22564

12425

04 Hours / 70 Marks Seat No. | | | | | | | | |

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

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

(3) Illustrate your answer 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. Attempt any FIVE of the following: **10**

a) Identify the following engineering material and state its chemical composition:

i) 40 C 10 S 18

ii) X 20 Cr 18 Ni 2

b) Define the following terms of the spring:

i) Compressed length

ii) Pitch of the coil.

c) State the importance of taper on cotter.

d) Classify the shaft couplings.

e) Explain the term 'Overhauling of Screws'.

Marks

f) State any two desirable properties of material used to manufacture spring.

g) Classify the bearings.

2. Attempt any THREE of the following: **12**

a) Explain the factors for selection of material.

b) Differentiate between cotter joint and Knuckle joint. (Any four points)

c) State the effect of keyway on the strength of shaft.

d) A plate, 75 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds. The joint is subjected to a maximum tensile force of 55 kN. The permissible tensile and shear stress in the weld material are 70 and 50 N/mm^2 respectively. Determine the length of each parallel fillet weld.

3. Attempt any THREE of the following: **12**

a) Define the 'Creep'. Explain the phenomenon of creep with the help of Creep curve.

b) State the four function of spring with application of each.

c) The nominal diameter of a triple start threaded square screw is 50 mm, while the pitch is 8 mm. It is used with a collar having an outer diameter of 100 mm and inner diameter as 65 mm. The coefficient of friction at the thread surface as well as at the collar surface can be taken as 0.15. The screw is used to raise a load of 15 kN. Using the uniform wear theory of collar friction, calculate:

i) torque required to raise the load.

ii) torque required to lower the load and

iii) the force required to raise the load, if the applied rod is of 500 mm radius.

d) Define Aesthetics. Explain importance of shape and size used in the aesthetic design.

e) Compare between threaded fastening and welded joints.

Marks

4. Attempt any TWO of the following: **12**

a) Define stress concentration. Enlist the causes of stress concentration and illustrate methods to reduce stress concentration with neat sketches.

b) Design a knuckle joint to transmit 50 kN. The design stresses may be taken as 80 MPa in tension, 40 MPa in shear and 150 MPa in compression.

c) A transmittion shaft made of plain carbon steel 40C8 (Sut = 650 N/mm^2 and Syt = 380 N/mm^2). A belt pulley, 1000 mm diameter is mounted on shaft, which overhangs the left hand bearing by 250 mm. The belts are vertical and transmit power to machine shaft below the pulley. The tension on tight and slack sides of the belts are 3 kN and 1 kN respectively, while the weight of the pulley is 500 N. The angle of wrap of the belt on the pulley is 180° and coefficient of friction is 0.24. Determine the diameter of shaft according to ASME code if k_b = 1.5 and k_t = 1.0

5. Attempt any TWO of the following: **12**

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

Power to be transmitted = 40 kW.

Speed of the shaft = 1000 rpm

Diameter of shaft = 50 mm.

Allowable bearing pressure for rubber bush = 0.45 N/mm^2.
Allowable shear stress for shaft, key and pins = 40 MPa.

Allowable shear stress for cast iron = 15 MPa.

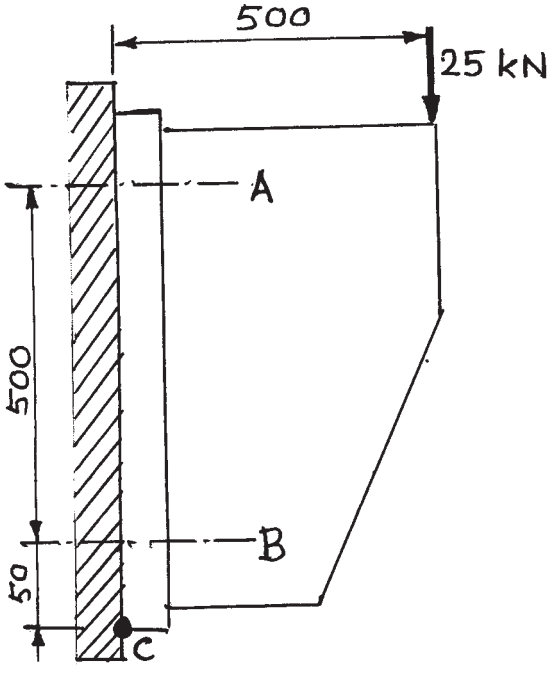
b) Write the steps in design procedure of screw jack (only screw and nut).

c) Write down the procedure for selection of bearing from manufacturer's catalogue.

Marks

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

a) A wall bracket is attached to the wall by means of four identical bolts, two at A and two at B, as shown in Figure No. 1 Assuming that the bracket is held against the wall and prevented from tipping about point C by all four bolts and using allowable tensile stress in the bolts as 35 N/mm^2, determine the size of the bolts on the basis of maximum principal stress theory.



b) A helical compression spring made of circular wire is subjected to an axial force which varies from 2.5 kN to 3.5 kN. Over this range of force, the deflection of the spring is approximately 5 mm. The spring index is 5 and ends of spring are squared and ground. The permissible shear stress for spring wire is 525 N/mm^2 and modulus of rigidity is 81370 N/mm^2. Design the spring and calculate:

i) Wire diameter

ii) Mean coil diameter

iii) Number of active coils

iv) Total number of coils

v) Solid length of spring

vi) Free length of spring.

Marks

c) A belt pulley is fastened to a 90 mm diameter of shaft by means of a key of 25 mm width and 140 mm length. Allowable stress for the shaft and key material are 40 N/mm^2 in shear and 100 N/mm^2 in crushing. Find the power transmitted and depth of key required. When shaft is rotating at 300 rpm.

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