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CE 131503

Roll No. of candidate | | | | | | | | | | |

2017

B.Tech. 5th Semester End-Term Examination

Civil

DESIGN OF STRUCTURES – I

Full Marks – 100 Time – Three hours

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

Use of IS: 456-2000 is allowed.

Answer Question No. 1 and any *Six* from the rest.

Assume any missing data.

1. Choose the correct option from the following: (10 × 1 = 10)

   (a) The property of the fresh concrete, in which the water in the mix tends to rise to the surface while placing and compacting, is called

   (i) segregation

   (ii) bleeding

   (iii) buckling

   (iv) creep

[Turn over

(b) 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

(c) For a cantilever of effective depth of 0.5 m, the maximum span to satisfy vertical deflection limit is

(i) 3.5 m

(ii) 4 m

(iii) 4.5m

(iv) 5m

(d) The moment of resistance of an over-reinforced section is determined on the basis of

(i) Tensile force developed in steel

(ii) Compressive force developed in concrete

(iii) Both (i) and (ii)

(iv) None of these

(e) The bond between steel and concrete is mainly due to

(i) Pure adhesive resistance

(ii) Frictional resistance

(iii) Mechanical resistance

(iv) All of these

(f) While designing a reinforced concrete pole as a column, it is considered as

(i) Fixed at both ends

(ii) Hinged at both ends

(iii) Fixed at one end and hinged at the other end

(iv) None of above

(g) The purpose of lateral ties in short reinforced concrete columns is to

(i) Facilitate construction

(ii) Facilitate compaction of concrete

(iii) Avoid buckling of longitudinal bars

(iv) Increase the load carrying capacity of the column

(h) A reinforced slab, built monolithically with the supporting columns and is reinforced in two or more directions, without any provision of beams, is called a

(i) Two way slab

(ii) Flat slab

(iii) Continuous lab

(iv) Circular slab

(i) The objective of providing foundation to the structure is to

(i) Distribute the load of superstructure over a large bearing area

(ii) Prevent the lateral movement

(iii) Increase the stability of structure

(iv) All of the above

(j) 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

2. (a) Answer the following questions: (5 × 2 = 10)

(i) What are the different limit states used for RCC design as per Indian Standard codes?

(ii) Calculate the development length for *20 mm* diameter bar as compression reinforcement in limit state method for Fe 500 steel and M25 grade concrete.

(iii) What is the maximum and minimum tensile reinforcement required for a reinforced concrete beam section as per IS: 456: 2000?

(iv) Differentiate between 'One way' and 'Two way' slab.

(v) What is the difference between strut and column?

(b) What are the different design philosophies used for RCC design? Briefly explain the 'Ultimate load Method'. (5)

3. (a) What are the different types of foundation? (3)

(b) Design an isolated footing supporting a column of size *450 mm* × *450 mm*. The axial load on the column is 1400 kN and the allowable bearing pressure under side of the footing at a foundation depth of *2.5 m* is *125 kN/m²*. (12)

4. (a) What are the stability and design criteria for RCC retaining wall? (3)

(b) Design a cantilever retaining wall to retain an earth embankment 4 m high above the ground level. The density of earth is *18 kN/m³* and its angle of repose is *30°*. The embankment is horizontal at top. The safe bearing capacity of the soil is taken *200 kN/m²* and the coefficient of friction between soil and concrete is *0.5*. Adopt M20 grade of concrete and Fe 415 HYSD bars. (12)

5. (a) What is reinforcement splicing? What are the different types? (3)

(b) A column with an unsupported length *3.2 m* is subjected to an axial load of *1200 kN*. The top end of the column is held in position at both the axes and the bottom end is held in position as well as restrained against rotation at both the axes. Design the column for both longitudinal and lateral reinforcement using M20 grade of concrete and Fe 415 steel. (12)

6. (a) A singly reinforced RCC beam section of width *300 mm* and depth *600 mm* (effective depth) is reinforced with *4-25 Φ* bar as tensile reinforcement. Adopting M20 grade of concrete and Fe 415 steel compute the maximum stresses in concrete and steel for an applied moment of *100 kN*. Also calculate the allowable moment of resistance of the section. (7)

(b) A T-beam section having flange width *1300 mm*, width of the web *325 mm*, depth of the flange *100 mm*, effective depth *600 mm* is reinforced with *8-25 Φ* bar as tensile reinforcement. If the grade of concrete is M20 and steel Fe 415 HYSD bars, evaluate the maximum moment that can be applied to the section. (8)

7. (a) What do you mean by 'bond' and 'anchorage' in RCC design? (3)

(b) A cantilever beam of span *5 m* is carrying an udl of *10 kN/m* throughout its span. If the beam has cross section *300 mm* × *600 mm*, design the beam using M25 and steel Fe 500 HYSD. Also design the shear reinforcement for the beam. (12)

8. (a) Differentiate among balanced, under reinforced and over reinforced beam section. (3)

(b) Design a RCC beam section of size *300 mm* × *600 mm* to carry a moment of *200 kN*. Using M15 grade of concrete and Fe 415 steel. (12)

9. (a) What are the different structural behavior of stair case? (2)

(b) Design a reinforced concrete slab of size 4 m × 6 m, which is carrying a superimposed load of 4 kN/m^2. Use M20 grade concrete and Fe 415 steel. Take floor finish as 1kN/m^2. The slab has two adjacent edges discontinuous. (13)
