P7658

[6180]-180

T.E. (Mechanical/Mechanical S.W)
DESIGN OF MACHINE ELEMENTS
(2019 Pattern) (Semester - I) (302043)

*Time : 2½ Hours]*   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q.No.1 or Q.No. 2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6 and Q.No.7 or Q.No.8. from the following.*
2) *Draw neat labeled diagrams wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of non programmable electronic calculator is permitted.*
5) *Assume suitable standard data, if necessary.*

Q1) a) Derive expression for torque required to raise the loads in case of square threads. **[4]**

     b) Prove that efficiency of self-locking square threads is less than 50%.**[5]**

     c) The nominal diameter of a triple 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 for collar friction, **[8]**

        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 applied at a radius of 500 mm.

OR

Q2) a) Derive the expression for the torque required to overcome collar friction. **[4]**

     b) Define power screw and state its applications and advantages and Disadvantages. **[5]**

     c) A C-clamp, as shown in Figure, has trapezoidal threads of 12 mm outside diameter and 2 mm pitch. The coefficient of friction for screw threads is 0.12 and for the collar is 0.25. The mean radius of the collar is 6 mm. If the force exerted by the operator at the end of the handle is 80 N, **[8]**
        find:

        i) The length of handle;

        ii) The maximum shear stress in the body of the screw and where does this exist; and

        iii) The bearing pressure on the threads.

P.T.O.

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150

A —— A

25

B —— B

$W = 4$ kN
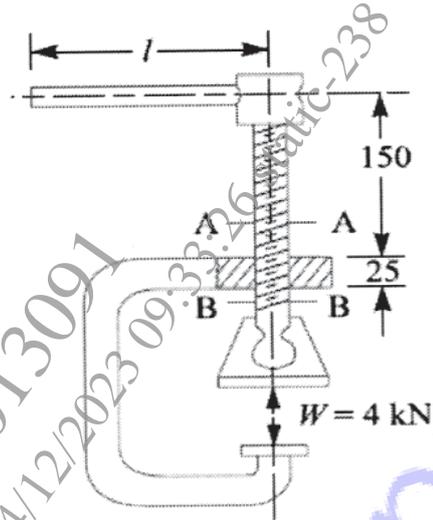
Q3) a) Define and Explain **[4]**

   i) Notch Sensitivity

   ii) Endurance limit.

b) What is stress concentration? What are the causes of stress concentration? **[5]**

c) A plate made of steel 20C8 (S_{ut} = 440 N/mm^2) in hot rolled and normalized condition is shown in Figure. It is subjected to a completely reversed axial load of 30 kN. The notch sensitivity factor q can be taken as 0.8, surface finish factor 0.89, Theoretical stress concentration factor 2.51 and the expected reliability is 90%. The size factor is 0.85. The factor of safety is 2. Determine the plate thickness for infinite life. **[8]**


±30 kN   ±30 kN

50

10ϕ
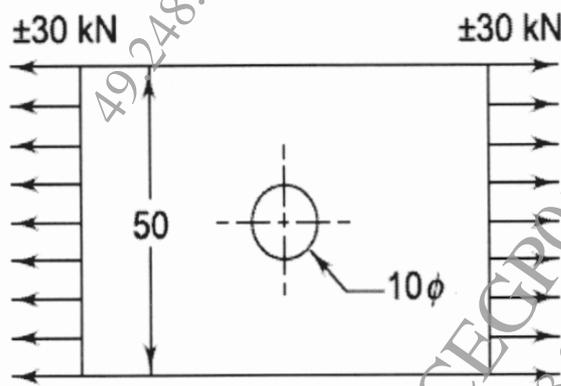
OR

Q4) a) Explain with neat sketch, re-circulating ball screw. State its application. **[4]**

b) With neat Sketch, write a short note on Fatigue Failure. **[5]**

c) A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of 250 N/mm^2. The bar is made of steel 40C8 (S_{ut} = 600 N/mm^2). Calculate the life of the bar for a reliability of 90%. Take K_b = 0.85, K_a = 0.44, K_c = 0.897. **[8]**

Q5) a) Discuss the procedure for designing Axially Loaded Unsymmetrical Welded Sections. **[4]**

b) Discuss in brief strength of parallel fillet welds. **[6]**

c) A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load 40 kN, as shown in Figure. Determine the Maximum shear stress if size of weld is 11.62 mm. **[8]**
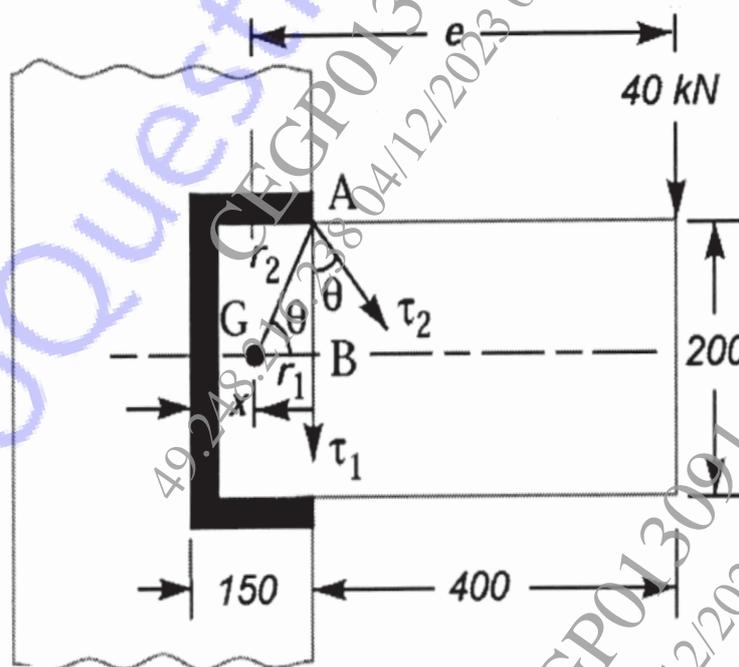
OR

Q6) a) Write a note on: Bolts of uniform strength. **[4]**

b) List the materials used for **[6]**

    i) Lightly loaded small small bolts, nuts and studs.

    ii) High strength bolts.

    iii) Corrosion resistance threaded fasteners.

c) A bracket shown in figure is fixed to steel column by means of four bolts of size M14. A load of W acts on the bracket. Take $\sigma_t = 84$ MPa. If ratio B/t for cross section of the arm bracket is 45. **[8]**

    Determine:

    i) Maximum load on bracket

    ii) Cross section of bolts.
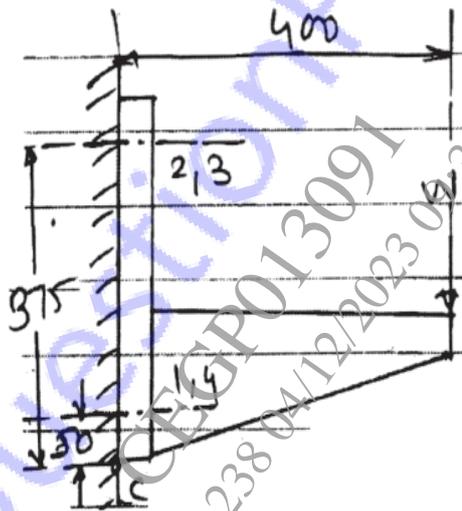
Q7) a) What is surging of springs? What remedial measures you will suggest to avoid the surging? **[4]**

b) Explain with the neat sketch, nipping of leaf spring. **[6]**

c) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm^2, find the axial load which the spring can carry and the deflection per active turn. **[8]**

OR

Q8) a) Explain the following terms for helical spring **[4]**

     i) Active and inactive coils

     ii) Spring index

b) Draw a neat sketch of a multi-leaf spring and show its essential parts. State functions of any two components. **[6]**

c) A mechanism used in printing machinery consists of a tension spring assembled with a preload of 30 N. The wire diameter of spring is 2 mm with a spring index of 6. The spring has 18 active coils. The spring wire is hard drawn and oil tempered having following material properties: Design shear stress = 680 MPa; Modulul of rigidity = 80 kN/mm²**[8]** Determine :

     i) the initial torsional shear stress in the wire;

     ii) Spring rate; and

     iii) The force to cause the body of the spring to its yield strength.

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