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**Question Paper Code : 50540**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fifth Semester

Civil Engineering

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**CE 3501 — DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS**

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

(Use of IS 456 and SPC16, SP34, Design charts are Permitted)

Answer ALL questions.

**PART A — ( $10 \times 2 = 20$  marks)**

1. Recall any two assumptions of working stress method.
2. Determine the modular ratio of M 25 grade concrete.
3. List four different cases in Flanged beam.
4. Highlight the types of reinforcement used to resist shear.
5. Recall the reason for provision of corner reinforcements in a two way slab.
6. Distinguish between one way shear and punching shear in flat slab.
7. Define slenderness ratio. Classify the columns based on slenderness ratio.
8. Write a short note on the Axially loaded column.
9. Mention the situation at when trapezoidal combined footings are provided.
10. List the assumptions made in combined footing.

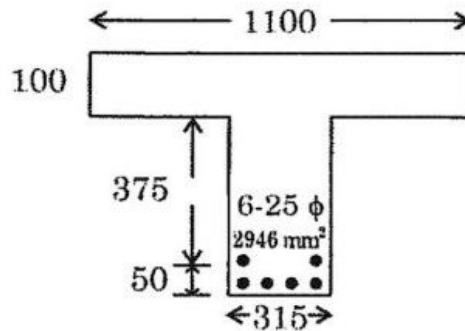
**PART B — ( $5 \times 13 = 65$  marks)**

11. (a) Explain the concept of elastic method and ultimate load method. Write the advantages of limit state method over other methods.

Or

- (b) A reinforced concrete beam is supported on two walls 250 mm thick, spaced at a clear distance of 6 m. The beam carries a super-imposed load of 9.8 kN/m. Design the beam using M20 concrete and HYSD bars of Fe 415 grade.

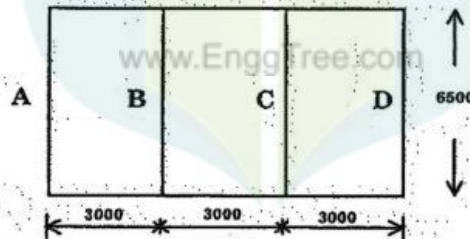
12. (a) Determine the MOR of flanged beam. The area of the steel in tension zone is 6 numbers of 25 mm diameter bars. Use M20 and Fe415.



All dimension are in mm

Or

- (b) Design a flanged beam with  $b_f = 1000$  mm,  $D_f = 100$  mm,  $b_w = 300$  mm subjected to a live load of  $4 \text{ kN/m}^2$ . Use M30 and Fe500.
13. (a) Design the one-way continuous slab subjected to uniformly distributed imposed loads of  $5 \text{ kN/m}^2$  using M 20 and Fe 415. The load of floor finish is  $1 \text{ kN/m}^2$ . The span dimensions shown in the following diagram are effective spans. The width of beams at the support = 300 mm.



All dimension are in mm

Or

- (b) Design one of the flights of a dog legged stairs spanning between landing beams using the following data. Type of staircase : dog legged with waist slab, treads and risers number of steps in the flight = 10 rise  $R=150$  mm Tread  $T = 300$  mm. Width of landing beams = 300 mm. Use M20 grade concrete and Fe 415 steel.
14. (a) Design the reinforcement in a column of size  $400 \text{ mm} \times 600 \text{ mm}$  subjected to an axial load of 2000 kN under service dead load and live load. The column has an unsupported length of 4.0 M and effectively held in position and restrained against rotation in both ends. Use M 25 concrete and Fe 415 steel.

Or

- (b) Design a square or circular column to carry a working load of 980 kN. the grades of concrete and steel are M 20 and Fe 415 respectively. Assume that the column is short.
15. (a) Explain the types of shallow foundation with neat sketches.

Or

- (b) Two columns having cross-section of  $250 \times 250$  mm and  $300 \times 300$  mm are loaded with 300 kN and 500 kN respectively. The c/c distance between the columns is 4 m and the bearing capacity of soil is  $100 \text{ kN/m}^2$ . Design a rectangular combined footing without a beam.

PART C — ( $1 \times 15 = 15$  marks)

16. (a) Calculate load carrying capacity of column  $300 \text{ mm} \times 450 \text{ mm}$  in size reinforced with 4 number of 16 mm diameter bars and 4 number of 12 mm diameter bars. Use M20 and Fe45 steel.

Or

- (b) Design a RCC square footing for a column  $400 \text{ mm} \times 400 \text{ mm}$  to carry an axial load of 1200 kN. Take SBC of soil as  $200 \text{ kN/m}^2$  and density of soil as  $18 \text{ kN/m}^3$ . Use M20 concrete and Fe 415 steel. Check for punching shear and one way shear need not be given.

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