301008

Seat No.	

T.E. (Civil Engineering) (Semester – II) Examination, 2014
STRUCTURAL DESIGN – II
(2008 Course)

Time : 4 Hours Max. Marks : 100

Instructions : *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 calculator is **allowed**.*
*7) Mere reproduction from IS code as answer, will not be given **full** credit.*
*8) Assume suitable data, if **necessary**.*

SECTION – I

1. a) i) Draw strain and stress distribution diagrams with all parameters for the design of RCC section of flexural member using LSM. **4**

   ii) Explain the stress strain relationship for concrete according to the assumptions in limit state of collapse in flexure. **4**

   b) Calculate the maximum ultimate uniformly distributed imposed load the L- beam of effective span 8 m can carry. The details of the beam are as follows **9**

      i) Width of rib = 230 mm

      ii) Effective flange width = 750 mm

      iii) Thickness of flange = 120 mm

      iv) Total depth = 600 mm with clear coger 25 mm

      v) Tension steel = 3-#20 through plus 2-#20 curtail at midspan.

      vi) The beam is subjected to ultimate dead load 25 kN/m (inclusive of self weight)

      vii) Use M20 grade of concrete and Fe 415 grade of steel.

   c) A rectangular beam section, 300 mm wide and 450 mm deep is reinforced with 4 bars of 20 mm diameter in the tensile zone and 2 bars of 20 mm in the compression zone. The clear cover is 25 mm for both the reinforcement. Determine moment of resistance of the section using WSM. Use M25 grade of concrete and Fe 415 grade of steel. **8**

OR

2. a) Determine the minimum effective depth required and the corresponding area of tension reinforcement for a rectangular cantilever beam having a width of 300 mm and effective span 3 m. The beam is subjected to uniformly distributed load of 30 kN/m (inclusive of self weight). Use M20 grade of concrete and Fe 415 bars. Use WSM. **8**

   b) A reinforced conctete beam has the following data : **17**

   i) Clear Span of beam = 6 m

   ii) Width of supporting columns = 300 mm

   iii) Beam section = 230 × 510 mm

   iv) Ultimate UDL on beam = 55kN/m, inclusive of self weight.

   v) Reinforcement at top – 2 Nos of 12 mm diameter bars

   vi) Reinforcement at bottom – 2 Nos of 16 mm diameter bars through + 2 nos of 16 mm diameter bars curtail.

   Design the shear reinforcement using vertical stirrups. Draw neat diagram showing zoning.

   Material-Concrete of grade M25, All reinforcement-Fe 500.

3. Design floor slabs S7 and S9 only for flexure and torsion. Refer the structural plan given in fig. 1. Consider live load = 4kN/m^2, Floor finish = 1.5 kN/m^2.

   Use M25 grade of concrete and Fe 500 grade of steel. Draw neat sketches showing details of main reinforcement and torsional reinforcement in two way slab. **25**

   OR

4. Design the I and II flights of a dog legged staircase as shown in figure 1 using the following data : **25**

   i) No of risers in I flight = 9

   ii) No of risers in II flight = 11

   iii) Floor to floor height = 3.0 m

   iv) Live load = 5 kN/m^2

   v) Floor finish = 1kN/m^2

   Materials : M25 Grade of concrete, Fe 500 grade of reinforcement.

   Show detailed load calculations. Draw the reinforcement details in sectional elevation for both flights.

SECTION – II

5. a) A continuous R.C.C. floor beam B29-B26-B23 (Refer Fig. 1) is simply supported at end supports and continuous through column C10 and C13. 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 150 mm thick brick wall on all interior beams. Floor to floor height is 3m. 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.

   Material-Concrete of grade M20, Fe 500 reinforcement. **25**

   OR

6. a) State the situation where doubly reinforced concrete beams become necessary. State the procedure to find tension and compression steel in doubly reinforced section. What is role of compression steel ? **10**

   b) A rectangular RC beam of size 230 mm × 600 mm with effective cover 40 mm is subjected to following actions : **15**

      I) Factored BM = 90 kN.m

      II) Factored SF = 60 kN

      III) Factored Torsional Moment = 50 kN.m

      Design the beam using M 25 and Fe 500 grade materials. **15**

7. Design an axially loaded short column C10 as shown in Fig. 1 in ground floor and below plinth along with isolated footing for a G + 2 building with following details : **25**

   i) Floor to Floor height = 3.6 m

   ii) Height of column below plinth = 2.5 m

   iii) Live load on all slabs = 4 kN/m^2

   iv) Floor Finish Load = 1.5 kN/m^2

   v) Water Proofing Load on roof slab = 1.5 kN/m^2

   vi) Wall thickness = 150 mm (Internal)

   vii) Slab thickness = 130 mm

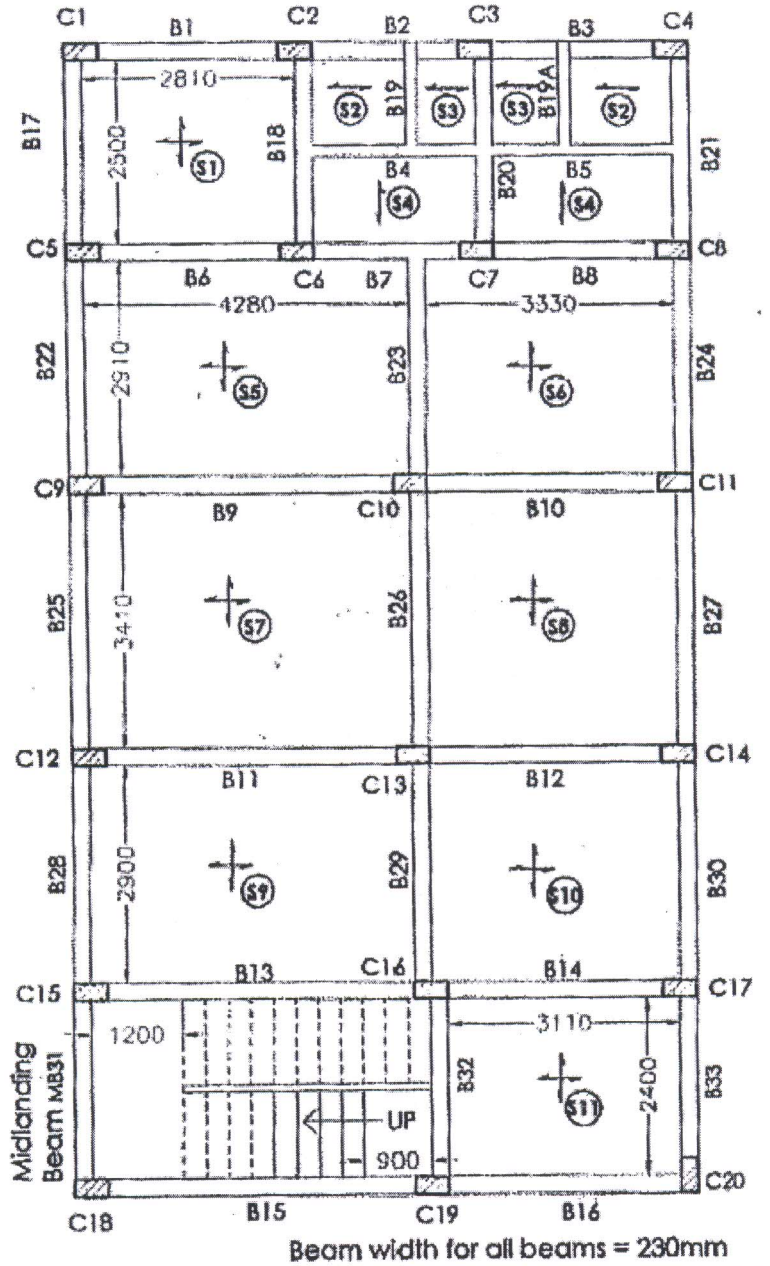
   viii) Size of beams = 230 × 450 mm

   ix) Safe bearing capacity of soil = 220 kN/m^2

   Material M 25 and Fe 415 used. Show detailed load and design calculations and reinforcement details in plan and sectional elevation.

OR

8. Design a bi-axial short column by limit state method with material M25 and Fe 415 to carry a working load of 1000 kN. Working moment of 100 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 3.6 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 = 300 kN/m^2. Show detailed design calculations and reinforcement details in plan and sectional elevation. **25**



Beam width for all beams = 230mm
Column width for all columns = 230mm

FIG.1 Typical Floor plan of Office building

Chart 5 : Interaction Diagram for Combined Bending and Compression Rectangular Section-Equal Reinforcement on All Sides

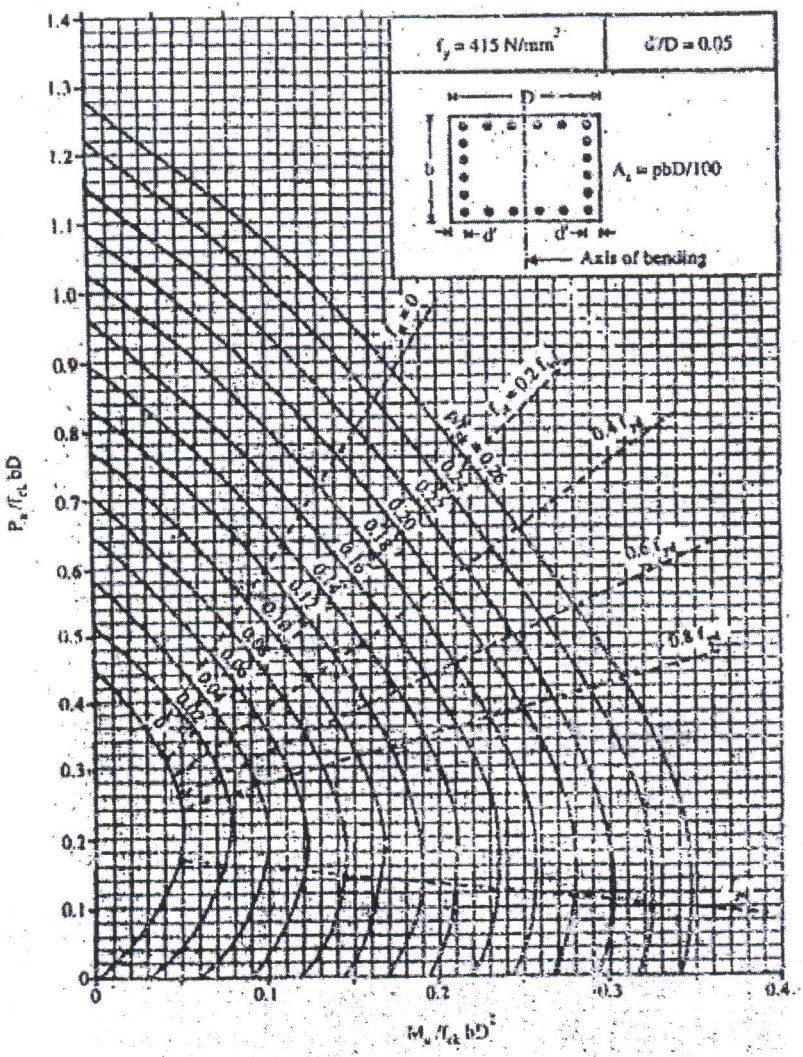


Chart 5

Chart 6 : Interaction Diagram for Combined Bending and Compression Rectangular Section-Equal Reinforcement on All Sides

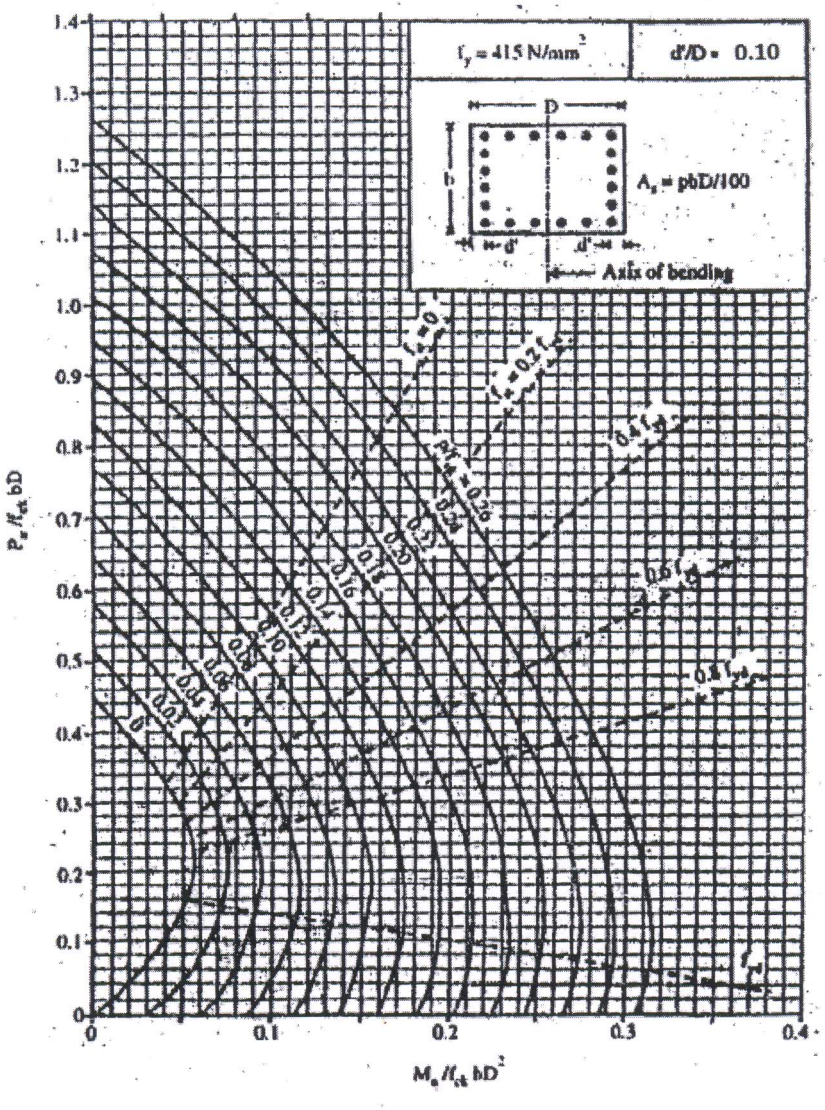


Chart 6

Chart 7 : Interaction Diagram for Combined Bending and Compression Rectangular Section-Equal Reinforcement on All Sides