17610

21819

4 Hours / 100 Marks 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.

Marks

1. (A) Solve any THREE of the following : **3 × 4 = 12**

(a) Draw stress-strain diagram for (i) ductile material (ii) brittle material

(b) Define endurance or fatigue limit and draw S-N curve for steel.

(c) Write the design procedure for socket and spigot cotter joint with strength equation (any 4) with neat sketches.

(d) Draw a neat labelled sketch of protective type flange coupling.

(B) Attempt any ONE of the following : **1 × 6 = 6**

(a) Write the general design procedure of bell crank lever.

(b) Determine the diameter of hollow shaft having inside diameter 0.6 times outside diameter. The shaft is driven by 900 mm diameter overhung pulley placed vertically. The weight of pulley is 600 N. The overhung is 250 mm, the tension in the tight and slack side are 2900 N and 1000 N respectively. Assume Fs = 85 N/mm^2.

2. Attempt any TWO of the following : 2 × 8 = 16

(a) Design a Knuckle joint to transmit 150 kN.

The design stresses are $\sigma_{(tensile)} = 75$ MPa.

$\sigma_{(compressive)} = 150$ MPa

$\tau_{Shear} = 60$ MPa

(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) A bracket as shown in fig no. 1 is fixed to the wall by means of four bolts. Find the size of the bolts if $\sigma_t = 70 N/mm^2$ for bolt material

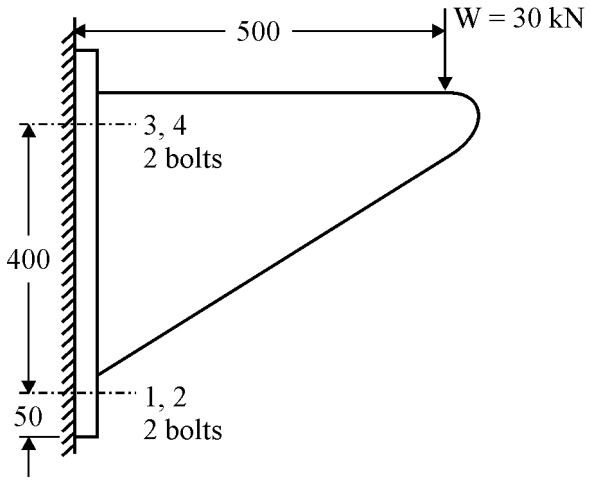

Fig. No. 1

3. Attempt any FOUR of the following : 4 × 4 = 16

(a) Define factor of safety w.r. to mild steel and cast iron.

(b) What is stress concentration ? Illustrate methods to reduce it with sketches.

(c) State the following material specifications.

(i) FeE 230 (ii) FG 200 (iii) 3SC8 (iv) X20Cr18Ni12

(d) State applications of maximum shear stress theory and principal normal stress theory.

(e) What are the advantages and disadvantages of muff coupling (02 each) ?

4. (A) Attempt any THREE of the following : **3 × 4 = 12**

(a) Write the equation with Wahl's factor, used for design of helical coil spring. State the SI units of each term in the equation.

(b) A helical compression spring carries a load of 500 N with a deflection of 25 mm. The spring index may be taken as 8. Assume permissible τ = 350 MPa. Modulus of rigidity N = 84 kN/mm^2, Wahl's factor as $\frac{4C-1}{4C-4}+\frac{0.615}{C}$, where C is spring index. Find the no. of active turns of spring.

(c) A 45 mm diameter shaft is made of steel with yield strength of 400 N/mm^2. A key of size 14 mm wide and 9 mm thick made of steel with yield strength of 340 N/mm^2 is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety as 2.

(d) Two steel plates 120 mm wide and 12.5 mm thick are to be connected together by double transverse fillet weld. The maximum tensile stress for the plate and welding material is not to exceed 70 N/mm^2. Find the length of weld required for maximum static loading.

(B) Attempt any ONE of the following : **1 × 6 = 6**

(a) State the strength equations of double parallel fillet weld and double transverse fillet weld with neat sketches.

(b) State and describe in brief any six ergonomics considerations in design of machine elements.

5. Attempt any TWO of the following : **2 × 8 = 16**

(a) Explain self-locking and overhauling of power screw. State the reasons for using square threads over 'V' threads for power transmission.

(b) Design a close coiled helical compression spring for service load ranging from 2250 N to 2750 N, the axial deflection of the spring of the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 N/mm^2 and modulus of rigidity, G = 84 kN/mm^2. Take design stress 25% of permissible stress for severe condition and intermittent operation.

(c) Give the design procedure of screw and nut of a screw jack with neat sketch.

6. Attempt any FOUR of the following : **4 × 4 = 16**

(a) Explain gear tooth failures (i) Scoring (ii) Pitting :

(b) State any six design considerations while designing the spur gear.

(c) Explain the principle of working of hydrodynamic formal bearing with a neat sketch.

(d) Give classification of bearings.

(e) Write the design steps involved in selection of bearing from manufacturer's catalogue.
