Total No. of Questions : 8]

SEAT No. :

P1364

[Total No. of Pages : 8

[4858] - 109

T.E. (Civil Engineering)

STRUCTURAL DESIGN - II

(2008 Pattern) (Semester - II)

Time : 4 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2 and Q.3 or Q.4 in Section - I.***
2) ***Attempt Q.5 or Q.6 and Q.7 or Q.8 in Section - II.***
3) ***Answer to the two sections should be written in separate books.***
4) ***Figures to the right indicate full marks.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Use of IS 456-2000 and non programmable calulator is allowed.***
7) ***Mere reproduction from IS code as answer, will not be given full credit.***
8) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) i) The term 'balanced section' is used in both WSM and LSM. Discuss the difference in meaning.

ii) Justify the code specification for the limiting neutral axis depth in LSM.

iii) Why is it uneconomical to use high strength steel as compression reinforcement in design by WSM?

[9]

b) A rectangular, singly reinforced beam, 230mm wide and 567mm effective depth is used as a simply supported beam over an effective span of 8m. The reinforcement consists of 4 bars of 16mm diameter at tension face. If the beam carries a load of 15kN/m, inclusive of its self weight, determine, the stresses developed in concrete and steel using WSM. Use M25 concrete and Fe415 steel. **[8]**

P.T.O.

c) A rectangular beam 300 mm wide and 565 mm effective depth is reinforced with 4 No. 20 mm diameter bars. Find, **[8]**

i) Depth of neutral axis

ii) Moment of resistance.

The materials are M25 grade of concrete and HYSD reinforcement of grade Fe500.Use L.S.M.

OR

Q2) a) Calculate the design constants for the following materials considering the balanced design for singly reinforced section. The materials are grade M 30 concrete and Fe 500 grade steel reinforcement. Use LSM. **[6]**

b) An isolated T beam having effective flange width 1300 mm, rib width 250 mm, flange thickness 125 mm and effective depth of 650 mm is reinforced with 4-20 mm diameter bars. The effective span of the beam is 8m, Find **[12]**

i) Depth of Neutral Axis

ii) Moment of Resistance

iii) Uniformly distributed load beam can carry in addition to self weight

Use : M25 Grade Concrete Fe415 grade reinforcement

Adopt working Stress method

c) Explain with sketches, why do continuous T-beam at support have to be designed as rectangular section? Draw the cross section of continuous T-beam at support and midspan. **[7]**

Q3) Design floor slabs S7 and S11 only for flexure and torsion. Refer the structural plan given in Figure 1. Width of all beams is 230mm. Consider live load = 3 kN/m^2, Floor finish = 1.5 kN/m^2. **[25]**

Use M25 grade of concrete and Fe 415 grade of steel. Draw neat sketches showing details of main reinforcement and torsional reinforcement in two way slab.

OR

Q4) a) Design the one flight of a dog legged staircase as shown in figure 1 using the following data : **[17]**

i) No of risers in each flight = 9

ii) Floor to floor height = 3.15m

iii) Live load = 4 kN/m^2

iv) Floor finish = 1kN/m^2

Materials : M25 Grade of concrete, Fe 415 grade of reinforcement.

Show detailed load calculations. Draw the reinforcement details in sectional elevation of only one flight.

b) Explain with neat sketches the design concepts of horizontally spanned and longitudinally spanned staircases. **[8]**

SECTION - II

Q5) A continuous R.C.C. floor beam B14-B15-B16 (Refer Fig.1) is simply supported at end supports (C17 and C20) and continuous through column C18 and C19. Consider live load on slab 3kN/m^2 and floor finish 1.5 kN/m^2. Assume slab thickness 130 mm for load calculation. Consider 230 mm thick brick wall on these beams. Floor to floor height is 3.15m. Show detailed load calculations and determine support moments, maximum span moments for all beams, using 20% redistribution of moments. Draw bending moment diagram and design the beam only for flexure. Show the reinforcement details along the length of beam with suitable cross sections. **[25]**

Material- Concrete of grade M20, Fe 500 reinforcement.

OR

Q6) a) A rectangular RC beam of size 300 mm × 750 mm with effective cover 40 mm is subjected to following actions : **[15]**

i) Factored BM = 150 kN.m

ii) Factored SF = 90 kN

iii) Factored Torsional Moment = 40 kN.m

Design the beam using M 25 & Fe 500 grade materials.

b) Explain the terms bond stress and development length. Calculate development length for 16 mm diameter bar in compression and tension by both methods (WSM and LSM). Use M30 concrete and Fe 500 steel. **[10]**

Q7) a) Design an axially loaded short square column with material M25 and Fe 415 to carry a working load of 900 kN. The unsupported length of column is 3.5 m. The column is held in position and not restrained against the rotation at both ends. Also design the footing for this column. Take SBC = 150 kN/m^2. Show detailed design calculations and reinforcement details in plan and sectional elevation. **[17]**

b) Draw columns cross sections for following data **[8]**

i) Size 230 × 600 with longitudinal reinforcement

(4– #20 + 2– # 16 + 4 – #12) equally distributed along all sides.

Transverse reinforcement – #8@150C/C

ii) Size 230 × 380 with longitudinal reinforcement (6– #12) distributed along two parallel edges to resist bending moment about axis bisecting the depth of column.

Transverse reinforcement – #8@190C/C.

OR

Q8) Design a bi-axial short column by limit state method with material M25 and Fe 500 to carry a working load of 800 kN, working moment of 60 kN-m about major axis bisecting the depth of column and 30 kN-m about minor axis bisecting the width of column. The unsupported length of column is 4.0 m. The column is fixed at one end and hinged at the other. Also design the footing for this column considering axial load and moment about major axis only. Take SBC = 250 kN/m^2. Show detailed design calculations and reinforcement details in plan and sectional elevation. **[25]**

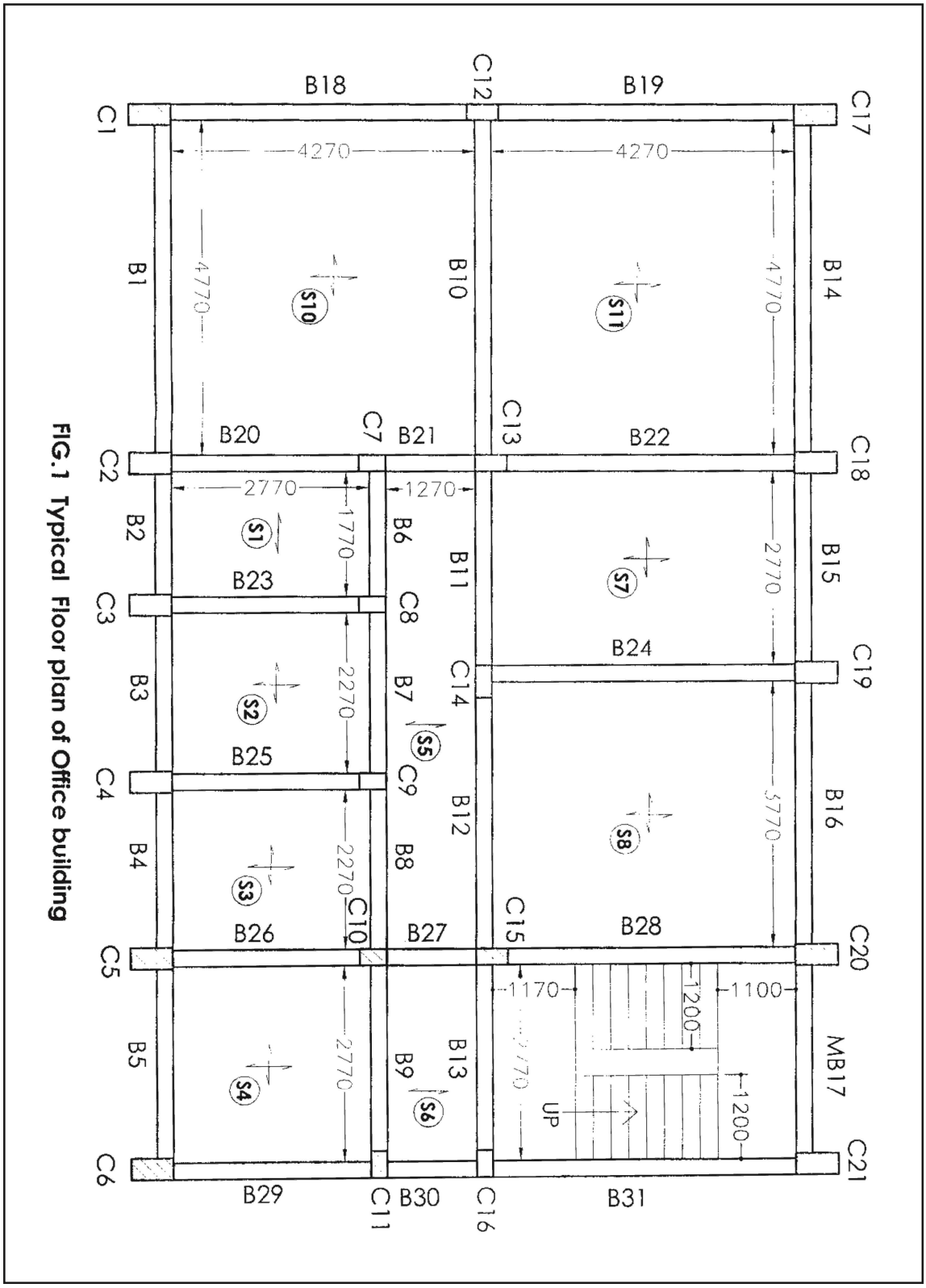


FIG.1 Typical Floor plan of Office building

Chart - 13 Interaction Diagram for Combined Bending and Compression Rectangular Section - Equal Reinforcement on All Sides.

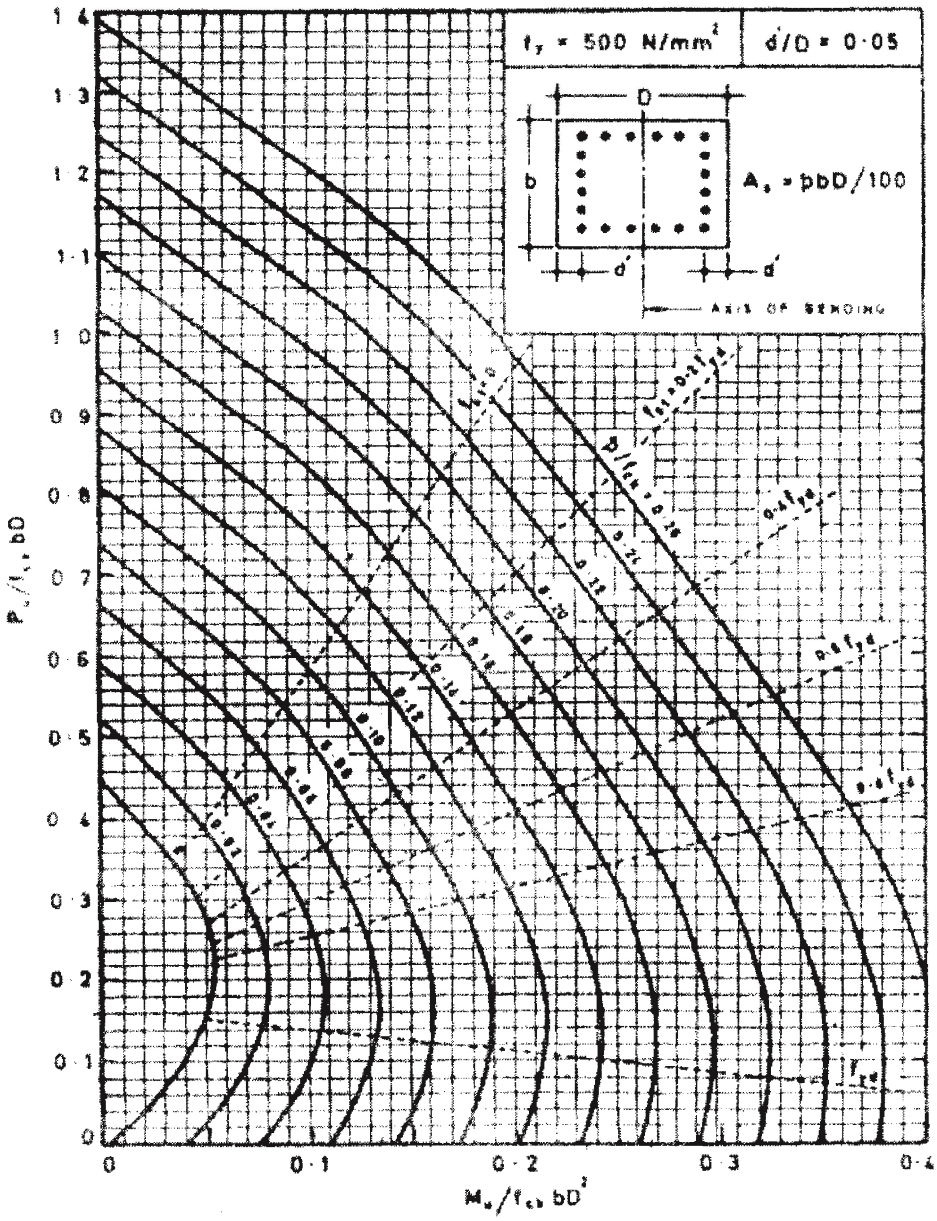


Chart - 14 Interaction Diagram for Combined Bending and Compression Rectangular Section - Equal Reinforcement on All Sides.

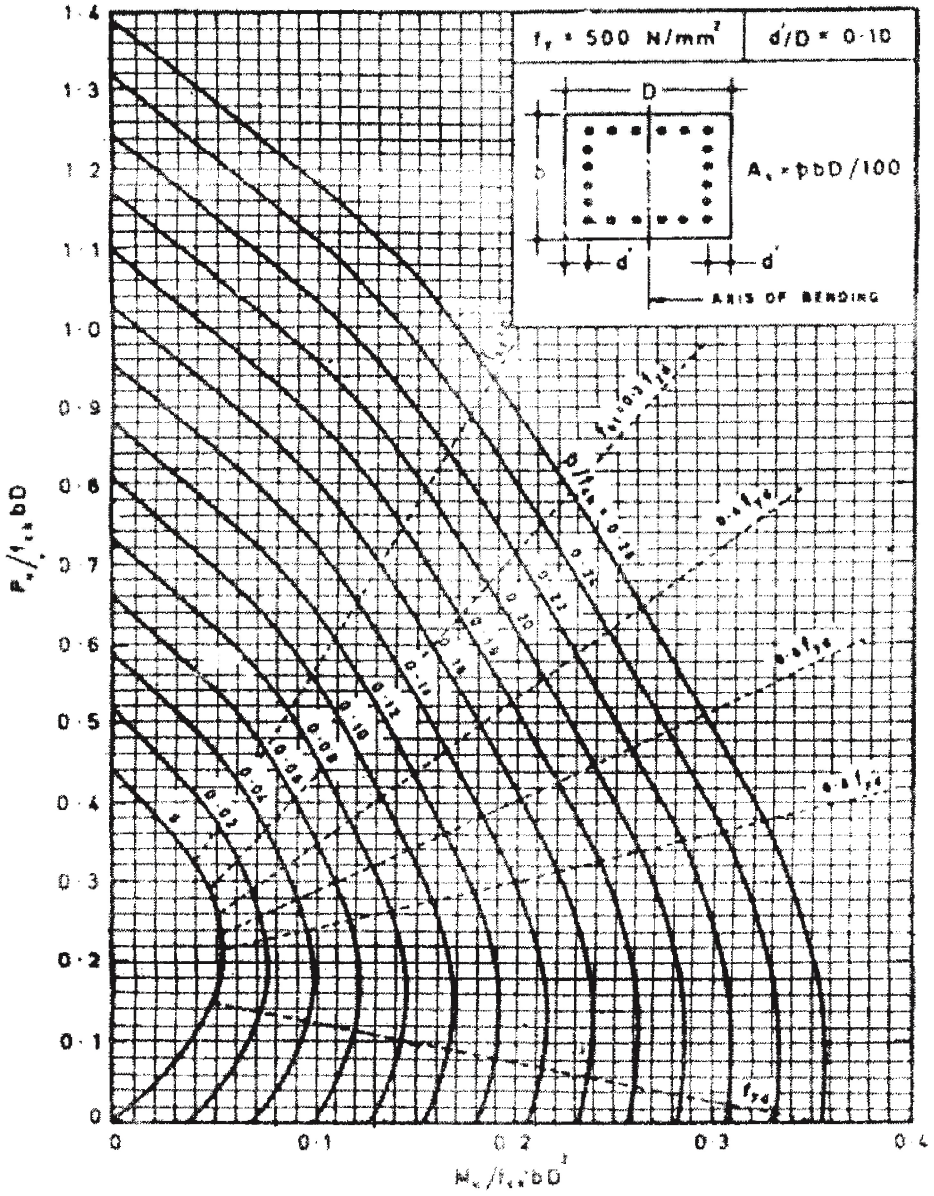
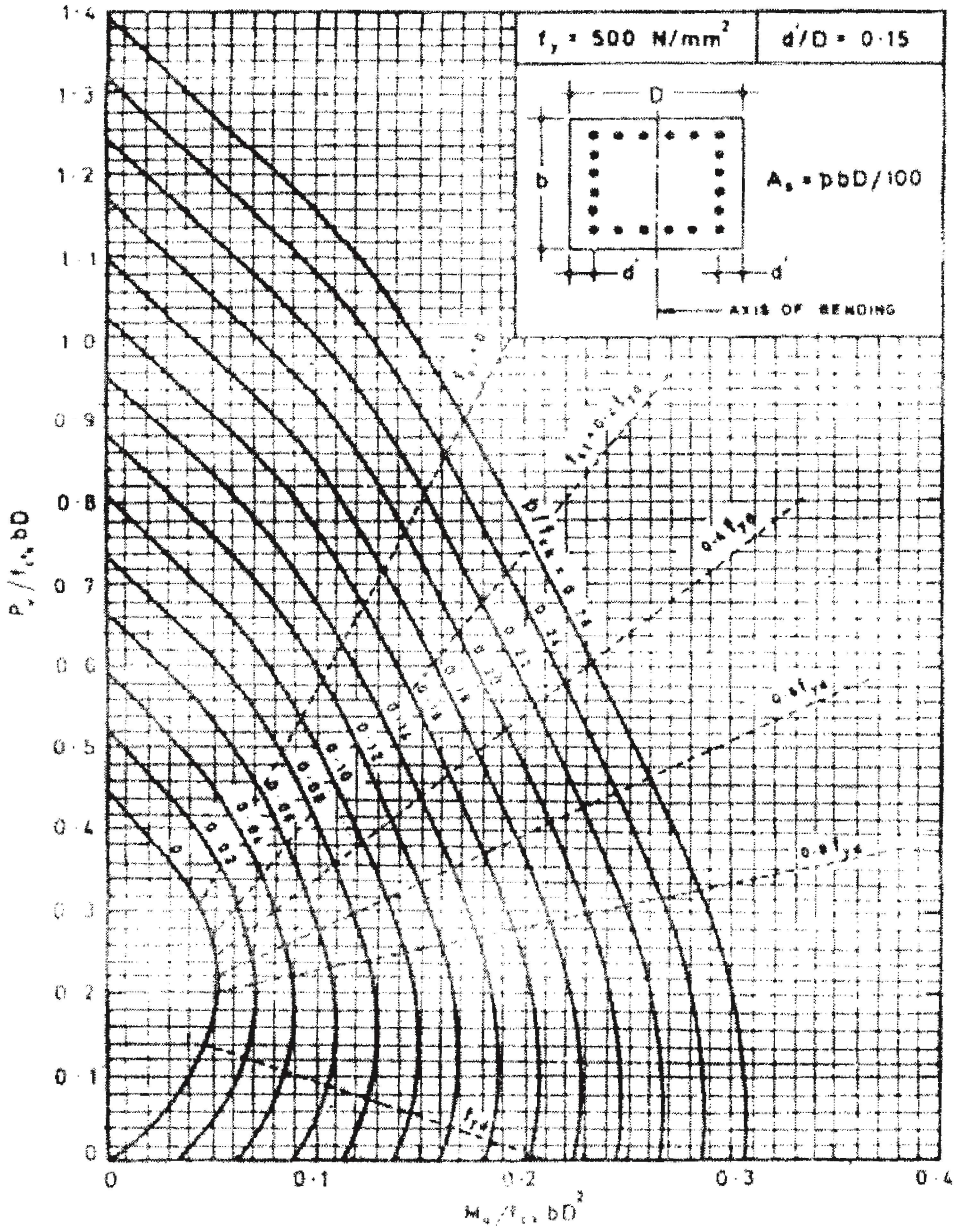


Chart - 15 Interaction Diagram for Combined Bending and Compression Rectangular Section - Equal Reinforcement on All Sides.



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