Total No. of printed pages = 8

DESIGN OF RCC STRUCTURE

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

PART – A

Marks – 25

1. Choose the correct answers from the following questions : $1 \times 10 = 10$

   (a) The maximum area of tension reinforcement in beams shall not exceed

   (i) 4%   (ii) 0.155

   (iii) 3%   (iv) 5%

[Turn over

(b) An RCC column is treated as long if its slenderness ratio is greater than

(i) 30   (ii) 40

(iii) 50   (iv) 60

(c) As per IS 456:2000, the pH value of water should not be

(i) less than 6   (ii) equal to 6

(iii) not less than 6   (iv) equal to 7

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

(i) tensile strength

(ii) setting time

(iii) soundness

(iv) All the three options.

(e) The risk of segregation is more for

(i) wetter mix

(ii) larger proportion of maximum size aggregate

(iii) coarser grading

(iv) All of the above

(f) The maximum ratio of span to depth of a simply supported slab and spanning in one direction is

(i) 35   (ii) 30

(iii) 25   (iv) 20

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

(i) within the flange

(ii) at the bottom edge of the slab

(iii) below the slab

(iv) All the above.

(h) The Young's modulus of elasticity of steel is

(i) 150 kN/mm²   (ii) 200 kN/mm²

(iii) 250 kN/mm²   (iv) 275 kN/mm²

(i) Spacing of stirrups in a rectangular beam, is

(i) kept constant throughout the length

(ii) decreased towards the centre of the beam

(iii) increased at the ends

(iv) increased at the centre of the beam.

(j) The advantage of reinforced concrete is due to

    (i) monolithic character

    (ii) fire resisting and durability

    (iii) economy because of less maintenance cost

    (iv) All of the above.

2. Fill up the blanks :   1×10=10

(a) Strength resistance to compression, measured in terms of the aggregate crushing value is _____.

(b) As per IS 456 : 2000, modular ratio is determined by the formula _____.

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

(d) The design strength of materials is obtained by dividing the characteristics strength by _____.

(e) The neutral axis depth (X_u) for the condition, $X_u \leq X_{u,max}$ of rectangular beam section is _____.

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

(g) The code IS 456:2000 limits the failure strain of concrete to _____ under flexure.

(h) The neutral axis depth of T-beam is given by _____.

(i) An RCC column is treated as short column if its slenderness ratio is less than _____.

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

3. Write true or false : (any *five*)   1×5=5

(a) The maximum ratio of span to depth of a slab simply supported and spanning in two directions, is 35.

(b) The steel generally used in R.C.C work is stainless steel.

(c) In a singly reinforced concrete beam, plane section transverse to the centre line of the beam before bending remain plane after bending.

(d) A T-beam behaves as a rectangular beam of a width equal to its flange if its neutral axis remains below the slab.

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

(f) As the percentage of steel increases, depth of neutral axis increases.

PART – B
Marks – 45
Answer any *five* questions.

4. Define modular ratio and cracking moment in a reinforced concrete. How does the creep of concrete affect the modular ratio ? A reinforced concrete beam section of size 300 mm × 500 mm effective depth is reinforced with 4 numbers of 16 mm diameter bars. Assuming M20 grade concrete and Fe 415 steel, determine allowable moment of resistance. 3+6=9

5. Define doubly reinforced beam section. A beam section of size 30 mm × 600 mm total depth is reinforced as 3-36 Ø as tensile reinforcement and 2-25 Ø as compression reinforcement. Assuming M25 grade concrete and Fe 415 steel, determine allowable and ultimate moment of resistance. 9

6. What is meant by slenderness ratio of a compression member ? Classify column based on slenderness ratio and define them. Distinguish between unsupported length and effective length. What do you mean by one way and two way slabs ? 1+3+2+3=9

7. Define development length. What is its significance? Calculate development length if the diameter of bar is 10 mm, for M20 grade concrete and Fe 415 steel. Explain the different types of bond. What are the mechanisms by which bond resistance is mobilised in reinforced concrete ? 1+1+2+2+3=9

8. Write the steps involves in determining the neutral axis depth when the neutral axis depth of a beam section is greater than the limiting neutral axis depth. Design a balanced reinforced concrete beam

section of width 250 mm to resist an external bending moment of 100 kNm. Assume M25 grade concrete and Fe 415 steel. 2+7=9

9. Define shear reinforcement with figure. A reinforced concrete beam of size 300 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