53 (CE 501) DGST

2014

DESIGN OF STRUCTURE-I

Paper : CE 501

Full Marks : 100

Time : Four hours

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

*Answer **any five** questions from **six**.*

1. *(a)* How does creep of concrete affect the modular ratio ? A reinforced concrete beam of rectangular section has the cross-sectional dimensions of 300×600. Assuming M20 grade concrete and *Fe* 415 grade steel, 2+8=10

   (i) compute the stresses due to an applied moment of 50 *kNm*. Check the calculations using the flexure formula.

   (ii) determine the allowable moment capacity of the section under service loads. Also determine the corresponding stresses in concrete and steel.

Contd.

(b) Explain the concept of 'transformed section', as applied to the analysis of reinforced concrete beams under service loads. Design a reinforced concrete beam section of width 250*mm* to resist a bending moment of 60*kNm*. Use M25 grade concrete and *Fe* 415 steel. 3+7=10

2. A rectangular reinforced concrete beam, located inside a building in a moderate exposure condition, is simply supported on two 230*mm* thick and 6-*m* apart masonry walls centre to centre. The beam has to carry, in addition to its own weight, a distributed live load of 10*kN/m* and a dead load of 5 *kN/m* and a concentrated dead load of 30*kN* placed at the midspan point. Design the beam section given that its size is limited to 250 *mm*×450 *mm*, for maximum moment at midspan. Assume *Fe* 415 steel. 20

3. (a) A rectangular beam width of 350*mm* and effective depth of 500*mm* has a factored shear force 400 *kN* at the support and 100*kN* at midspan. The tension steel consists of 4 nos. of 25*mm* diameter bars extending upto the support. Assuming M25 grade concrete and *Fe* 415 steel, design vertical stirrups at supports and midspan section. 12

(b) What are the mechanisms by which bond resistance is mobilised in reinforced concrete ? Explain clearly the difference between flexural bond and development bond. 5

(c) Define 'development length'. What is its significance ? 3

4. Explain clearly the difference in the behaviour of one-way slabs and two-way slabs. Design a simply supported slab to cover a hall with internal dimensions $4{\cdot}0m \times 6{\cdot}0m$. The slab is supported on masonry walls $230mm$ thick. Assume a live load of 3 kN/m^2 and a finish load of $1kN/m^2$. Use M20 concrete and *Fe* 415 steel. Assume that the slab corners are free to lift up. 20

5. Design a circular column having an axial load of 2000 *kN*. The unsupported length of the column is 3·3 *metre*. Design the column using helical reinforcement. Assume M25 grade concrete and *Fe* 415 steel. 20

6. Design and isolated footing for a column of size $300mm \times 400mm$ carrying an axial load of $1200kN$. The safe bearing capacity of the soil is $150kN/m^2$. Use M20 grade concrete and *Fe* 415 steel. 20