53 (CE 801) DEST–III

2015

DESIGN OF STRUCTURE-III

Paper : CE 801

Full Marks : 100

Time : Three hours

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

Answer ***any five*** *questions.*

1. What is the aim of prestressing a structural member ? Why high strength-concrete is necessary in prestressed concrete ? Differentiate between pretensioning and post tensioning. A prestressed concrete beam of rectangular section 375*mm* wide and 750 *mm* deep has a span of 12·50*m*. The effective prestressing force is 1520*kN* at an eccentricity of 150*mm*.The dead load of the beam in 7*kN*/*m* and the beam has to carry a live load of 12·50 *kN*/*m*. Determine the extreme stresses in concrete

   (a) At the mid section without the action of live load.

(b) At the mid section with the action of the live load. 20

2. (a) Mention the various losses in prestress and also find their expressions.
A prestressed concrete beam 150×350 is subjected to an initial stress of $1300\,N/mm^2$ at an eccentricity of $75mm$ through five cables of $50\,mm^2$ 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. And also find the total loss. Take span $= 8m$, $E_s = 210\,kN/mm^2$; $E_c = 35\,kN/mm^2$. 4+8=12

(b) A pre-tension beam of rectangular section $(80\times120)\,mm$ is to be designed to support concentrated loads of $4kN$ each at $\frac{1}{3}$rd point over an effective span of $3m$. If permissible stress in concrete are limited to 0 and $1{\cdot}4\,N/mm^2$ tension at transfer and working load respectively. If $3mm$ diameter wires initially stressed to $1400\,N/mm^2$ are used, find the number of wires required and eccentricity of prestressing force assuming 20% loss. 8

3. Explain the basic difference in structural behaviour between stair slabs spanning transversely and stair slabs opening longitudinally'.

Design a dog-legged staircase for an office building, given the following data :

height between floors = $3{\cdot}2m$;

riser = $160mm$, tread=$270mm$

No. of risers in a flight = 12

width of flight = loading width = $1{\cdot}25m$

live load = $5{\cdot}0kN/m^2$;

finishes load = $0{\cdot}6\ kN/m^2$.

Assume the stairs to be supported on $230mm$ thick masonry walls at the outer edges of the landing, parallel to the risers. Use $M20$ concrete and $Fe\,415$ steel. Assume mild exposure conditions. 5+15=20

4. The beam along longitudinal direction having four spans, such that span of two exterior ones is $5{\cdot}5m$ and that for interior ones are $5{\cdot}1m$ and $6m$ for the one near the left span and right span respectively. Dead load and superimposed loads transferred to the beam are $10{\cdot}5kN/m$ and $8{\cdot}4kN/m$ respectively. Storey height is $3{\cdot}2m$. Design the beam for bending moment and shear force by code recommendations for moment and shear co-efficients. 20

5. An RCC tank having a storage capacity of 120*cum* rests on firm ground. The tank is circular in plan. The wall is monolithic with the base slab. Height of water should be maintained at 2·6*m* and there should be a free-board of minimum 25*cm*. Design the tank wall. Use M20 grade concrete and *Fe* 415 steel. 20

6. The maximum bending moment and shear force induced on a rectangular beam of $250 \times 500\,mm$ is 125*kNm* and 80*kN*. If the beam is subjected to a twisting moment of 80*kNm*, design the beam using IS 456 : 2000. 20