Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022
CIVIL ENGINEERING

(2020 SCHEME)

Course Code : 20CET303

Course Name: Design of Concrete Structures

Max. Marks : 100 **Duration: 3 Hours**

Use of IS 456, SP16, SP 34, IS 875 Part 1, 2, 3 , 5, IS 1893& IS 13920 are permitted

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain under reinforced, over reinforced and balanced section in limit state design of RC structures.
2. Derive the limiting values of depth of neutral axis for different grades of steel.
3. Explain why and how shear reinforcement is provided in beams.
4. Enumerate the situations in which a doubly reinforced section becomes necessary.
5. Explain the IS code recommendations for the provision of torsion reinforcement in two way slabs.
6. Enumerate the IS code recommendations for the calculation of effective span of stairs supported on landings.
7. Distinguish between columns subjected to axial load and uniaxial bending and axial load and biaxial bending.
8. List out the assumptions of limit state of collapse in compression.
9. Explain the different types of shallow footings.
10. What are the design requirements of beam-column joints in earthquake resistant design?

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Enumerate the reasons why steel is used as reinforcement. (3)

    b) A rectangular reinforced concrete section having a breadth of 350mm is reinforced with 2 bars of 28mm diameter and 2 bars of 25mm diameter at an effective depth of 750 mm. Adopting M 20 grade concrete and Fe 415 steel.Determine the moment of resistance of the section. Also determine the flexural capacity of the beam. (11)

OR

12. A reinforced concrete beam is supported on two walls of 700 mm thick spaced at a clear distance of 6 m. The beam carries a superimposed load of 10 kN/m. Design the beam using M 20 grade concrete and Fe 415 steel. (14)

MODULE II

13. a) Discuss the different ways of improving bond stress in RCC structures. (4)
    b) An RCC beam 250mm x 400 mm (effective) is carrying a uniformly distributed load of 16kN/m. The beam is reinforced with 4 bars of 22 mm diameter. The clear span of the beam is 4.2 m. Design the shear reinforcement. Use M 20 concrete and Fe 250 steel. (10)

OR

14. Design a simply supported rectangular beam 250 mm x 600 mm over an effective span of 5 m. The superimposed load on the beam is 60 kN/m. Effective cover to reinforcement is taken as 50 mm. Use M 20 concrete and Fe 415 steel. (14)

MODULE III

15. Design and detail a simply supported slab for a room of interior dimensions 6 m x 4 m subjected to an imposed load of 10 kN/m^2. Thickness of supporting wall is 230 mm. Use M 25 concrete and Fe 415 grade steel. (14)

OR

16. Design a dog legged staircase in a room of an office building measuring 3 m x 6 m (clear dimension). The floor to floor height is 3.5 m. The building is a public building liable to overcrowding. Stairs are supported on brick walls 230 mm thick at the ends of landing. Use M 25 grade concrete and Fe 500 steel. (14)

MODULE IV

17. a) Classify columns based on slenderness ratio. (2)
    b) Design a circular column of diameter 400 mm subjected to a service load of 1300 kN. The column has an unsupported length of 3 m and is effectively held in position at both ends but not restrained against rotation. Use M 25 concrete and Fe 415 steel for the design. The column has helical ties. (12)

OR

18. Verify the adequacy of the short column of dimensions 300 mm x 500 mm for the following conditions. (14)
P_u = 1500 kN, M_{ux} = 125 kNm, M_{uy} = 75 kNm.
Use M 25 grade concrete and Fe 415 steel.

MODULE V

19. Design a rectangular isolated footing of uniform thickness for an R.C column bearing a vertical load of 600 kN and having a base size of 400 mm x 600 mm. The safe bearing capacity of the soil may be taken as 140 kN/m^2. Use M 20 grade concrete and Fe 415 steel. (14)

OR

20. a) A beam of width 400 mm and depth 750 mm is reinforced with 3 bars of 40 mm diameter at a clear cover of 40 mm. Calculate the crack width when the section is subjected to a bending moment of 490 kNm at the following points. (14)
    a. On the side of the beam 300 mm below neutral axis
    b. Mid way between bars on the tension face
    c. At the bottom corner
    d. On the tension face directly under the reinforcement bar

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