

**B.E DEGREE EXAMINATIONS: NOV/DEC 2014**

(Regulation 2009)

Sixth semester

**CIVIL ENGINEERING**

CEE121: Design of Reinforced Concrete Elements

*(IS 456-2000 and SP 16 Design charts and Tables are permitted)*

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. In singly reinforced beams, main steel reinforcement is provided in
  - a) Tensile zone
  - b) Compressive zone
  - c) Both tensile and compressive zone
  - d) Neutral zone
2. Normally, the tensile strength of concrete is about ..... of its compressive strength.
  - a) 10 to 15 %
  - b) 15 to 20 %
  - c) 20 to 25 %
  - d) 25 to 30 %
3. Basic values of span to effective depth ratio for simply supported beam span up to 10 m
  - a) 20
  - b) 30
  - c) 7
  - d) 26
4. The ratio of the diameter of reinforcing bars and the slab thickness is
  - a) 1/4
  - b) 1/5
  - c) 1/6
  - d) 1/8
5. The maximum shear stress in a rectangular beam is ..... times of average shear stress.
  - a) 1.15
  - b) 1.25
  - c) 1.50
  - d) 1.75
6. When shear stress exceeds the permissible limit in a slab, then it is reduced by
  - a) increasing the depth
  - b) providing shear reinforcement
  - c) using high strength steel
  - d) using thinner bars but more in number

7. For a longitudinal reinforcing bars in a column nominal cover shall in any case not less than
  - a) 15 mm
  - b) 20 mm
  - c) 25 mm
  - d) 40 mm
8. Nominal longitudinal reinforcement in a column not less than
  - a) 0.15 %
  - b) 2.0 %
  - c) 2.5 %
  - d) 3.0 %
9. The maximum compressive strain in concrete under axial compression is
  - a) 0.002
  - b) 0.02
  - c) 0.2
  - d) 2
10. In reinforced concrete footing on soil, the minimum thickness at edge should not be less than
  - a) 100 mm
  - b) 150 mm
  - c) 200 mm
  - d) 250 mm

**PART B (10 x 2 = 20 Marks)**

11. Define Limit State.
12. Define partial safety factors.
13. Differentiate between one way slab and two way slab.
14. Define crack control.
15. Write down the formula for development length.
16. Name the types of reinforcements used to resist shear can be classified.
17. How the types of loadings done in column.
18. Define unsupported length in columns.
19. Define SBC of Soil.
20. What are the various types of RC column footings?

**PART C (5 x 14 = 70 Marks)**

21. a) Explain the working stress and limit state methods of design of RC structures.
 

**(OR)**

 b) Design a rectangular reinforced concrete beam simply supported on masonry walls 300 mm thick with an effective span of 5 m to support a service load of 8 kN/m and dead load of 4 kN/m in addition to its own weight. Adopt M 20 grade concrete and Fe 415 HYSD bars. Width of support of beams = 300 mm.
22. a) A series of beams placed at 2.5 m centres are supported on masonry walls and the effective span of the beam is 5 m. The slab thickness is 100 mm and ribs

below the slab are 200 mm wide and 250 mm deep. If the slab and beams are so cast as to act together, determine the reinforcements at midspan for the T-beam to carry an imposed load of  $5 \text{ kN/m}^2$  of the slab. Use Fe 415 steel and M20 concrete.

(OR)

- b) Design a simply supported R.C slab for a roof of a hall 4 m x 10 m (inside dimensions) with 230 mm walls all around. Assume a live load of  $4 \text{ kN/m}^2$  and finish  $1 \text{ kN/m}^2$ . Use M 25 grade concrete and Fe 415 steel.

23. a) A rectangular beam width  $b=350\text{mm}$  and  $d=550\text{mm}$  has a factored shear of 400kN at the critical section near the support. The steel at the tension side of the section consists of four 32mm bars which are continued to support. Assuming  $f_{ck} = 25$  and  $f_y = 415(\text{N/mm}^2)$ , design vertical stirrups for the section.

(OR)

- b) Determine the reinforcements required for a rectangular beam section with the following data :

Size of the beam : 300 mm x 600 mm

Factored torsion : 45 kN-m

Factored shear : 95 kN

Factored bending moment : 115 kN-m

Use Fe 415 steel and M20 concrete.

24. a) An unbraced column 400 mm square is subjected in the following factored loads  $P = 3200 \text{ kN}$ . At the top,  $M_x = 76 \text{ kN-m}$  and  $M_y = 68 \text{ kN-m}$ . At the bottom,  $M_x = 8 \text{ kN-m}$  and  $M_y = 34 \text{ kN-m}$ ,  $L_o = 5 \text{ m}$ ,  $L_x = 6 \text{ m}$  at both the axes. Assuming  $f_{ck} = 40 \text{ N/mm}^2$  and  $f_y = 415 \text{ N/mm}^2$ , design the longitudinal steel.

(OR)

- b) Determine the cross section and the reinforcement for an axially loaded column with the following data :

Factored load = 3000 kN

Concrete grade = M20.

Characteristic strength of reinforcement =  $415 \text{ N/mm}^2$ .

Un supported length of the column = 3 m.

25. a) Design a solid footing has to transfer a dead load of 1000 kN and an imposed load of 400 kN from a square column 400 x 400 mm (with 16 mm bars). Assuming  $f_{ck} = 20 \text{ N/mm}^2$  and  $f_y = 415 \text{ N/mm}^2$ , and safe bearing capacity to be  $200 \text{ kN/ m}^2$ .

**(OR)**

- b) Explain in detail, the design procedure for combined rectangular footing with BMD & SFD.

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