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**Question Paper Code : 20274**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fifth Semester

Civil Engineering

CE 6505 — DESIGN OF REINFORCED CONCRETE ELEMENTS

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

IS 456 and SP-16 is permitted, Assume any other suitable data if necessary.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the importance of Elastic method over Limit state method?
2. What is the formula used to find the actual neutral axis in working stress method?
3. What is the significance of doubly reinforced section?
4. Write any two advantages of flanged beams.
5. What is the importance of anchorage value of bends?
6. Define shear friction.
7. Write any two salient assumptions are made for the limit state design of columns.
8. What are the important limitations of slender columns?
9. Why the dowel bars are provided in footing?
10. Define punching shear.

PART B — (5 × 13 = 65 marks)

11. (a) A Reinforced concrete rectangular beam is supported on two walls 750 mm thick, spaced at a clear distance of 6.5 m. The beam carries a super imposed load of 30 kN/m. Design the beam in working stress method. Use M20 grade concrete and M.S bars. Draw reinforcement details.

(13)

Or

(b) Design one way simply supported slab on a clear span of 4 m, the width of the supports being 300 mm. The dead load on the slab may be taken as  $1200 \text{ N/m}^2$  excluding its self weight. The live load on the slab is  $2100 \text{ N/m}^2$ . Use M20 grade concrete and Fe415 grade steel. Adopt working stress method. (13)

12. (a) A T-beam slab floor of an office comprises of a slab 150 mm thick spanning between ribs spaced at 3 m centres. The effective span of the beam is 7.5 m. Live load on floor is  $4.0 \text{ kN/m}^2$ . Using M20 grade and Fe415 HYSD bars. Design one of the intermediate Tee beams. Use limit state method. (13)

Or

(b) Design a two way slab for an office floor size  $3.3 \text{ m} \times 4.5 \text{ m}$  with discontinuous and simply supported edges on all the sides with the corners prevented from lifting and supporting a service live load of  $4.2 \text{ kN/m}^2$ . Adopt M20 grade and Fe415 HYSD bars. (13)

13. (a) (i) Explain the terms Diagonal tension and bond stress with reference to R.C beams. (5)

(ii) Obtain an expression for calculation of bond stress and shear stress in case of reinforced concrete beams of rectangular section with tensile steel of diameter ( $\phi$ ). Also obtain relationship between bond stress and shear stress. (8)

Or

(b) A simply supported RC beam of size  $300 \times 510 \text{ mm}$  effective is reinforced with 4 bars of 16 mm diameter HYSD steel of grade Fe415. Determine the anchorage length of the bars at the simply supported end if it is subjected to a factored force of 350 kN at the centre of 300 mm wide masonry support. The concrete mix of grade M20 is to be used. (13)

14. (a) Design a column having an effective length of 4.50 m to support a factored load of 1580 kN. Consider the reinforcement ratio  $p$  to be in the range 1.5 to 2.0 percent and the effective cover to longitudinal steel of 55 mm. The materials to be used are M25 grade of concrete and HYSD steel bars of grade Fe415. (13)

Or

(b) Design the reinforcements in a short column  $400 \text{ mm} \times 400 \text{ mm}$  at the corner of a multistoreyed building to support an axial factored load of 1500 kN, together with biaxial moments of 55 kN.m acting in perpendicular planes. Adopt M20 grade of concrete and steel grade Fe415 HYSD bars. (13)

15. (a) A 230 mm thick masonry wall is to be provided with a reinforced concrete footing on a site having soil with SBC, unit weight and angle of repose of  $135 \text{ kN/m}^2$ ,  $18 \text{ kN/m}^3$  and  $30^\circ$  respectively. The M20 grade of concrete and HYSD steel bars of grade Fe415. Design the footing when the wall supports at service state: a load of  $150 \text{ kN/m}$  length. (13)

Or

(b) Design a combined column footing with a strap beam for two reinforced concrete columns  $300 \text{ mm} \times 300 \text{ mm}$  size spaced 4m apart and each supporting a factored axial load of 750 kN. Assume the ultimate bearing capacity of soil at site as  $230 \text{ kN/m}^2$ . Adopt M20 grade of concrete and steel grade Fe415 HYSD bars. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A reinforced concrete floor slab for a room having inside dimension  $4 \text{ m} \times 10 \text{ m}$  and supported on all sides by 400 mm thick brick wall. The super imposed load may be taken as  $4 \text{ kN/m}^2$ . Adopt M20 grade of concrete and steel grade Fe415 HYSD bars. (15)

Or

(b) Design a column subjected to biaxial bending,  $P = 200 \text{ kN}$ ,  $M_x = 25 \text{ kN.m}$  and  $M_y = 15 \text{ kN.m}$ . Adopt M20 grade of concrete and steel grade Fe415 HYSD bars. Take a factor of safety as 1.5. (15)