

**CIVIL ENGINEERING – PAPER - I**

**Time : 3 Hours**

**Max. Marks : 200**

**Note :** 1. Attempt any five (05) questions. All questions carry equal marks.  
 2. Indian Standard Code of Practice for Prestress Concrete IS 1343-1980 is required

1. Determine the ultimate moment of resistance for the T-beam section of effective width of 850 mm shown below (Fig. 1). Assume M20 grade concrete and Fe 250 grade steel. (40)

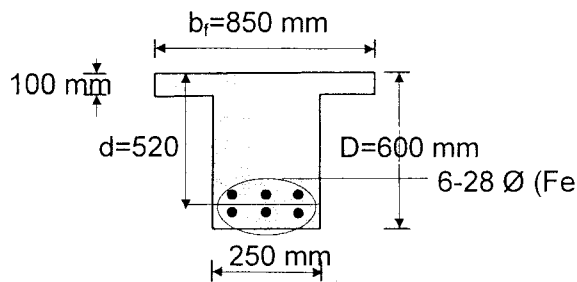


Fig. 1

2. Design shear-reinforcement for the doubly reinforced beam shown in Fig. 2. The beam is simply supported with a total centre-to-centre span of 6.0 m. Use 8mm $\phi$  vertical stirrups made of Fe 250 steel. The shear at the bar-cutoff point (860 mm from centre of support) also needs to be checked. The concrete is of M25 and flexural steel of Fe 415. (40)

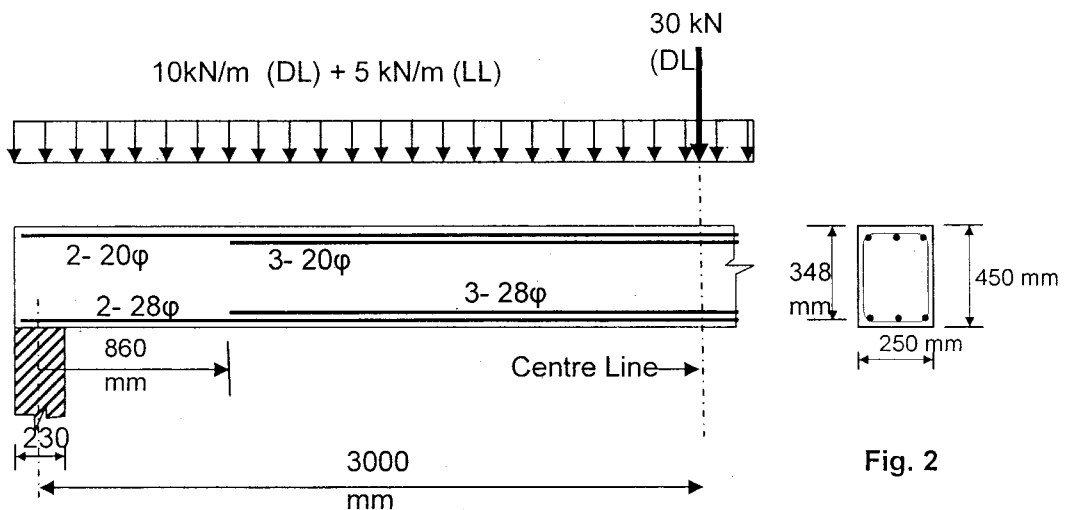


Fig. 2

3. A pretensioned beam 200 mm wide and 300 mm deep is prestressed by 10 wires of 7 mm diameter initially stressed to  $1200 \text{ N/mm}^2$ , with their centroids located 100 mm from the soffit. Find the maximum stress in concrete immediately after transfer, allowing only for elastic shortening of concrete.
- If the concrete undergoes further shortening due to creep and shrinkage while there is relaxation of 5 % steel stress, estimate the percentage loss of stress in the wires, using the IS code (IS 1343-1980) regulations, and the following data (40)

$$E_s = 210 \text{ kN/mm}^2$$

$$E_c = 5700 (f_{cu})^{1/2}$$

$$f_{cu} = 42 \text{ N/mm}^2$$

$$\text{Creep coefficient } \phi = 1.6$$

$$\text{Total residual shrinkage strain} = 300\text{E-}6$$

4. Generate the stiffness matrix for the beam with respect the coordinates shown in the Fig.3 (40)

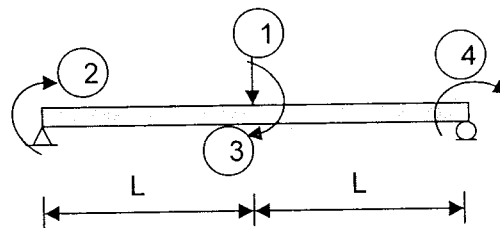


Fig. 3

5. Find the collapse load for the portal frame shown in Fig. 4 (40)

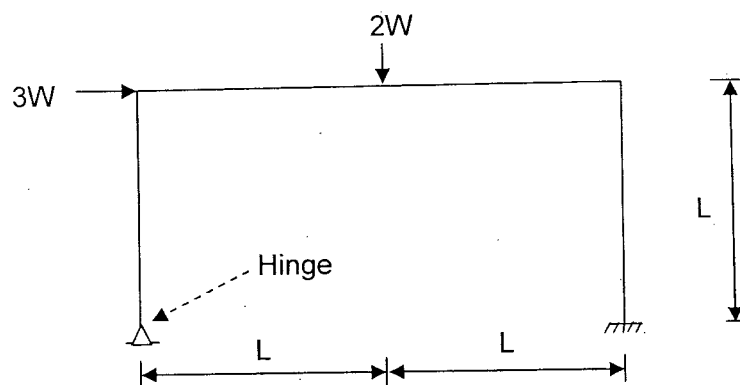


Fig. 4

6. A 300 I.S.F 8 mm is used as a tension member in a lattice girder. It is connected to a 12 mm gusset plate by 18 mm  $\phi$  hand-driven rivets. The yield stress of steel is  $250 \text{ N/mm}^2$ . Calculate the maximum force that the member can carry, if (40)
- Chain riveting is done as shown in Fig. 5a
  - Zig-zag riveting is done as shown in Fig. 5b

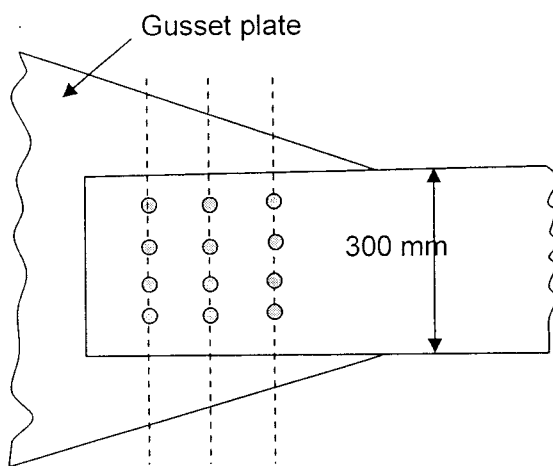


Fig. 5b) Zig-zag riveting

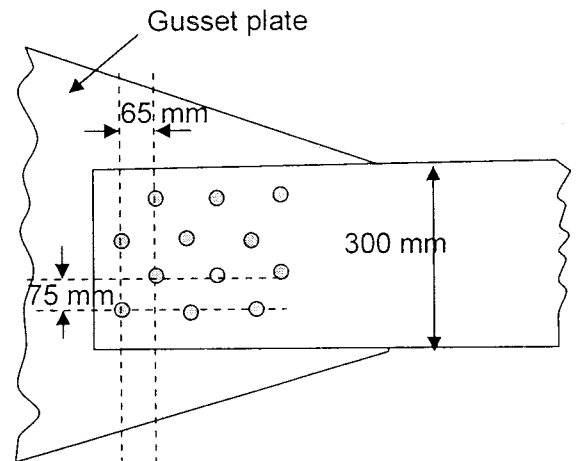


Fig. 5a) Chain riveting

7. A rectangular block  $250 \text{ mm} \times 100 \text{ mm} \times 80 \text{ mm}$  is subjected to axial load as follows: (40)
- 480 kN tensile in the direction of its length
  - 900 kN tensile on the  $250 \text{ mm} \times 80 \text{ mm}$  faces
  - 1000 kN compressive on the  $250 \text{ mm} \times 100 \text{ mm}$  faces
- Assuming Poissons's ratio as 0.25, and Young's modulus to be  $2 \times 10^5 \text{ N/mm}^2$ , evaluate the following.

- Volumetric strain
- The change in volume of the block due to the application of the above load
- Modulus of rigidity and bulk modulus for the material