21718

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**.*

Marks

1. a) Attempt **any three** :   **12**

  a) Define Endurance or fatigue limit and draw typical S-N curve for steel.

  b) Show that efficiency of square threaded power screw is never greater than 50%.

  c) Define stress-concentration. Explain any 4 methods to reduce it with neat sketches.

  d) Write general equation for :
   i) Bending moment
   ii) Torsion Equation and explain the various terms used in it.

 b) Attempt **any one** :   **6**

  a) Explain ergonomics and aesthetics in automobile design.

  b) Define :
   i) Resilience
   ii) Modulus of resilience. Show modulus of resilience on stress-strain diagram for ductile material.

2. Attempt **any two** :   **16**

 a) i) Why square thread is preferred over 'v' thread for power transmission ?   **4**

  ii) Differentiate key and cottor. Also explain why taper is provided on cottor. Give recommended value of taper.   **4**

 b) A helical spring is made from a wire of 8 mm diameter and has outside diameter 90 mm; if the permissible shear stress is 350 N/mm^2 and modulus of rigidity 84 kN/mm^2, find the axial load which the spring can carry and the deflection per active turn.
  i) Neglecting the effect of curvature.
  ii) Considering the effect of curvature.

P.T.O.

c) The pull in the tie rod of an iron roof truss is 50 kN. Design a suitable turn bucule (adjustable screwed joint). The permissible stress are 75 MPa in tension, 37.5 MPa in shear and 90 MPa in crushing. (Use the following data for ISO screw threads for screws, bolts and nut for course series).

Designation	Pitch (mm)	Major or nominal diameter Nut & Bolt d = D (mm)	Effective or pitch diameter Nut & Bolt (dp) mm	Minor or core diameter (dc) mm Bolt	Nut	Depth of thread (bolt) mm	Stress area (mm^2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Course Series							
M36	4	36.000	33. 402	31.093	31.670	2.454	817
M39	4	39.000	36.402	34.093	34.670	2.454	976
M42	4.5	42.000	39.077	36.416	37.129	2.760	1104

3. Attempt **any four** : 16

a) A hollow shaft is to be designed to transmit 600 kW at 110 rpm. The maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and angle of twist in a length of 3 mts not to exceed 1.4 degree. Find external diameter of the shaft if the internal diameter to external diameter is 3/8. Take modulus of rigidity 84 GPa.

b) Prove that for a square key the permissible crushing stress is twise the permissible shear stress.

c) Give the composition of :

   i) $X_2O \, Cr18 \, Ni_2$,

   ii) $35C_8$

   iii) Fe E 230

   iv) FG 200

d) State and explain following theories :

   i) Maximum principle stress theory.

   ii) Maximum shear stress theory.

e) Differentiate between rolling contact and sliding contact bearing on the basis of :

   i) Size

   ii) Life

   iii) Coefficient of friction

   iv) Resistance to shock

17610

Marks

4. a) Attempt **any three** : **12**

    a) Write Lewis equation for the strength of gear tooth. Give the meaning of each term.

    b) Define the terms :

       i) Solid length

       ii) Free length

       iii) Spring index

       iv) Pitch, w.r. to helical compression spring.

    c) Draw symbolic representation of following types of weld :

       i) Double V butt joint

       ii) Double 'U' butt joint

       iii) Single level butt

       iv) Spot

    d) A plate 100 mm wide and 10 mm thick is to be welded by another weld by means of double parallel fillet welds. The plates are subjected to a static load of 80 kN.

    (Take τ permissible = 55 N/mm^2).

 b) Attempt **any one** : **6**

    a) Design a Knuckle joint to transmit 150 kN, the design stress are 75 MPa, 60 MPa and 150 MPa in tension, shear and compression respectively.

    b) Explain the following modes of failure of gear tooth :

     i) Pitting

     ii) Scoring

     iii) Abrasive wear

5. Attempt **any two** : **16**

    a) A closed coil helical spring is used for front suspension of an automobile. The spring has stiffness 90 N/mm with square and ground ends. The load on the spring causes a total deflection of 8.5 mm. By taking permissible shear stress of material as 450 MPa. Find :

      i) Spring wire diameter

      ii) Length of spring

    Assume spring index = 6 and G = 80×10^3 N/mm^2.

    b) Give the design procedure of screw and nut of a screw jack.

    c) Write the general design procedure of a flange coupling (unprotected type).

6. Attempt **any four**: 16

a) Explain:

   i) self locking

   ii) overhauling of a power screw.

b) Explain with neat sketch, the bolt of uniform strength.

c) The spindle of a drilling machine is subjected to a maximum load of 10 kN. Determine the diameter of solid C.I. column of the machine, if tensile stress is limited to 40 N/mm². The distance between axis of spindle and axis of column is 330 mm; also find the direct stress and stress due to bending in the column. (Ref. Fig. No: 1)
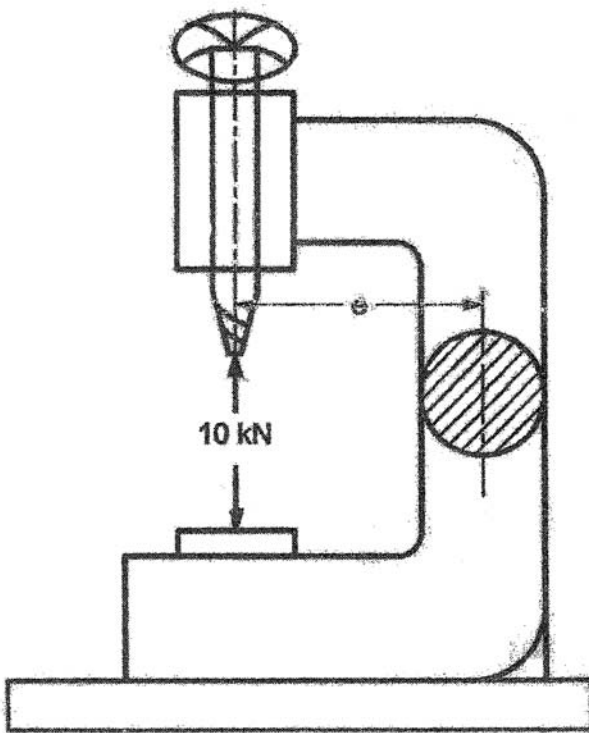

Fig. No. 1 [Q. No. 6(c)]

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

e) State any four advantages and disadvantages of welded joints over screwed joint.

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