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# Q 2122

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Sixth Semester

Civil Engineering

CE 337 — STRUCTURAL DESIGN — II

Time : Three hours

Maximum : 100 marks

(Use of IS 456, Design Aids SP 16 and IS 1905 is Permitted)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the advantages of limit state method over working stress and ultimate load methods?

2. How do you find the moment of resistance of a beam section?

3. Distinguish between one-way and two-way slabs.

4. Explain the terms 'balanced', 'over reinforced' and 'under reinforced' sections in bending.

5. What are the types of reinforcements used to resist shear?

6. Explain the difference between primary and secondary torsion. Give two examples each.

7. What is the minimum and maximum percentage of steel allowed in R.C. Column? Explain why it is necessary to specify the minimum and maximum percentage.

8. Give examples of columns that are in practice subjected to uniaxial and biaxial bending.

9. Sketch the placement of steel in rectangular footing with a non-central load.

10. What are the situations in which combined footings are preferred over isolated footings?

PART B — ($5 \times 16 = 80$ marks)

11. (a) A singly reinforced concrete beam is of width 450 mm and effective depth 715 mm. It is reinforced with 8 Nos. 20 mm mild steel bars. Assuming M20 concrete, determine its moment of resistance according to the working stress method. Determine also the stress in steel when the beam is subjected to the above moment.

Or

(b) Determine the reinforcement for a T beam with flange width = 1500 mm, web width = 300 mm, thickness of slab = 100 mm, effective depth 735 mm, to carry a moment of 380 kNm due to characteristic loads. Use M 25 concrete and $F_e$ 415 steel. Use working stress design.

12. (a) Design a simply supported R.C.C. slab for a roof of a hall 4 m × 10 m (inside dimensions) with 230 mm walls all around. Assume a live load of $4\,kN/m^2$ and finish $1\,kN/m^2$. Use grade 25 concrete and $F_e$ 415 steel.

Or

(b) A T beam continuous over several supports has to carry a factored negative support moment of 1000 kNm. Determine the area of steel at supports if $b_w$ = 400 mm, $b_{fy}$ = 1600 mm, $D_f$ = 100 mm, D = 610 mm, d' = 60 mm, $f_{ck}$ = 30 N/mm$^2$, f = 415 N/mm$^2$.

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

Or

(b) A reinforced concrete rectangular beam has a breadth of 350 mm and effective depth of 800 mm. It has a factored shear force of 105 kN at section XX. Assuming that $f_{ck}$ = 25, $f_y$ = 415 (N/mm$^2$), and percentage of tensile steel at that section is 0.5 per cent, determine the torsional moment the section can resist if no additional reinforcement for torsion is provided. work out the problem according to IS 456 principles of design for torsion.

14. (a) A rectangular column of effective height of 4 M is subjected to a characteristic axial load of 800 kN and bending moment of 100 kNm about the major axis of the column. Design a suitable section for the column so that the width should not exceed 400 mm. Use the minimum percentage of longitudinal steel. Assume $f_y$ =415 N/mm$^2$ and $f_{ck}$ = 20 N/mm$^2$.

Or

(b) An R.C. Column 500 × 400 mm is subjected to an axial ultimate load of 2500 kN and bent in single curvature about the minor axis with $M_{y(top)}$ = 90 kNm and $M_{y(bottom)}$ = 120 kNm as ultimate moments. If $L_o$ = 7.2 M and $L_e$ = 5.75 M on both axes, calculate the design moments for the column.

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

Or

(b) Design a plain concrete footing for a 450 mm wall carrying 300 kN per metre length. Assume grade 20 concrete and the bearing capactiy of soil to be 200 kN/m$^2$.