

316357

25226

4 Hours / 70 Marks

Seat No.

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- 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. Attempt any FIVE of the following : 10
- a) Identify the material & its composition
 - i) X 10 Cr18Ni9Mo4Si2
 - ii) X 772 W18Cr4V1
 - b) Give the applications of Knuckle Joint (Any four).
 - c) Classify the shaft coupling.
 - d) Draw thread profiles used in power screw. (Any two)
 - e) Define following terms with respect to springs:
 - i) Spring rate
 - ii) Spring index

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- f) State the H.F. Moore equation, which expresses the effect of a keyway on the strength of a shaft, and explain the meaning of each term in the equation.
- g) Write the equation used to calculate the torque required to overcome friction between a screw and nut when raising a load, and state the meaning of each term in the equation.

2. Attempt any THREE of the following : 12

- a) Explain with neat sketches the Methods of reducing stress concentration in cylindrical members with holes.
- b) Define factor of safety (FOS). Explain it for brittle & ductile material in terms of stress ratio.
- c) Write the design procedure for turn buckle. (Any four steps). Illustrate your answer with appropriate sketches.
- d) Derive the strength equation of a single transverse double parallel fillet weld with neat sketch.
- e) Explain the concept of “Bolts of Uniform Strength” with neat sketches.

3. Attempt any FOUR of the following : 16

- a) The shaft running at 125 r.p.m. transmits 440 kW. Find the diameter of shaft (d) if allowable shear stress in shaft material is 55 N/mm^2 and the angle of twist must not be more than 1° on a length of 16(d). The modulus of rigidity $G = 0.80 \times 10^5 \text{ N/mm}^2$.
- b) Write down the procedure with the help of flow chart for selection of bearing from manufacture's catalogue.

- c) A screw jack is used to lift a load of 50 kN through a maximum lift of 200 mm. The material used for a screw is steel of allowable stresses in tension and compression as 100 N/mm^2 and 50 N/mm^2 respectively. The pitch of screw is 8 mm. The nut is made of phosphor bronze with allowable stresses as 50 N/mm^2 and 45 N/mm^2 in tension and crushing. The allowable shear stress for nut material is 40 N/mm^2 . The allowable bearing pressure between nut and screw is not to exceed 20 N/mm^2 . If the coefficient of friction between screw and nut is 0.14. Design the screw and nut.
- d) A wall bracket, as shown in Figure No. 1, is fixed to a wall by means of four bolts. Find the size of the bolts. The safe stress in tension for the bolt and bracket may be assumed as 70 MPa.

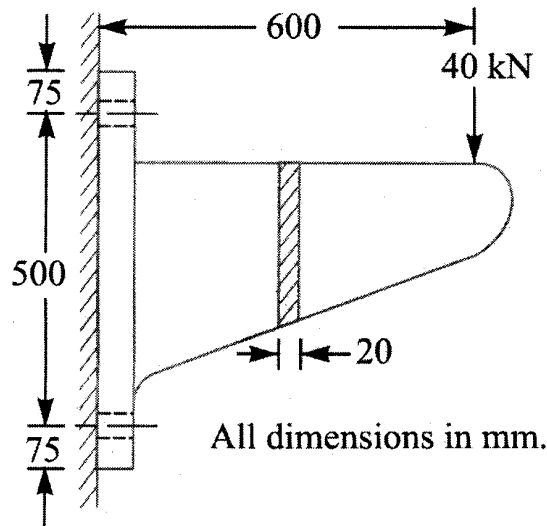


Fig. No. 1

- e) State the significance of Wahl's correction factor in design of spring. Write the equation. State the meaning & SI unit of each term in the equation.
- f) State any four areas of application of springs.

4. Attempt any TWO of the following :

16

- a) An overhang crank with pin and shaft is shown in Figure No. 2. A tangential load of 15 kN acts on the crank pin. Determine the maximum principal stress and the maximum shear stress at the centre of the crankshaft bearing.

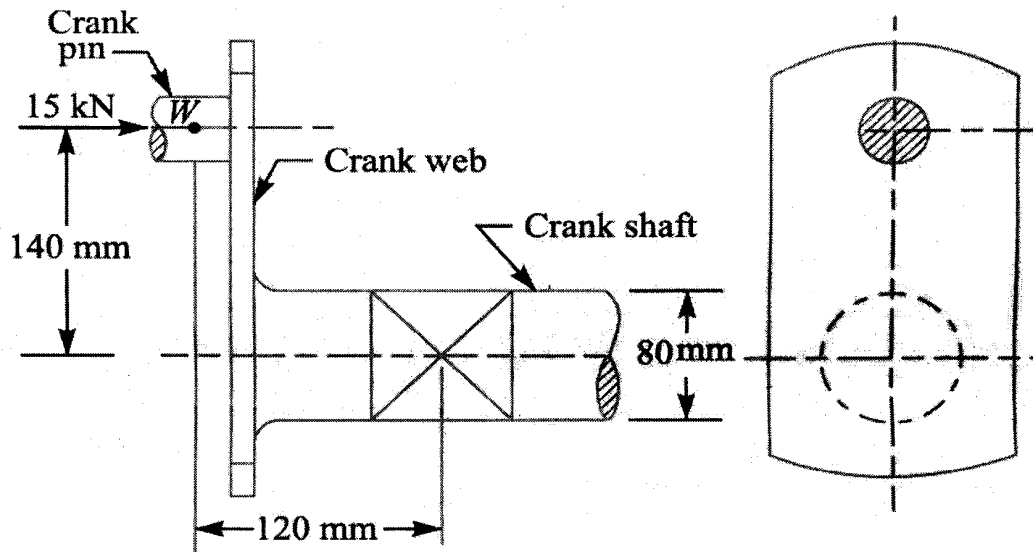


Fig. No. 2

- 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) i) State the advantages and disadvantages of hollow shaft over solid shaft (at least two each).
- ii) Define equivalent torsional moment and equivalent bending moment. State when these two terms are used in the design of shafts.

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

- a) Design and draw muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.
- b) A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8 N/mm^2 ,

Find:

- i) the torque required to rotate the screw;
- ii) the number of threads of nut in engagement with screw.
- c) A railway wagon having 1500 kg mass and moving at 1 m/s velocity dashes against a bumper consisting of two helical springs of spring index 6. The springs, which get compressed by 150 mm while resisting a dash made of spring steel having allowable shear stress of 360 N/mm^2 and modulus of rigidity $8.4 \times 10^4 \text{ N/mm}^2$. Design the helical coil spring with circular cross section of spring wire.
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