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# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIFTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023**

**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 Part1, 2, 3 & 5, IS 1893 & IS 13920 are Permitted***

## PART A

***(Answer all questions. Each question carries 3 marks)***

1. Explain balanced, under reinforced and over reinforced sections in the context of Limit state design philosophy.
2. What is Factor of safety and Partial safety factor? Mention difference between them.
3. Explain how, the bent up bars nearer to the supports contribute to the shear resistance of RC beams?
4. List various types of shear reinforcements commonly used. Explain each with neat sketches.
5. Sketch typical reinforcement detail in a one way continuous slab.
6. Differentiate between one way slab and two way slab.
7. Explain the function of lateral tie in a column.
8. Define slenderness ratio. What are its implications in the design of RC compression members?
9. List the different types of footings.
10. What is the need for ductile detailing in RC members?

## PART B

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

### MODULE I

11. A rectangular beam 250mm wide and effective depth 450 mm has 4 bars of 20mm diameter. Find the moment of resistance of the section if M20 concrete and Fe 415 grade steel are used. As per IS 456:2000, Also find the limiting moment of resistance. (14)

**OR**

12. With neat sketch explain the stress block parameters used in the design of singly reinforced concrete beam as per limit state method. (14)

**MODULE II**

13. Design a rectangular beam section to resist a factored bending moment of 575 kNm. The size of the section is limited to 300 mm × 700 mm overall. Use M20 concrete and Fe 415 steel. (14)

**OR**

14. a) State the conditions when a doubly reinforced beam is preferred. (5)
    b) Why does the code impose minimum and maximum limits with regard to (i) spacing (ii) percentage area of flexural reinforcement? (9)

**MODULE III**

15. Design a simply supported RCC slab for a roof of a hall 4 m × 10 m (inside dimensions) with 250 mm walls all around. Assume a live load of 4 kN/m$^2$ and finish 1 kN/m$^2$. Use M 25 concrete and Fe 500 steel. (14)

**OR**

16. Design an interior panel of a continuous slab system with effective dimensions 4m × 5m subjected to a live load of 3 kN/m$^2$. Use M25 concrete and Fe 500 steel. (14)

**MODULE IV**

17. Design a uniaxial eccentrically loaded rectangular column section for the following data: Pu=2500kN, Mu=125kNm about major axis. Unsupported length =3.2m, $L_{ex}$=3m, $L_{ey}$=2.75m, Use M25 concrete, Fe500 steel. Sketch reinforcement details. (14)

**OR**

18. Design and detail a column under biaxial bending with the following data: (14)
    Size of column = 400×600 mm
    The column is effectively held in position at both ends but not restrained against rotation. The unsupported length of column is 3.5m
    Concrete grade = M25
    Grade of Steel = Fe 500
    Factored load Pu = 1900 kN
    Factored Moment $M_{ux}$ = 150 kNm & $M_{uy}$ = 110kNm

**MODULE V**

19. Design a rectangular footing for an axial loaded column carrying 1200kN load, Size of the column is 300mm × 500mm. Safe bearing Capacity of soil is 180 kN/m$^2$. Use M25 Concrete and Fe 415 Steel. Sketch reinforcement details of footing in section & plan. (14)

**OR**

20. a) Discuss the analysis of a trapezoidal combined footing and sketch the plan and elevation. (9)

    b) Draw the ductile detailing of a column and beam-column junction. (5)

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