22564

21222

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

15 minutes extra for each hour

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) Define Machine Design.

(b) State materials used for helical spring.

(c) List applications of cotter joint.

(d) State functions of key.

(e) Write applications of power screw.

(f) Define :

(i) Spring index

(ii) Spring stiffness

(g) Classify bearing.

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

(a) Explain steps involved in general design procedure.

(b) Draw neat sketch of knuckle joint & state its strength equation (any four).

(c) Prove that for a square key crushing stress is twice of shearing stress.

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

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

(a) Sketch S-N curve & explain the term endurance limit.

(b) Two steel plates 10 cm wide & 1.25 cm thick are to be connected together by double transverse fillet weld. For static & dynamic loading, take stress concentration factor 1.5 and tensile stress as 7000 N/cm^2. find the length of weld.

(c) The spring of spring balance elongates by 150 mm, when subjected to load of 400 N. The spring index is 6. Take permissible shear stress for the spring material as 540 N/mm^2. Consider the effect of direct shear & wire curvature. Take $G = 8.4 \times 10^4$ N/mm^2.

(d) State the following material specifications :

(i) FeF230

(ii) FG200

(iii) 35C8

(iv) 10C8510

(e) Write strength equations for design of screw spindle of toggle jack.

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

(a) Define stress concentration. List any four methods to reduce it with neat sketches.

(b) Draw a neat sketch of turn buckle. Explain its design procedure.

(c) A shaft is required to transmit 1 MW power at 240 rpm. The shaft must not twist more than 1° on a length of one metre. If the modulus of rigidity for the material of the shaft is 80 kN/mm^2, find diameter of shaft and shear stress induced in it.

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

(a) Sketch protective type flange coupling & explain its design procedure.

(b) A vertical 2-start square threaded screw of 120 mm mean diameter and 24 mm pitch, supports a vertical load of 20 kN. The axial thrust in screw is taken by collar bearing of 300 mm outside and 150 mm inside diameter. Find the force required at the end of the lever, which is 400 mm long in order to lift and lower the load – coefficient of friction for screw & nut is 0.18 and for collar bearing is 0.25.

(c) Write down the procedure for selection of bearing from manufacture's catalogue with suitable example.

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

(a) (i) Explain with neat sketch bolt of uniform strength.

(ii) A cylinder head of steam engine is held in position by M20 bolts. The effective diameter of cylinder is 350 mm and steam pressure is 0.75 N/mm^2. If the bolts are not initially stressed, find the number of bolts required. Take working stress for the bolt material 20 N/mm^2.

(b) Design a closed coil helical spring for a service load ranging from 2207 N to 2698 N. The axial deflection of spring is 6 mm. Assume spring index as 5. The permissible shear stress is 420 N/mm^2 Modulus of rigidity 84×10^3 N/mm^2. Neglect effect of stress concentration.

(c) Compare the weight, strength and stiffness of a hollow shaft of same external diameter as that of solid shaft. The inside diameter of the hollow shaft is half the external diameter. Both the shafts have the same material and length.

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