Total No. of Questions : 8]

SEAT No. :

PA-1530

[Total No. of Pages : 4

[5926] - 150

T.E. (Mechanical Sandwich Engg.)

DESIGN OF MACHINE ELEMENTS

(2019 Pattern) (Semester - I) (302043)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data, if necessary.***

UNIT - I

Q1) a) The lead screw of a lathe has Acme threads of 50 mm outside diameter and 8 mm pitch. The screw must exert an axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 r.p.m. Determine **[8]**

i) the power required to drive the screw; and

ii) the efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar. Also state the condition of screw.

b) Derive expression for torque required to raise the loads in case of square threads. **[5]**

c) Derive and expression for maximum efficiency of square threads. **[4]**

OR

Q2) a) 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: 1. the torque required to rotate the screw; 2. the stress in the screw; and 3. the number of threads of nut in engagement with screw. Also state the condition of screw. **[8]**

P.T.O.

b) What are the advantages of trapezoidal threads over square threads? State the meaning of each term involved in designation T r40 × 14(p7). **[5]**

c) Explain self-locking and over-hauling property of screw. Prove the condition for screw to be self-locking. **[4]**

UNIT - II

Q3) a) A rotating bar made of steel 45C8 (S_{ut} = 630 MPa) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 315 N/mm^2. Calculate the fatigue strength of the bar for a life of 90,000 cycles. **[8]**

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

c) Explain with neat sketch the Gerber curve, Soderberg and Godman lines? **[5]**

OR

Q4) a) A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm^2. The corrected endurance limit stress for the machine component is 270 N/mm^2. The ultimate tensile strength and yield strength of the material are 600 and 450 N/mm^2 respectively. Find the factor of safety using **[8]**

i) Gerber theory

ii) Soderberg line

iii) Goodman line. Also, find the factor of safety against static failure.

b) What is modifying factor to account for stress concentration? Explain Endurance strength Modifying factors? **[5]**

c) Explain : **[5]**

i) Notch Sensitivity

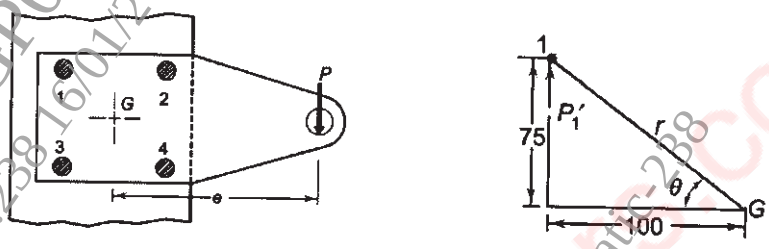
ii) Fatigue life

iii) Endurance limit.

iv) Modified Goodman diagram.

UNIT - III

Q5) a) The structural connection shown in Figure is subjected to an eccentric force P of 10 kN with an eccentricity of 500 mm from the CG of the bolts. The centre distance between bolts 1 and 2 is 200 mm, and the centre distance between bolts 1 and 3 is l50 mm. All the bolts are identical. The bolts are made from plain carbon steel 30C8 (S_{yt} = 400 N/mm^2) and the factor of safety is 2.5. Determine nominal diameter of the bolts. **[8]**

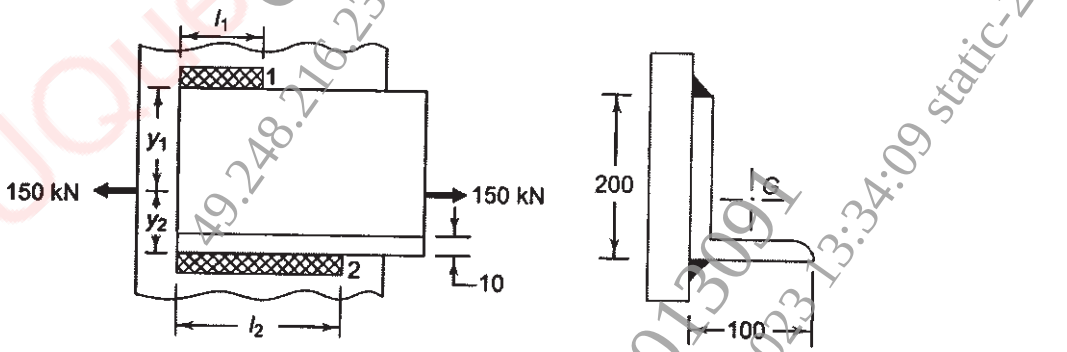


b) Write a note on : Bolts of uniform strength. **[5]**

c) Discuss the advantages and disadvantages of welded joints. **[5]**

OR

Q6) a) An ISA 200 × 100 × 10 angle is welded to a steel plate by means of fillet welds as shown in Figure. The angle is subjected to a static force of 150 kN and the permissible shear stress for the weld is 70 N/mm^2. Determine the lengths of weld at the top and bottom. **[8]**



b) Discuss in brief strength of parallel fillet welds. **[5]**

c) Prove that stress on the throat is equal to the ratio of force on weld to 0.707 × s × 1. **[5]**

UNIT - IV

Q7) a) Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity, G = 84 kN/mm^2. Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils. **[7]**

b) Explain the following terms for helical spring **[6]**

i) Active and inactive coils

ii) Spring index

iii) Spring rate

c) Explain with the neat sketch, nipping of leaf spring. **[4]**

OR

Q8) a) Design a helical compression spring for a pressure relief valve using following data; Operating pressure = 14.5 Bar; Valve lift at 18% pressure rise = 7 mm ; Diameter of valve = 37 mm ; Limiting mean coil diameter = 36 mm ; Maximum shear stress = 465 MPa ; G = 85 GPa, Clash clearance = 15 % of Maximum deflection of spring, End style of spring is square and ground std. Take spring wire diameter 6, 6.5, 7, 7.5, 8, 8.5 (mm). **[7]**

b) What is mean by spring surge and what is its effect? **[5]**

c) Explain shot peening. **[5]**