Total number of printed pages: 03

Programme(UG)/8th/UCE802

2024

DESIGN OF STRUCTURES - III

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

Use of IS:456-2000, IS:800-2007 and IS:883:1994 are allowed

1. Design a longitudinally spanning dog-legged RCC stair for a residential building shown in figure-1. The stair is supported on 300mm x 400mm RCC beam at the ends of the landings. The stair is provided with 12 numbers of riser of dimension 150mm and 11 numbers of treads of dimension 280mm. Take live load as 3.0 kN/m^2 and floor finish as 0.75 kN/m^2. Use M20 concrete and Fe 500 steel. 20

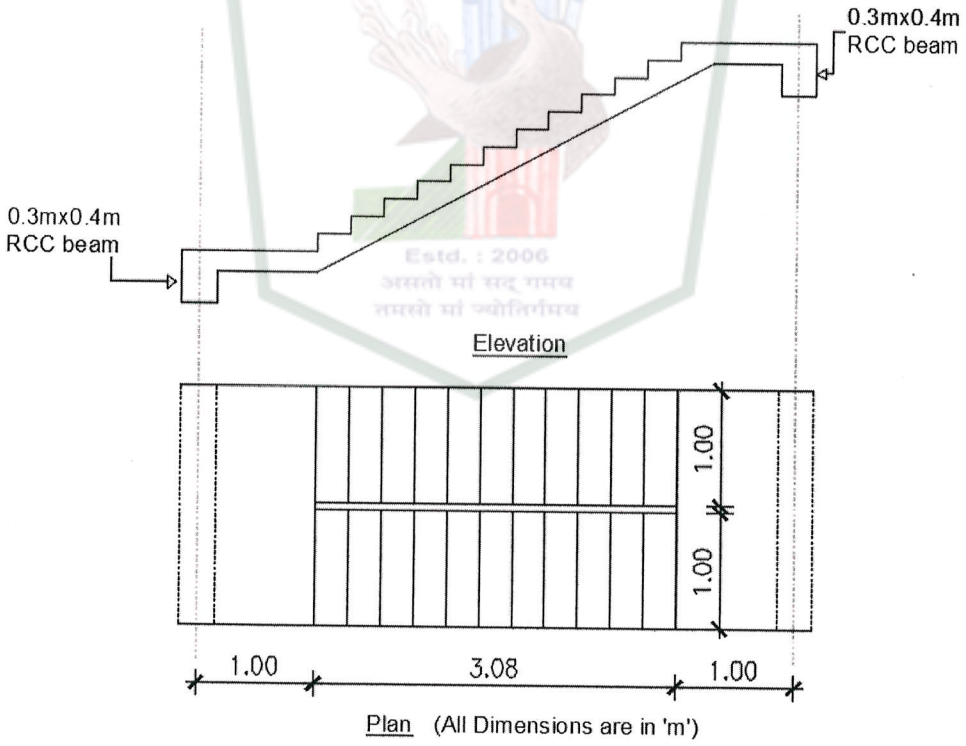

Figure-1

2. State the assumptions made in cantilever method of frame analysis. And analyze the frame shown in figure-2 by portal method. Take EI as constant for all the members. 20

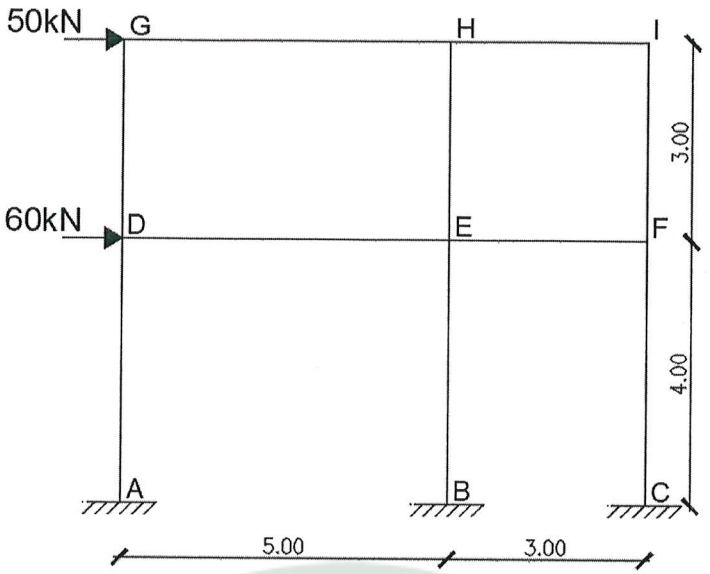

Figure-2

3. Design a RCC circular water tank of 80,000 litres capacity. The wall of the tank is rigidly jointed with the base and is resting on a firm ground. The height of the tank is 5m. Use M30 grade of concrete and Fe 415 steel. 20

4. Design a steel footbridge for the following data. Assume, suitably for any missing data. 20

   (a) Span 15m c/c
   (b) Cross-girder spacing = 2.25 m c/c
   (c) Clear working width between main girder = 1.75 m c/c
   (d) Live load = 4.0 kN/m^2
   (e) Flooring – Timber plank of Hollock species

5. a) State the assumptions made in PSC. 04

   b) A symmetrical I-section PSC beam carries an imposed load of 10 kN/m. The span of the beam is 5m, top and bottom flanges have dimensions of 350mm wide and 80mm thick. The self-weight of the beam is 2.0 kN/m. Thickness of web is 80mm. Overall depth of the beam is 500mm. The effective prestressing force of 450kN is applied and is located at 70mm above the soffit of the beam. Estimate the stresses at the centre of span of the beam for the following load conditions: 16

      a) Prestress + Self weight

      b) Prestress + Self weight + IL

6. a) Explain the losses in PSC due to the following: 10

   (a)Elastic Deformation, (b)Shrinkage of concrete, (c)Creep of concrete and (d)Relaxation of steel

b) A prestressed concrete beam of 500mm deep and 300mm wide is prestressed by 10 wires of 7mm diameter initially stressed to 1200N/mm^2. Their centroids are located at 100mm from the soffit. Find the maximum stress in concrete immediately after transfer allowing only for elastic shortening of concrete. If concrete undergoes further shortening due to creep and shrinkage while the relaxation in steel is 5% of steel stress, estimate the final % loss of stress in wires. Take E_s = 210 kN/mm^2, E_c = 36 kN/mm^2, Creep coefficient = 1.6 and shrinkage strain = 3 x 10^{-4}. 10

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