Code : 011617

B.Tech 6th Semester Exam., 2018

DESIGN OF CONCRETE STRUCTURE—I

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer of the following (any *seven*) : 2×7=14

(a) The temperature reinforcement in the vertical slab of a T-shaped RC retaining wall is

(i) not needed

(ii) provided equally on inner and front faces

(iii) provided more on inner face than on front face

(iv) provided more on front face than on inner face

(b) Diagonal tension in a beam

(i) is maximum at neutral axis

(ii) decreases below the neutral axis and increases above the neutral axis

(iii) increases below the neutral axis and decreases above the neutral axis

(iv) remains same

(c) The purpose of reinforcement in pre-stressed concrete is

(i) to provide adequate bond stress

(ii) to resist tensile stresses

(iii) to impart initial compressive stress in concrete

(iv) All of the above

(d) To minimize the effect of differential settlement, the area of a footing should be designed for

(i) dead load only

(ii) dead load + live load

(iii) dead load + fraction of live load

(iv) live load + fraction of dead load

(e) When shear stress exceeds the permissible limit in a slab, then it is reduced by

(i) increasing the depth

(ii) providing shear reinforcement

(iii) using high strength steel

(iv) using thinner bars but more in number

(f) Critical section for shear in case of flat slabs is

(i) at a distance of effective depth of slab from periphery of column/drop panel

(ii) at a distance of $d/2$ from periphery of column/capital/drop panel

(iii) at the drop panel of slab

(iv) at the periphery of column

(g) The centroid of compressive force from the extreme compression fiber in limit state design lies at a distance of

(i) $0 \cdot 367 x_u$

(ii) $0 \cdot 416 x_u$

(iii) $0 \cdot 446 x_u$

(iv) $0 \cdot 573 x_u$

where x_u is the depth of neutral axis at the limit state of collapse.

(h) For a reinforced concrete section, the shape of shear stress diagram is

(i) wholly parabolic

(ii) wholly rectangular

(iii) parabolic above neutral axis and rectangular below neutral axis

(iv) rectangular above neutral axis and parabolic below neutral axis

(i) A beam curved in plan is designed for

(i) bending moment and shear

(ii) bending moment and torsion

(iii) shear and torsion

(iv) bending moment, shear and torsion

(j) Minimum pitch of transverse reinforcement in a column is

(i) the least lateral dimension of the member

(ii) sixteen times the smallest diameter of longitudinal reinforcement bar to be tied

(iii) forty-eight times the diameter of transverse reinforcement

(iv) lesser of the above three values

2. (a) What is the purpose of serviceability requirement? 7

(b) Distinguish among the working stress method, ultimate load design and limit state design. 7

3. (a) Calculate the maximum moment that can be sustained by a beam with $b = 250$ mm, $d = 400$ mm and $A_{st} = 3600\ mm^2$. Assume $f_{ck} = 20$ MPa and $f_y = 415$ MPa. 7

(b) Under what circumstances are doubly reinforced beams used? What are the advantages of doubly reinforced beams over singly reinforced beams? 7

4. A rectangular beam of size 250 mm width and 500 mm effective depth is reinforced with four bars of 25 mm diameter. Determine the required vertical shear reinforcement to resist factored shear force of (a) 80 kN, (b) 300 kN and (c) 600 kN. Consider concrete of grade M-20 and steel of grade Fe-415. 14

5. Design a floor slab for an interior room with clear dimensions of 3·0 m × 8 m for a building located in Mumbai. The slab is resting on 230 mm thick masonry walls. Assume live load as 3·0 kN/m^2 and dead load due to finish, partition and so on as 1·2 kN/m^2. Use M-20 concrete and Fe-415 steel. 14

6. A T-beam floor consists of 150 mm thick R-C slab monolithic with 300 mm wide beams. The beams are spaced at 3·5 m center to center and their effective span is 6 m. If the superimposed loads on the slab is 5 kN/m^2, design an intermediate T-beam. Use M-20 mix and Fe-250 grade steel. 14

7. Design the torsional reinforcement in a rectangular beam section 350 mm wide and 750 mm deep subjected to an ultimate twisting moment of 140 kN-m combined with ultimate BM of 200 kN-m and ultimate SF of 110 kN. Assume M-25 concrete and Fe-415 grade of steel. 14

8. Design a reinforced concrete column which is 4·5 m long and fixed at both ends. It is carrying an axial load of 2000 kN. Use M-25 concrete and Fe-415 steel. 14

9. Design a rectangular beam section subjected to an ultimate moment of 120 kN/m. Use concrete M-20 and stee Fe-415. Adopt limit state method. 14