Sample Test Paper - I

Course Name : Diploma in Mechanical Engineering

Course Code : ME/MH/MI

Semester   : Sixth

Subject Title : Design of Machine Elements

Marks   : 25

17610

Time:1 Hour

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. Preferably, write the answers in sequential order.

Q1. Attempt any THREE   **3 x 3= 9 Marks**
   a) State any six design consideration in designing the machine element.
   b) Define Fatigue, Factor of Safety and Creep.
   c) List steps in designing Bell crank lever.
   d) Classify rigid coupling. State any one application of each.

Q2. Attempt any ONE   **1 x 8= 8 Marks**
   a) Draw neat sketch showing all details of cotter joint. State strength equations for each component with suitable failure cross sectional area.
   b) Describe the importance of aesthetic considerations in design related to shape, size, color and surface finish.

Q3. Attempt any ONE   **1 x 8= 8 Marks**
   a) A line shaft is driven by means of a motor placed vertically below it. The pulley on the line shaft is 1.5 meter in diameter and has belt tension 5.4 KN and 1.8 KN on the right side and slack side of belt respectively. Both these tension may be assumed to be vertical. If the pulley be overhang from the shaft, the distance of the centre line of the pulley from the center line of the bearing being 400mm. Find the diameter of shaft, assuming maximum allowable shear stress of 42MPa.
   b) Design a CI protective type flange coupling to transmit 15KW at 900 rpm from an electric motor to a compressor. Assume shear stress for shaft, bolt and key materials = 40MPa, Crushing stress for bolt and key = 80MPa and shear stress for CI material = 8MPa. Assume suitable data if required.

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Sample Test Paper - II

Course Name : Diploma in Mechanical Engineering

Course Code : ME/MH/MI

Semester   : Sixth

17610

Subject Title : Design of Machine Elements

Marks   : 25   **Time:1 Hour**

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. Preferably, write the answers in sequential order.

Q1. Attempt any THREE   **3 x 3= 9 Marks**
   a) State the strength equations when two rectangular plates are joint by double transverse weld and single longitudinal weld.
   b) State the meaning of following terms related to helical spring.(i) Spring Index (ii) Spring Rate (iii) Solid length
   c) State various stresses induced in screw fasteners.
   d) Classify bearing in details .

Q2. Attempt any ONE   **1 x 8= 8 Marks**
   a) (i) Why square threads are preferred over V- thread for power transmission?
        (ii) Describe self locking property of threads. State its importance.
   b) Design a helical spring for a spring loaded safety valve for the following conditions.
        Operating pressure P_1 = N/mm^2,Maximum pressure when the valve is blow off freely P_2 = 1.075N/mm^2, Maximum lift of the valve when pressure is 1.075N/mm^2 =δ =6mm, diameter of valve seat D_v = 100mm, f_s max = 400 N/mm^2, G = 86 x 10^6 N/mm^2, Spring index C =5.5.
        Show the obtained dimensions on proportionate sketch.

Q3. Attempt any ONE   **1 x 8= 8 Marks**
   a) (i) State the application of following bearings. Deep groove ball bearing, Taper roller bearing, Thrust roller bearing and Needle roller bearing.   (4M)
        (ii) A plate 75 mm wide and 12.5mm thick is joined with another plate by single transverse and double parallel fillet weld. The maximum tensile and shear stress are 75MPa and 56MPa respectively. Find the length of each parallel fillet weld, if the joint is subjected to pull of 90KN.   (4M)
   b) (i) State the formula for Walh's correction factor and its importance in design of spring. (2M)
        (ii) A toggle jack is used to lift a load of 5 KN. The jack is operated by means of a 400mm long lever. The eight symmetrical links are 125mm in length. Design the screw and nut if permissible tensile stress is limited to 20N/mm2. take co-efficient as 0.15. Assume pitch of the thread as 6mm.   (6M)

Sample Question Paper

Course Name : Diploma in Mechanical Engineering

Course Code : ME/MH/MI

Semester   : Sixth

17610

Subject Code : Design of Machine Elements

Marks   : 100   Time: 4 Hours

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. Preferably, write the answers in sequential order.

Q.1 (a) Attempt any THREE.   **12 Marks**
a) What is stress concentration? State its significance in design of machine elements.
b) Write the design procedure for turn buckle.
c) Draw neat sketch showing all details of protective type flange coupling..
d) Define Pitch, Lead of screw thread.

Q.1 (b) Attempt any ONE.   **06 Marks**
a) State and describe in brief any six ergonomics consideration in design of machine elements.
b) Determine the diameter of hollow shaft having inside diameter 0.6 times outside diameter. The shaft is driven by a 900mm diameter overhang pulley placed vertically. The weight of pulley is 600N. The overhang is 250mm. the tension in the tight and slack sides are 2900N and 1000N respectively. Assume fs=85N/mm^2.

Q.2 Attempt any TWO.   **16 Marks**
a) Differentiate Key and Cotter (any four points). Also explain why taper is provided on cotter? Give recommended values of taper.
b) Compare the weight and strength of hollow shaft of 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..
c) (i) Figure shows stress strain diagram for material. Redraw and identify the type of material and name the meaning of points A to G.
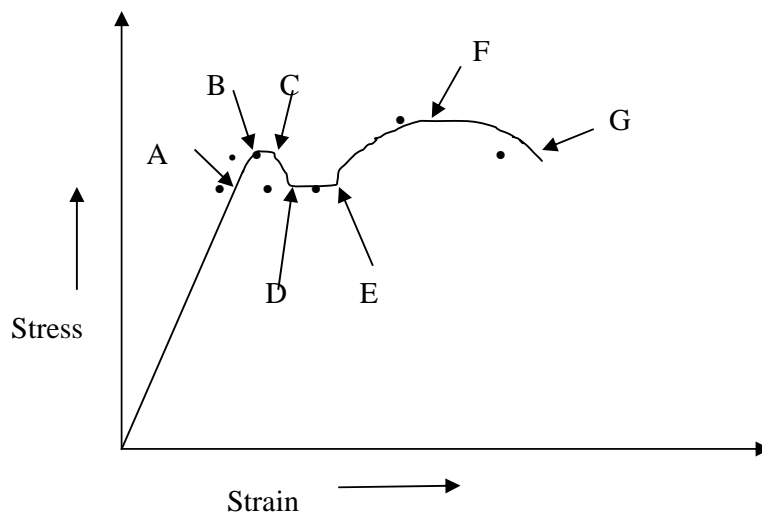
(ii) State any two applications each of a cotter joint and a Knuckle joint.

Q.3 Attempt any FOUR.   **16 Marks**

    a) Give the compositions of i). 35 Mn 2Mo 45 Steel, ii) 30 cr 13 and iii) XT72W18Cr4V1.
    b) Design knuckle joint to transmit 150 KN, the design stress may be taken as 75MPa in tension, 60MPa in shear and 150MPa in compression.
    c) Prove that for square key, the permissible crushing stress is twice the permissible shear stress.
    d) Describe bolt of uniform strength with neat sketch.
    e) State any four applications of Hydrostatic bearing and sliding contact bearing.

Q.4 (a) Attempt any THREE.   **12 Marks**

    a) State aesthetic consideration in design of office table context to following points: Shape, Size, Color and Surface finish.
    b) State the formula for deflection of spring. State the meaning of each term.
    c) State the effect of key way on the strength of shaft with suitable diagram.
    d) State any four advantages and disadvantages of welded joints over riveted joint.

Q.4 (b) Attempt any ONE.   **06 Marks**

    a) State any six design considerations while designing the spur gear.
    b) State any six factors to be considered while selecting higher factor of safety.

**Q.5 Attempt any TWO.**   **16 Marks**

    a) A screw jack carries a load of 80KN. Assume the coefficient of friction between screw and nut as 0.14 and pitch of screw as 8mm. neglect collar friction and collar action. The allowable stresses of screw material in tension and compression are 100N/mm2 and in shear is 60N/mm2. The material for the nut is phosphor-bronze for which the allowable stresses may be taken as 50N/mm2 in tension, 45N/mm2 in crushing and 40N/mm2 in shear. The bearing pressure between nut and the screw is not to exceed 18N/mm2. design and draw the screw and nut of the screw jack
    b) A rail wagon of mass 20 tones is moving with a velocity 2m/s. It is brought to rest by two buffers with spring of 300mm diameter. The maximum deflection of spring is 250mm. the allowable shear stress in the spring material is 600MPa. Design the spring for the buffers.
    c) i) Design a rectangular key for shaft of 50mm diameter. The permissible for key material are 40N/mm2 in shear and 70N/mm2 in crushing.

       ii) State the engineering applications of Acme thread profile and Buttress thread profile with neat sketch.

Q.6 Attempt any FOUR.   **16 Marks**

    a) Show that the efficiency of self locking screw is less than 50%.
    b) Design a compression helical spring with ground ends prepared out of bronze for the valve, used in hydraulic circuit. The spring index is 12. Maximum load on the spring is 100 N. Safe shear stress is 100N/mm2. modulus of rigidity is 4x104 N/mm and the deflection under maximum load is 15mm. find out- (1) diameter of spring wire (2) diameter of spring coil (3) number of spring coils (4) stiffness of spring.

c) A wall bracket shown in figure 1is fixed to a wall by means of four bolts, find the size of bolt. The permissible tensile stress for bolt material is 70 N/mm^2.

Figure 1
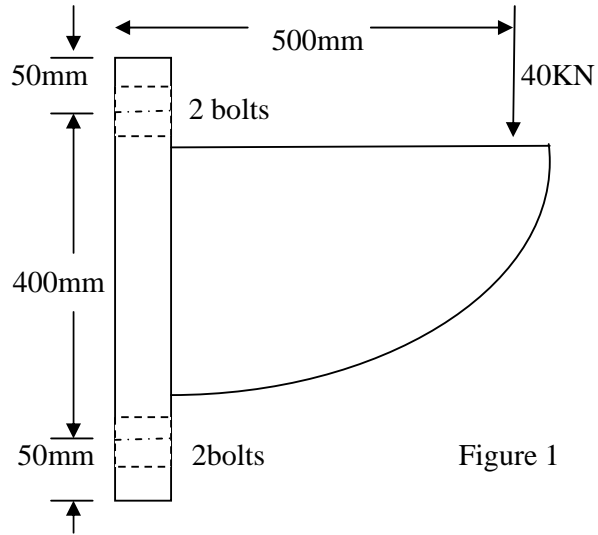
d) Compare Sliding contact bearing and Roller contact bearing on the basis of size, life, coefficient of friction and housing diameter.

e) Write down the procedure for selection of bearing from manufacturers catalogue.