53 (CE 501) DGST

2013

(December)

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 **out of seven**.*

1. *(a)* A rectangular beam section of size $300mm \times 500mm$ effective depth is reinforced with 4 nos. of $20mm$ diameter bars as tensile reinforcement and 4 nos. of $12mm$ diameter bars as compression reinforcement. Determine the allowable moment of resistance and stresses induced in extreme fibre concrete, compression steel and tension steel if the grade of concrete and steel are *M20* and Fe415 respectively. 10

Contd.

(b) Design a reinforced concrete beam section of width 250*mm* to resist a Bending Moment of 60*kNm*. Use *M*25 grade concrete and *Fe*415 grade steel. 10

2. A reinforced concrete beam of size 300*mm*×500*mm* effective depth is subjected to a service bending moment of 150 *kNm*. Design the beam section assuming *M*25 grade concrete and *Fe*415 steel. Design stresses at specific strains for *Fe*415 steel are given below in the table :

Strain	Stress *(Mpa)*	Strain	Stress *(MPa)*	Strain	Stress *(Mpa)*
0	0	0.00192	324.8	≥ 0.0038	360.9
0.00144	288.7	0.00241	342.8		
0.00163	306.7	0.00276	351.9		

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3. (a) A rectangular beam width of 350*mm* and effective depth 500*mm* has a factored shear force of 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 *M*25 grade concrete and *Fe*415 grade steel, design vertical stirrups at supports and midspan section. 15

(b) What are the mechanisms by which bond resistance is mobilised in reinforced concrete ? Explain in brief. What are the different types of bond ? Define them. 5

4. Design a 1 way slab of clear span 4 *meters* simply supported on 230*mm* thick masonry walls and subjected to a live load of $4kN/m^2$ and surface finish of $1kN/m^2$. Assume moderate exposure condition and *Fe*415 steel.

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5. Design a restrained concrete slab to cover a room with internal dimensions of $4.0m \times 5.0m$ and 230*mm* thick brick walls all around. Assume a live load of $3kN/m^2$ and a finish load of $1kN/m^2$. Use *M*20 grade concrete and *Fe*415 grade steel. Assume that the slab corners are prevented from lifting up. Assume mild exposure conditions. 20

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

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7. Design a circular column having an axial load of 200*kN*. The unsupported length of the column is 3.3 *meter*. Use *M25* grade concrete and *Fe*415 grade steel.

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