53 (CE 501) DGST-I

2019

DESIGN OF STRUCTURE–I

Paper : CE 501

Full Marks : 100

Time : Three hours

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

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

1. *(i)* Why do we use less factor of safety for steel as compare to concrete ? 2

   (ii) What is the difference between under-reinforced and over-reinforced section ? Why is it not preferred to design over-reinforced section ? 5

Contd.

(iii) An RCC beam $300mm \times 650mm$ is reinforced with 4 bars of $20mm$ diameter. The beam is carrying a load of $40kN/m$ including its own weight over an effective span of $4m$. The effective cover is $40mm$. Determine allowable moment and ultimate moment of resistance. 13

2. (i) State the assumptions of limit state of collapse (flexure). Define doubly reinforced beam section. Write the steps involved in determining allowable and ultimate moment of resistance of a doubly reinforced section. 8

(ii) A rectangular reinforced concrete beam, located inside a building in a coastal town, is simply supported on two $250mm$ thick and $7m$ apart masonry walls centre to centre. The beam has to carry, in addition to its own weight, a distributed live load of $10kN/m$ and a dead load of $6kN/m$, and also a concentrated dead load of $30kN$ placed at the mid-span point. Design the flexural reinforcement of the beam, given that its size is limited to $250mm \times 400mm$. Assume Fe 415 steel. 12

3. (a) A simply supported RCC beam $200mm \times 450mm$ effective depth is reinforced with 4 bars of $25mm$ diameter on tension side. The beam is carrying a load of $10kN/m$ over a span of $7m$. Design the vertical shear reinforcement at support and mid-span. Use M25 concrete and Fe 415 steel. 15

(b) What do you understand by development length and shear reinforcement? What is the necessity of providing shear reinforcements? 5

4. What is compression member? Define slenderness ratio of a column. Based on slenderness ratio classify column. Design a circular column having an axial load of $2500kN$. The column has an unsupported length of $3.2m$ and both ends of the column is effectively held in position but not restrained against rotation. Use M25 concrete and Fe 415 steel. 20

5. A restrained concrete slab of size $4m \times 5m$ having 2 long edges discontinuous. Design the slab if the live load is $5kN/m^2$ and finish surface is $1kN/m^2$. Use M25 concrete and Fe 415 steel. 20

6. Design an isolated footing for a column of size 300×400mm carrying an axial load of 1200kN. The safe bearing capacity of the soil is 150kN/m^2. Use M25 concrete and Fe 415 steel. 20