BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
B.E. (Civil Engg.), Part –III, 5th Semester Final Examinations, December 2012
Sub: Design of R.C. Structures (CE-501)

Time: 3 hours **Full Marks: 70**

*Use separate answer script for each half. Answer any **Six** questions, taking **Three from each half**. Two marks are reserved for neatness. Assume any data reasonably, if required. All the notations used have their usual meanings. Use of IS code and handbook are not allowed in the examination hall.*

Use M 25 concrete and Fe 500 steel.

First half

Use Limit State Method

1. Determine the reinforcement to be provided in a short column subjected to biaxial bending with the following data: size of column = 400 mm x 400 mm, P_u = 1200 kN, M_{ux} = 150 kN-m, M_{uy} = 90 kN-m. The unsupported length of the column is 3.2 m with effective length factor 0.85. Use chart given in Fig. 1. Also, show the reinforcement detailing.

2. A rectangular column 300 mm x 450 mm carries a factored axial load of 1500 kN. Design and detail an isolated footing to support the column. The safe bearing capacity of soil is 180 kN/m^2. Assume τ_c = 0.7 N/mm^2.

3. Design and detail the corner slab of a school building roof with effective grid dimensions 4.0 m x 3.0 m. Assume unfactored live load on slab as 1.5 kN/m^2 and modification factor = 1.6. Final deflection check is not required. Short span co-efficients, α_x are as follows :-

l_y/l_x	1.0	1.2	1.3	1.4	1.5
(-)ve Moment at Continuous edge:	0.047	0.060	0.065	0.071	0.075
(+)ve Moment at Midspan:	0.035	0.045	0.049	0.053	0.056

4. Design and detail a doubly reinforced rectangular beam having a simply supported effective span of 5.7 m. The unfactored uniformly distributed load (inclusive of selfweight) on the beam is 40 kN/m and size of beam is limited to 250 mm x 450 mm. Also design for shear. Assume τ_c = 0.5 N/mm^2. Given, $f_{sc} = 434.8 - 6.1022 \times \left(4.17 - \varepsilon_{sc} \times 10^3\right)$ for $\varepsilon_{sc} \geq 0.00174$, else, $f_{sc} = E_s \varepsilon_{sc}$.

5. Design and detail a dog-legged staircase for a building within the available stairwell size 5.1 m x 3.0 m. Floor to floor height of the building is 3.1 m. Take unfactored live load as 3 kN/m^2.

Second half

Use Working Stress Method.

6. Design and detail a floor slab for a room having effective lengths 2.5 m X 5.5 m, simply supported on all four sides over 250 mm thick walls. Take live load on the slab as 3 kN/m^2 and weight of floor finish and plaster as 1 kN/m^2. The modification factor may be taken as 1.55.

7. A column is to support a load of 800 kN inclusive of its own weight. The column is effectively held in position at both ends and restrained against rotation at one of the ends. The unsupported length of the column is 5.2 m. Design and detail the column, considering a square section of side not exceeding 300 mm.

8. Design and detail a simply supported beam of effective span 3.5 m when subjected to a uniformly distributed load of 28 kN/m, exclusive of self weight. Assume τ_c = 0.5 N/mm^2, τ_{bd} = 1.44 N/mm^2, modification factor=1.4.

9. Determine moment of resistance of a T-beam, with flange width 800 mm, depth of flange 100 mm, width of rib 300 mm, tensile reinforcement 4 nos. 22 mm diameter bars in the bottom of rib. The overall depth is 550 mm and the diameter of stirrup is 8 mm. Neglect compression of the rib. Also, calculate the moment of resistance of the above beam assuming rectangular section.

10. Two columns A and B are carrying loads of 500 kN and 400 kN respectively. The size of each column is 400 mm x 400 mm. They are separated by a distance of 2.5 m. The width of foundation is restricted to 2.0 m. Design and detail (for flexure only) a combined footing for the columns. Safe bearing capacity of the soil is 90 kN/m^2.

Chart 49 COMPRESSION WITH BENDING — Rectangular Section — Reinforcement Distributed Equally on Four Sides

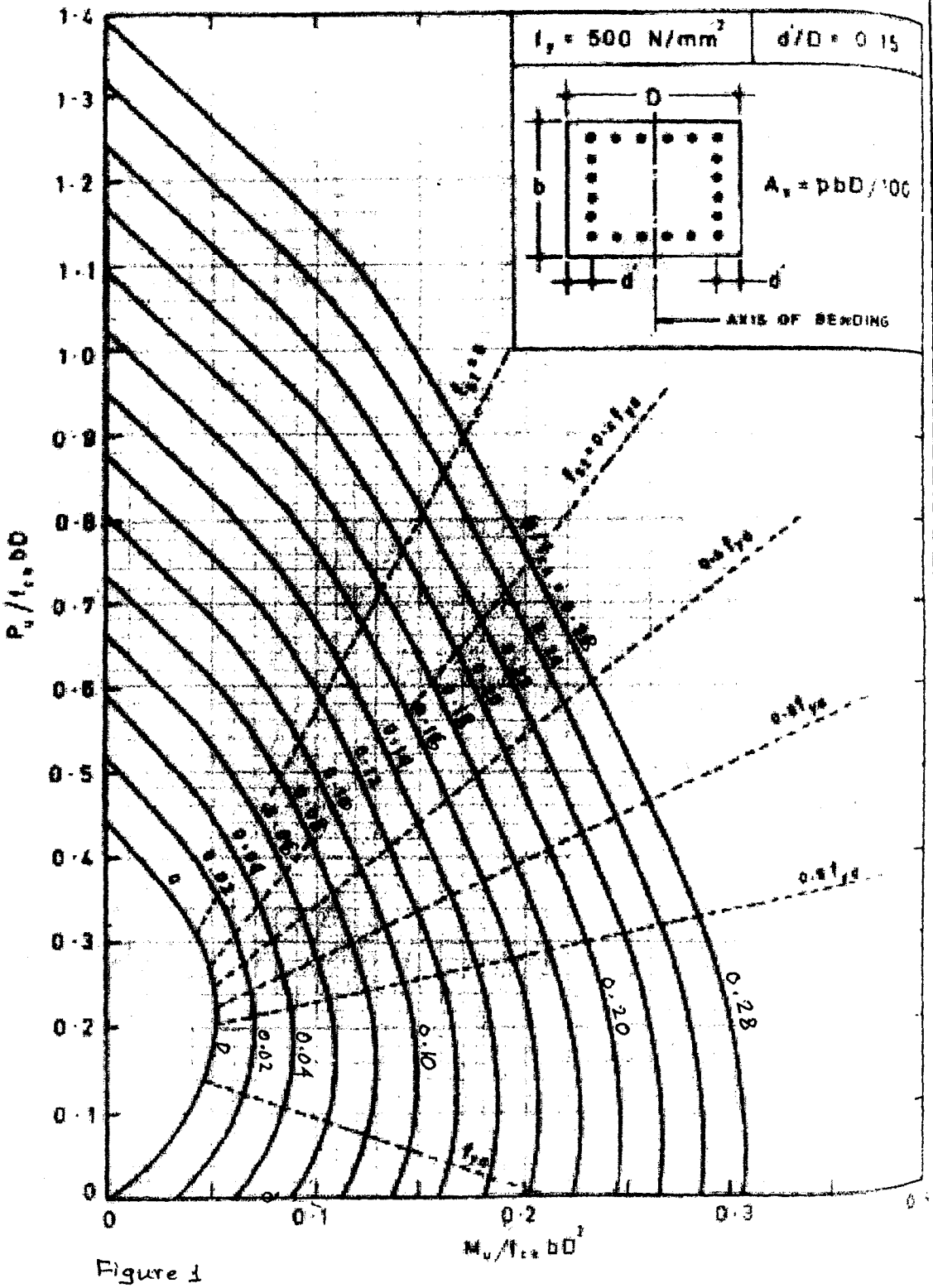

Figure 1