53 (CE 501) DGST-I

2018

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.*

1. Determine the allowable moment capacity and the ultimate moment of resistance of the beam section of $350mm \times 700mm$ size, $30mm$ clear cover and is reinforced with $2-25\phi$ and $2-28\phi$ bars, considering
   (i) M20 concrete and Fe415 steel
   (ii) M25 concrete and Fe250 steel. 20

2. What is T-beam ? How can you determine the neutral axis depth of a T-beam ? A doubly reinforced section of size $250mm \times 400mm$ with clear cover $30mm$ is reinforced as : $3-20\phi$ as compression reinforcement and $3-28\phi$ as tensile reinforcement. Assuming M20 concrete and Fe415 steel, determine ultimate and allowable moment of resistance. 4+16=20

3. What are the advantages and disadvantages of providing large clear cover to reinforcement in flexural members ? Design a one-way slab, with a clear span of 6·0*m*, simply supported on $20mm$ thick masonry walls, and subjected to a live load of $3kN/m^2$ and a surface finish load of $1kN/m^2$, using Fe415 steel. Assume that the slab is subjected to *(a)* mild exposure *(b)* very severe exposure, and compare the results. 20

4. *(a)* Define shear reinforcement with diagram. A rectangular beam section having udl of $30kN/m^2$ excluding self weight of beam has a sectional size of $350mm$ and $550mm$ effective depth. The tension steel consists of 4 nos. of $25mm$ diameter bars extending upto support. Assuming M25 grade concrete and Fe415 steel, design vertical stirrups at support and midspan section. 16

(b) Define development length and what are its advantages. 4

5. Explain the need for corner reinforcement in two-way rectangular slabs whose corners are prevented from lifting up. Design a restrained slab of size $4{\cdot}0m \times 5{\cdot}0m$ having two adjacent edges discontinuous. The slab is supported on masonry walls $230mm$ thick. Assume a live load of $3kN/m^2$ and a finish load of $1kN/m^2$. Use M25 concrete and Fe415 steel and consider the slab corners to be prevented from lifting up. 20

6. (a) Why does the code specify limits to the minimum and maximum reinforcement in columns ? A column of size $400 \times 500mm$ has an unsupported length of $3m$ and is subjected to a load of $2500kN$. Design a column for M25 concrete and Fe 415 steel considering both ends of the column as effectively held in positions but not restrained against rotation. 15

(b) Define bond. What is flexural and anchorage bond ? Explain the mechanism of bond resistance. 5

7. Design an isolated footing to support a column of size of $300mm \times 500mm$ to carry an axial load of $2000kN$. The safe bearing capacity of soil is $130kN/m^2$. The width of the footing is limited to $3m$. Use M20 concrete and Fe415 steel. 20
