Total No. of printed pages = 3

CE 131503 (NR)

Roll No. of candidate

24/2/22 2021

B.Tech. 5th Semester End-Term Examination

CE

DESIGN OF STRUCTURES — I

(New Regulation)

Full Marks – 70 Time – Three hours

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

Note :

1. Question 1 is compulsory.
2. Solve any *four* from question 2 to question 7.
3. Use of IS : 460-2000 is allowed.
4. Assume any missing data.

1. Write the correct answer for the following questions : (10 × 1 = 10)

 (i) In case of slabs, to prevent cracking of the edges, the corners should be provided with ————

 (ii) Overall depth of beam can be calculated by adding effective depth and ————

 (iii) Staircases used in public buildings should have a maximum riser of ————

 (iv) ———— sections shall be preferred to ensure ductile failure of RC beams.

 (v) The maximum strain in the tension reinforcement in the section at failure should not be less than ————

 (vi) A simply supported beam, reinforcing bars provided near support is intended to resist ————

 (vii) Neutral axis depth factor for a balanced section can be expressed as ————

 (viii) In an under reinforced concrete beam, the actual depth of neutral axis is ———— than the critical depth of neutral axis.

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(ix) A simply supported beam, reinforcing bars provided near support is intended to resist ————

(x) Considering IS codal provision, the critical section for two-way shear is at a distance ———— from the face of the column.

2. (a) Define characteristic strength. Why is the cube strength different from the cylindrical strength for the same grade of concrete?

(b) What is modulus of elasticity? Write the empirical expression for the modulus of elasticity recommended by IS 456-2000.

(c) Explain the difference between working stress method, ultimate load method and limit state method. (4+2+9 = 15)

3. (a) Explain the concept of transformed section as applied to the analysis of reinforced concrete beam under service loads.

(b) Analyse a rectangular beam section of 300mm wide and 600 mm effective depth, reinforced with 4 bars of 25mm diameter on the tension side and 3 bars of 20 mm diameter on the compression side with an effective cover of 30mm. The grade of reinforcement steel used is Fe415 and that of the concrete mix is M20. Determine

(i) The limiting moment of resistance of the section.

(ii) The safe uniformly distributed load the beam can support in addition to its self weight over an effective span of 9 m. (5+5+5 = 15)

4. (a) What is the purpose of retaining wall? List different types of retaining walls encountered in practice.

(b) Design a cantilever type of R.C.C. retaining wall to retain leveled earthen embankment 3m high above ground level. Density of earth is 16000 N/m^3 and its angle of repose is 30°. The safe bearing capacity of soil at a depth of 1m below ground level is 100 kN/m^2. The coefficient of friction between soil and concrete may be taken as 0.55. Use M 15 grade of concrete and mild steel reinforcement in the design. (3+12 = 15)

5. (a) Differentiate the behavior of a slender column from that of the short column.

(b) Design the reinforcement in a column of size 400 mm x 600 mm subjected to an axial load of 2000 kN under service dead load and live load. The column has an unsupported length of 4.0 m and effectively held in position and restrained against rotation in both ends. Use M 25 concrete and Fe 415 steel. (3+12 = 15)

6. A square footing having dimension 1500 mm × 1500 mm is made to transfer a characteristic load of 600 kN to the ground through a square column of side 350 mm. Consider weight of footing as 10% of characteristic axial load. The factor of safety is taken as 1.5. The overall depth of footing is 350mm. The clear cover is 40mm. the diameter of reinforcement provided is 12mm. Calculate:

(a) The one-way shear force due to soil reaction at the critical section for design.

(b) The two-way shear force due to soil reaction at the critical section for design.

(c) The bending moment due to soil reaction computed at the required section for design. (5+5+5 = 15)

7. (a) A dogged-legged staircase is consisted of steps with tread and riser depth as 180 mm and 130 mm respectively addition to that it has a loading slab one side of its flights and its width is 1200 mm. If the floor to floor height of a buildings is 2860 mm, Calculate the total number of tread (T) and riser (R) in the staircase.

(b) A dogged-legged staircase is consisted of steps with tread and riser depth as 250 mm and 150 mm respectively. Addition to that it has a total 11 number of riser and loading slab at one side of its flights and its width is 1200 mm. The landing slab is parallel to the risers. Calculate the effective span of the staircase. (7+8 = 15)