53 (CE 801) DGST

2018

DESIGN OF STRUCTURE - III

Paper : CE 801

Full Marks : 100

Time : Four hours

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

*Answer **any five** questions.*

1. *(a)* Why is it necessary to use high grade of concrete and steel in prestressed concrete? What is the aim of prestressing a structural member? Differentiate between pre-tensioning and post-tensioning. Briefly discuss the advantages and disadvantages of prestressed concrete.

2+2+4+4=12

(b) A prestressed concrete beam of rectangular section 375mm wide and 750mm deep has a span of 12m. The effective prestressing force is 1520kN at an eccentricity of 150mm. The dead load of the beam is 7kN/m and the beam has to carry a live load of 12.75kN/m. Determine the extreme stresses in concrete–

(a) at the midsection without the action of live load.

(b) at the mid section with the action of the live load. 8

2. (a) Mention the various losses in the prestress concrete and discuss them briefly. 10

(b) A prestressed concrete beam 150×350 is subjected to an initial stress of 1200N/mm^2 at an eccentricity of 75mm through five cables of 50mm^2 each. Two cables are parabolic with eccentricity of 60mm above the centroid at supports. Another two cables are also parabolic with zero eccentricity at supports. Last cable is straight with constant eccentricity. Find the loss in each cable.

Also find the total loss. Take span 7.5m, $E_s = 210kN/mm^2$ and $E_c = 35kN/mm^2$. 10

3. (a) What are the various types of devices used for tensioning steel ? Differentiate between pre-tensioning and post-tensioning. 4+4=8

(b) A post-tensioned beam of rectangular section (250×450)mm is prestressed by four cables having cross-sectional area 37.8mm^2 each. All the cables are straight and located at 90mm from the bottom with initially stressed upto 1750N/mm^2. Wires are tensioned successively There is a slip of 10mm at jack. Find the magnitude of final prestressing force available if loss due to clastic deformation of concrete is also considered. Span of beam is 15m. 12

4. (a) Explain the basic structural behaviour between stair slabs spanning transversely and stair slabs spanning longitudinally. 5

(b) Design a dog-legged staircase for an office building given the following data :

height between floors = 3.2m

Width of flight = landing width = 1.25m

Live load = 5.5kN/m^2

Finishes load = 0.8kN/m^2

Assume the stairs to be supported as 230mm thick masonry walls at the outer edges of the landing, parallel to the risers. Use $m25$ concrete and *Fe* 415 steel. Assume moderate exposure condition. 15

5. The beam along longitudinal direction having four spans, such that span of two exterior ones is 5.5m and that for interior ones are 5.1m and 6m for the one near the left span and right span respectively. Dead load and superimposed loads tranferred to the beam are 10kN/m and 8kN/m respectively. Storey height is 3.25m. Design the beam for bending moment and shear force. 20

6. Design an open rectangular tank of size $5m \times 3m \times 2.5m$ deep resting on a fixed ground. Use $m25$ grade concrete and *Fe* 415 steel. Assume *any* missing data. 20