain with neat sketches only

        (i)   Methods of reducing stress concentration in cylindrical members with shoulders.

        (ii) Methods of reducing stress concentration in cylindrical members with holes.

    b) Design a foot brake lever from the following data:

        Length of lever from C.G. of the spindle to the point of application of the load = 1 meter.

        Max. load on the foot plate = 800 N

        Overhang from the nearest bearing = 100 mm

        Permissible tensile and shear stress = 70 MPa.

    c) What are the considerations in design of dimensions of formed and parallel key having rectangular cross section?

    d) Compare welded joints with screwed joints. (Any six points)

    e) A shaft 30 mm. diameter is transmitting power at a maximum shear stress of 80 MPa. If a pulley is connected to the shaft by means of a key, find the dimension of the key so that stress in the key is not to exceed 50 MPa and length of the key is 4 times the width.

4. a) **Attempt any THREE of the following:** 12

        (i)   Give the composition of :

            1) 35 Mn 2 Mo 28

            2) 30 Ni 4 Crl and

            3) 25 Cr 3 Mo 55

        (ii) Define following terms with respect to springs :

            1) Free length

            2) Solid height

            3) Spring rate

            4) Spring index

    (iii) Explain effect of keyways on strength of shaft. Name one type of key which does not affect strength of shaft.

    (iv) Define following terms w.r.t. bolts:

        1) Major diameter

        2) Minor diameter

        3) Pitch

        4) Lead

b) **Attempt any ONE of the following:**   **6**

    (i) Explain different causes of gear tooth failure and suggest possible remedies to avoid such failures.

    (ii) Explain the importance of Aesthetic considerations in design by giving any two examples.

5.   **Attempt any TWO of the following:**   **16**

a) (i) Show that the efficiency of a self locking screw is less than 50%.

    (ii) What is self locking property of threads and where it is necessary?

b) (i) The extension springs are in considerably less use than compression springs. Why?

    (ii) Explain the terms self locking and overhauling of screw.

c) (i) Define following terms as applied to rolling contact bearings:

        1) Basic static load rating

        2) Basic dynamic load rating

        3) Limiting speed

    (ii) List important physical characteristics of good bearing material.

Marks

6. **Attempt any FOUR of the following:** 16

a) Draw profiles to square and Acme threads with full details. Which one is stronger?

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 spring index of 10. Permissible shear stress for the material of the spring = 480 MPa and its modulus of rigidity = 80 KN/mm^2. Design the spring.
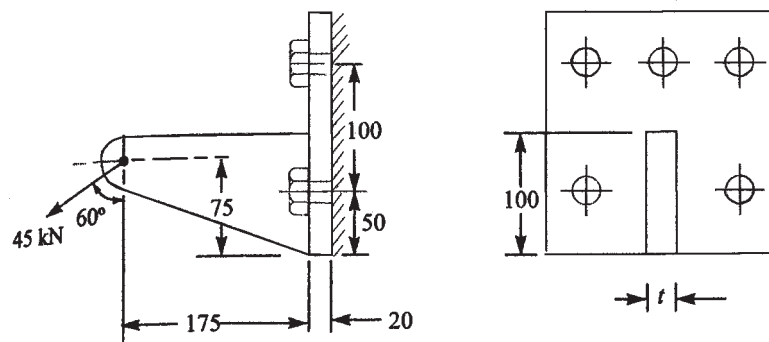
Take Wahle's factor = $\dfrac{4C-1}{4C-4} + \dfrac{0.615}{C}$, 'C' being the spring index.

c) A bracket as shown in Figure No. 1 is fixed to a vertical steel column by means of five standard bolts.

Determine :

(i) The diameter of the fixing bolts.

(ii) The thickness of the arms of the bracket.

Assume safe working stress of 70 MPa in tension and 50 MPa in shear

All dimensions in mm.

Fig. No. 1

d) What are rolling contact bearings? State their advantages over sliding contact bearings.

e) State the strength equation of double parallel fillet weld and single transverse fillet weld with neat sketches.

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