Total No. of printed pages = 7

END SEMESTER EXAMINATION, NOVEMBER- 2018

Semester – 5th

Subject Code : CT-504

DESIGN OF RCC STRUCTURE

Full Marks – 70

Time – Three hours

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

PART – A

Marks – 25

Answer *all* questions.

1. Choose the correct answers from the following questions : 1×10=10

   (i) If the depth of actual neutral axis is more than critical neutral axis, the section is

   (a) balanced

   (b) over-reinforced

   (c) under-reinforced

   (d) transformed

[Turn over

(ii) The modular ratio of concrete is given by the formula

(a) $280/2\sigma_{cbc}$ (b) $280/4\sigma_{cbc}$

(c) $280/3\sigma_{st}$ (d) $280/3\sigma_{cbc}$

(iii) Value of factor of safety for concrete is

(a) 1.5 (b) 1.75

(c) 2.25 (d) 2

(iv) For quality control of Portland cement, the test essentially done is

(a) tensile strength

(b) setting time

(c) soundness

(d) All the three options.

(v) The neutral axis of a T-beam exists in

(a) within the flange

(b) at the bottom edge of the slab

(c) below the slab

(d) All the above.

(vi) In an under-reinforced section

(a) concrete is fully stressed

(b) steel is fully stressed

(c) Both (a) and (b)

(d) None of the above.

(vii) For Fe 415 steel, permissible stress is

(a) 230 N/mm^2 (b) 250 N/mm^2

(c) 200 N/mm^2 (d) 150 N/mm^2

(viii) Limiting depth of neutral axis corresponds to

(a) balanced section

(b) under-reinforced section

(c) over-reinforced section

(d) None of the above.

(ix) The moment of resistance of an over reinforced section is taken as

(a) more than $M_{u,lim}$

(b) less than $M_{u,lim}$

(c) equal to $M_{u,lim}$

(d) None of the above.

(x) If $l_y / l_x > 2.0$, the slab is

(a) two way slab (b) continuous slab

(c) flat slab (d) one-way slab

2. Fill up the blanks : 1×10=10

(a) Torsion reinforcement should not be provided at the corners which are ——— at both edges.

(b) The modulus of elasticity of concrete is given by ———.

(c) If the two-way slab has torsion reinforcement at the corners, it is called as ———.

(d) As per IS 456 : 2000, the expression of the development length is given by ———.

(e) Hanger bars do not qualify as compression reinforcement in doubly reinforced beams, when its area is less than or equal to ——— percentage.

(f) The design strength of materials is obtained by dividing the characteristics strength by ———.

(g) The effective depth of a column when both the ends are effectively held in position but restrained against rotation is ———.

(h) The distance from the centre of the bar to the extreme bottom fibre of a beam section is known as ———.

(i) The code IS 456 : 2000 limits the failure strain of concrete to ———.

(j) The ratio of effective length to its lateral dimension in a long column is ——— than 12.

3. Write true or false : 1×5=5

(a) The maximum percentage of steel in a RCC column is 8%.

(b) Shear reinforcement is provided to resist diagonal tension.

(c) The partial safety factor for steel is 1.5.

(d) A column is regarded as long column if the ratio of its effective length and lateral dimensions exceeds 15.

(e) Resistance to compression, measured in terms of the aggregate crushing value is called hardness.

PART – B

Marks – 45

4. An RCC beam 300 mm × 600 mm effective depth is reinforced with 4 bars of 20 mm diameter. The beam has to carry a superimposed load of 50 kN/m including self weight of the beam, over an effective span of 5m. Find the actual stresses developed in steel and concrete. Find the compressive stress in concrete at 50 mm from top of the beam and draw bending stress diagram. Also find the allowable moment of resistance. 9

5. Define doubly reinforced beam section. A beam section of size 250 mm × 500 mm total depth is reinforced as 3-28 Ø as tensile reinforcement and 2-20 Ø as compression reinforcement. Assuming M25 grade concrete and Fe 415 steel, determine allowable and ultimate moment of resistance. 9

6. (a) Define development length. What is its significance ? Explain the different types of bond. What are the mechanisms by which bond resistance is mobilised in reinforced concrete ? 5

   (b) What do you mean by unsupported length and effective length ? Explain in brief with diagrams, one-way and two-way slabs ? 4

7. What do you mean by working stress method and limit state method ? Design a balanced reinforced concrete beam section of width 250 mm to resist an external bending moment of 110 kNm. Assume M20 grade concrete and Fe 415 steel. 4+5=9

8. Define shear reinforcement with figure. A reinforced concrete beam of size 250 mm × 500 mm effective depth is reinforced with 4 numbers of 20 mm diameter bar as tensile reinforcement. The shear reinforcement consists of 2 legged 8 mm diameter stirrup @ 150 mm c/c spacing. Estimate the shear capacity of the section for M20 grade concrete and Fe 415 steel. 9