53 (CE 801) DGST

2017

DESIGN OF STRUCTURE–01

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. What do you mean by prestressed concrete ? Write the advantages and disadvantages of prestressed concrete. Differentiate between pre-tensioning and post-tensioning members. A prestressed concrete beam of rectangular section 300*mm* wide and 650*mm* deep has a span of 12*m*. The effective prestressing force is 1500*kN* at an eccentricity of 150*mm*. The dead load of beam is 8*kN/m* and the beam has to carry a live load of 12*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.

2+4+4+10=20

(a) Write notes on losses of prestressed concrete. A pre-tensioned beam 250*mm* wide and 300*mm* deep is prestressed by 12 wires each 7*mm* diameter initially stressed to $1200 N/mm^2$ with their centroids located 100*mm* from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep shrinkage and relaxation using IS : 1343-80 code with the following data :

Relaxation of steel stress = 90 N/mm^2

$E_s = 210\ kN/mm^2$

$E_c = 35\ kN/mm^2$

Creep co-efficient (ϕ) = 1·6

Residual shrinkage strain = 3×10^{-4}

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(b) Explain with diagram the pressure line or thrust line. A prestressed concrete beam, 350*mm* wide by 700*mm* deep section uniform throughout span has a simply supported span of 7 metre. The beam is pretensioned through linearly bent tendon having an eccentricity of 200*mm* at mid-span and zero at end, prestressing force being 1200*kN*. Find extreme fibre stresses at mid span section if *udl* of 50*kN/m* excluding self *wt.* acts throughout the span. Locate the position of resultant thrust at midspan and quarter span section. 3+7=10

3. Explain the basic difference in structural behaviour between stairs slab spanning transversely and stairs slab spanning longitudinally.

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

height between the floors = $3{\cdot}3m$

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

No. of risers in a flight = 12

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

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

finishes load = $1kN/m^2$

Assume the stairs to be supported on $230mm$ thick masonry walls at the outer edges of the landing, parallel to the risers. Use M25 concrete and Fe 415 steel. Assume mild exposure conditions. 3+17=20

4. Write notes on simplified (approximate) methods of analysis. A continuous beam having four spans such that the two exterior spans are $4{\cdot}6m$ each and the interior spans are $4{\cdot}1m$ each. The beam is subjected to a dead load of $20kN/m$ and a live load of $15kN/m$ throughout the length. Design the beam for bending moment and shear force by code recommendations for moment and shear-co-efficients. 3+17=20

b) Design a circular tank with fixed base for capacity of 500,000 *litres*. The depth of water is to be 4·5*m*, including a free board of 200*mm*. Use M25 grade concrete and Fe 415 steel. 8
