

[58701-1022

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

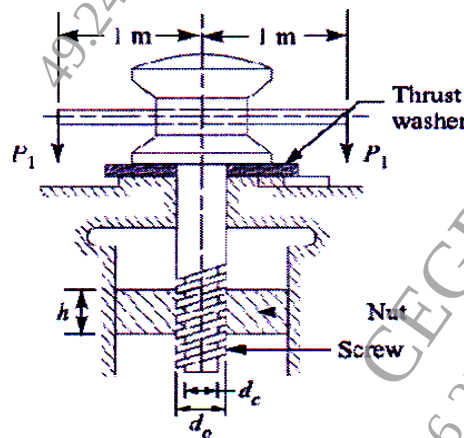
Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

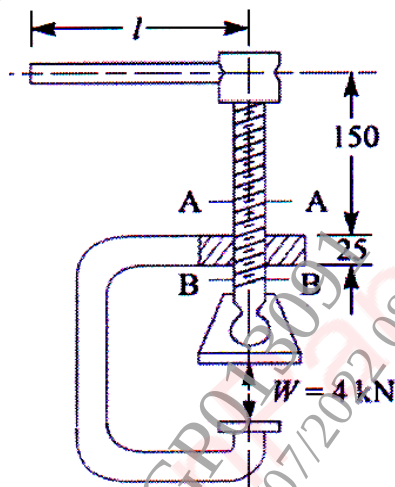
- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Draw neat labeled diagrams wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable/Standard data if necessary.
- 5) Use of non programmable electronic calculator is permitted.

- Q1)** a) What are the different types of screw threads used for power screw? [4]
 b) Derive the expression for the torque required to overcome collar friction. [5]
 c) A sluice gate weighing 18 kN is raised and lowered by means of square threaded screws, as shown in Fig. The frictional resistance induced by water pressure against the gate when it is in its lowest position is 4000 N. The outside diameter of the screw is 60 mm and pitch is 10 mm. The outside and inside diameter of washer is 150 mm and 50 mm respectively. The coefficient of friction between the screw and nut is 0.1 and for the washer and seat is 0.12. Find: i) The maximum force to be exerted at the ends of the lever raising and lowering the gate, ii) Efficiency of the arrangement, and iii) Number of threads and height of nut, for an allowable bearing pressure of 7 N/mm². [8]



OR

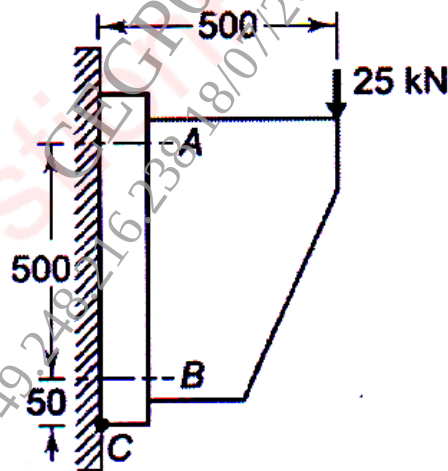
- Q2) a)** Describe the term: Virtual coefficients of friction. [4]
- b)** Explain self-locking and over-hauling property of screw. Prove the condition for screw to be self-locking. [5]
- c)** A C-clamp, as shown in Figure, has trapezoidal threads of 12 mm outside diameter and 2 mm pitch. The coefficient 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, 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. [8]



- Q3) a)** Write a short note on; Modified Goodman diagram. [4]
- b)** Write a short note on Fatigue Failure. [5]
- c)** A spherical pressure vessel, with a 500 mm inner diameter, is welded from steel plates. The welded joints are sufficiently strong and do not weaken the vessel. The plates are made from cold drawn steel 20C8 ($S_{ut} = 440 \text{ N/mm}^2$ and $S_{yt} = 242 \text{ N/mm}^2$). The vessel is subjected to internal pressure, which varies from zero to 6 N/mm^2 . The expected reliability is 50% and the factor of safety is 3.5. The size factor is 0.85. The vessel is expected to withstand infinite number of stress cycles. Calculate the thickness of the plates. Take $K_a = 0.82$, $K_b = 0.85$, $K_c = 1$. [8]

OR

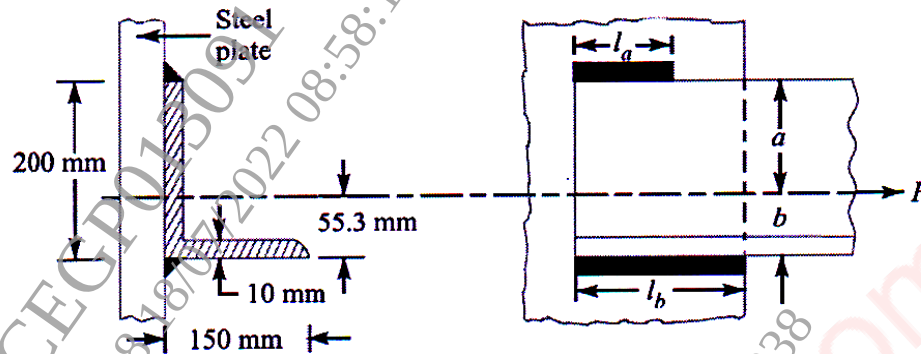
- Q4) a)** Define and explain Notch Sensitivity [4]
- b)** What is the difference between the Gerber curve, Soderberg and Goodman lines? [5]
- c)** A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm². The corrected endurance limit stress for the machine component is 270 N/mm². The ultimate tensile strength and yield strength of the material are 600 and 450 N/mm² respectively. Find the factor of safety using (i) Gerber theory (ii) Soderberg line (iii) Goodman line Also, find the factor of safety against static failure. [8]
- Q5) a)** What are the assumptions made in the design of welded joint? [4]
- b)** Discuss the procedure for designing an eccentric loaded welded joint. [6]
- c)** 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. Assuming that the bracket is held against the wall and prevented from tipping about the point C by all four bolts and using an allowable tensile stress in the bolts as 35 N/mm², determine the size of the bolts on the basis of maximum principal stress theory. [8]



OR

- Q6) a)** State the advantages and disadvantages of welded joints. [4]
- b)** Explain with neat sketch, following screw fasteners [6]
- i) Through Bolts ii) Tap Bolts iii) Cap Screws

- c) A $200 \times 150 \times 10$ mm angle is to be welded to a steel plate by fillet welds as shown in Figure. If the angle is subjected to a static load of 200 kN, find the length of weld at the top and bottom. The allowable shear stress for static loading may be taken as 75 MPa. [8]



- Q7) a) Define following terms : [4]
 i) Solid length
 ii) Spring index
 iii) Active and Inactive coils
 iv) Spring Rate
 b) Explain A.M. Wahl's factor and state its importance in the design of helical springs. [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) How will you find whether the given helical spring is a compression spring or tension spring? [4]
 b) Explain with the neat sketch, nipping of leaf spring. [6]
 c) Design a valve spring of a petrol engine for the following operating conditions: Spring load when the valve is open = 400 N; Spring load when the valve is closed = 250 N; Maximum inside diameter of spring = 25 mm; Length of the spring when the valve is open = 40 mm; Length of the spring when the valve is closed = 50 mm; Maximum permissible shear stress 400 MPa. [8]

