B.E. (Civil Engineering) Seventh Semester (C.B.S.)

Advanced Concrete Structures

P. Pages : 2 **NIR/KW/18/3516**

Time : Four Hours Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.
11. Use of IS 456 : 2000 and IS 3370 is permissible.

1. Design a circular water tank with flexible base with a storage capacity of 3 lakhs liters of water. The height of tank is 4.5 m and free board of 0.3 m. Use M20 grade of concrete and Fe-415 grade of steel. Design top dome, ring beam and circular wall. Draw reinforcement details. **14**

OR

2. Design the rectangular water tank $5m \times 4m$ with depth of storage 3.5 m. The tank is resting on the ground whose walls are fixed at base and free at the top. Design the walls of water tank by using IS code method or by approximate method. Use M25 grade concrete and Fe 415 grade steel. **14**

3. Design an isolated rectangular footing for a rectangular column of size $450 \times 350\,mm$ with ultimate load of 1150 kN and also carries ultimate moment of 55 kN-m. The column is reinforced with 6 bars of 12 mm diameter. Use M20 grade of concrete and Fe415 grade of steel. The safe bearing capacity of the soil is $150\,kN/m^2$. Draw detail diagram of reinforcement. **13**

OR

4. Design a biaxially loaded RCC column subjected to ultimate load of 500 kN, ultimate moment of 75 kNm about major axis and 60 kNm about minor axis. The unsupported length of column is 4m. The size of column is $350 \times 450\,mm$. Use M20 grade concrete and Fe 415 grade steel. **13**

5. a) Draw a bending moment diagram envelope after 30% moment redistribution for a fixed beam of span 9 meter with two concentrated load of 100 kN, at a distances of 3 m from both the ends. **10**

b) Explain Redistribution of moments with a suitable diagram. **3**

OR

6. A continuous beam of two spans 8 m each, carrying a factored dead load of $10\,kN/m$ and factored live load of $20\,kN/m$. Draw BMD envelope after maximum allowable redistribution as per IS 456 : 2000. **13**

7. Design a cantilever retaining wall consisting of 4 meter height. Stem retaining a surcharge loading of $12\,kN/m^2$. Density of soil is $17\,kN/m^3$, angle of repose is 30º, use M20 grade concrete and Fe 415 grade of steel. Take safe bearing capacity of soil is $200\,kN/m^2$. Draw Reinforcement details also. **14**

OR

8. A Counterfort retaining wall to retain 7 meter high embankment above ground level. The foundation is to be taken 2.5 m below ground level where the bearing capacity of soil may be taken $180\,kN/m^3$. The backfill is horizontal and soil has density of $18\,kN/m^3$ with an angle of internal friction 30º. Coefficient of friction between concrete and soil may be taken as 0.5. Design the stem of counterfort retaining wall. Use M20 grade of concrete and Fe 415 grade of steel. Draw reinforcement details also. **14**

9. Design a RC portal frame with hinge base is required to suit the following data. **13**
   Spacing of portal frame = 5 meter c/c
   Height of columns = 4 meter
   Distances between column centers = 14 meter
   Live load on roof = $2.5\,kN/m^2$
   Floor finish = $0.5\,kN/m^2$
   Analyse and design the portal frame by using M20 grade concrete and Fe 415 grade of steel. Use I beam = 1.75 I column.

OR

10. Design dog legged stair case (waist type slab) for an office building of $2.5\,m \times 4\,m$ to suit the following data : **13**
    Height between the floors = 3.6 m
    Provide 100 mm bearing at each end.
    Live load = $4\,kN/m^2$
    Floor finishing load = $1\,kN/m^2$
    One end of flight is resting on plinth beam and other on the lending beam at the end of the flight. Use M20 grade concrete & Fe415 grade steel.

11. Design a combined footing for two column C_1 & C_2 of size $500\,mm \times 500\,mm$ and $400\,mm \times 400\,mm$. Carrying loads of 1500 kN and 1000 kN respectively. The width of footing is restricted to 2.2 m. The columns are spaced at 4 meter center to center. The SBC of soil is $170\,kN/m^2$ and unit weight of soil is $18\,kN/m^2$ angle of repose is 30º. Use M20 grade concrete and Fe415 Steel. **13**

OR

12. Two columns A and B spaced at 5 m center to center. Column A, $300\,mm \times 300\,mm$ in size and carries load of 550 kN and is on property line. Column B $400\,mm \times 400\,mm$ in size, carries a load of 800 kN. The bearing capacity of soil is $120\,kN/m^2$. Design the footing slab for the strap beam footing. Use M20 grade and Fe 415 grade steel reinforcement. **13**

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B.E. (Civil Engineering) Seventh Semester (C.B.S.)

Advanced Concrete Structures

P. Pages : 4 **NJR/KS/18/4571**

Time : Four Hours Max. Marks : 80

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8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use of IS 456 : 2000, IS 875-1987 and IS 3370 : 2009 is permitted.
13. Detailing carry marks.

1. A circular water tank of capacity 2,75,000 litres is covered with a circular dome and is resting on ground. The depth of water is 3.5m and free board is 200mm. Take live load on the dome as 2 kN/m^2 including load due to floor finish. Use M25 grade of concrete and Fe415 grade steel. Design the top dome and top ring beam at the junction of wall and dome. Sketch the details of reinforcement. **14**

OR

2. Design the wall of a square water tank for a capacity of 75m^3. The tank is fixed at base and free at top. The depth of water is 3m and the free board is 0.3m use M20 grade concrete and Fe415 grade steel. Design for both longitudinal and lateral bending and provide required distribution steel. Design by using IS code or by approximate method. **14**

3. Design an isolated footing for a column 400mm x 300mm transmitting a load of 1000kN and moment of 80 kN.m. The SBC of soil is 200 kN/m^2. Use M20 grade of concrete and Fe415 grade of steel. **13**

OR

4. Design biaxially loaded braced rectangular column to carry an ultimate axial load of 2000kN and ultimate biaxial moment of Mux = 250 kN.m. and Muy = 150 kN.m acting about an axis bisecting the depth and width of column respectively. The effective length about x axis is 3m and y axis is 2.75m. The unsupported length about both axis is 3.5m. Take column size 400 x 600 mm. Use M25 concrete and Fe415 steel. **13**

5. A continuous beam of two spans 8m each carries a factored dead load of 15 kN/m and factored live load 25 kN/m. Draw the bending moment diagram envelopes after 25% redistribution. **13**

OR

6. a) Describe about moment curvature relationship, with respect to reinforced concrete sections. Also draw the diagram. **5**

b) Draw elastic bending moment diagram and bending moment diagram after 20% moment redistribution for a fixed beam of 6m span subjected to two characteristic point loads of 12kN acting at third point. Take partial safety factor for load is 1.5. Draw the diagram. **8**

7. Design the stem of a cantilever retaining wall which is required to support a bank of earth 4m above the GL. Assume a hard strata for foundation is available at 1.3m below GL. The safe bearing capacity of soil is 170 kN/m^2, unit weight of soil is 16 kN/m^3 and the angle of shearing resistance is 30º. Use M20 grade concrete and Fe415 grade steel. **13**
Curtail the main reinforcement and design distribution reinforcement also.

OR

8. A counterfort retaining wall to retain 6.5m high embankment above ground level. The foundation is to be taken 1.5m below ground level where the bearing capacity of soil may be taken as 200 kN/m^2. The back fill is horizontal and soil have density of 17 kN/m^3 with angle of internal friction 30º. Coefficient of friction between concrete and soil may be taken as 0.4. Design stem of counterfort retaining wall. Use M25 concrete and Fe415 steel. **13**

9. Design beam and column of an intermediate single bay-single storey portal frame. The centre line dimensions of the bay and storey are 6m and 4.5m respectively. [The height of the bay is measured above the top of the footing which is assumed to be fixed]. **14**
The centre to centre distance of frames is 3.6m. Total service load inclusive of its self weight and finishes from the 125mm deep slab is 9 kN/m^2. Use M20 grade concrete and Fe415 type steel. Detail the design by a neat diagram.

OR

10. Design a dog-legged stair case (waist slab type) for an office building to suit the following data. height between floor = 3.2m, Risers = 160mm, Tread = 270mm, Length of landing = 1.25m. **14**
Width of flight = Landing width = 1.25m.
Assume stairs to be supported on 230mm thick masonry wall at the outer edges of the landing parallel to the risers. Adopt M20 grade concrete and Fe-415 type steel. Assume a live load of 5 kN/m^2.

11. Design a combined rectangular footing for two column A and B carrying loads of 1000 kN each of service. The size of both columns is 400mm x 400mm. The centre to centre distance of column is 4.0m. Take SBC of soil as 180 kN/m^2 and unit weight of soil as 18 kN/m^3. Angle of repose = 30º. Use M20 grade concrete and Fe415 steel. **13**

OR

12. Design the raft beam for two columns 350 x 350mm and 450 x 450mm supported the service loads of 800 kN and 1500 kN respectively and centre to centre distance between them is 4.4m. The total width of raft slab is 2m. The offsets from centre lines of columns are 0.82m and 1.98m as shown in fig. 1. Use M25 grade of concrete and Fe415 type steel. provide the raft beam over the entire length of the raft slab. Design of raft slab is not required and assume its thickness as 300mm. **13**
Detail design by a neat sketch.

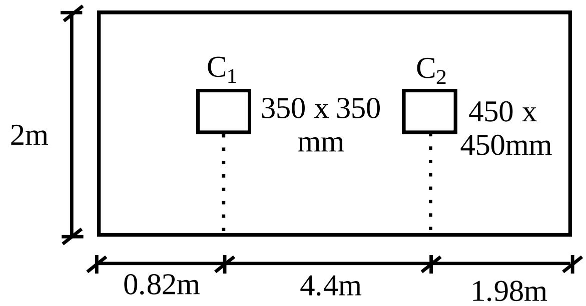

Fig.1

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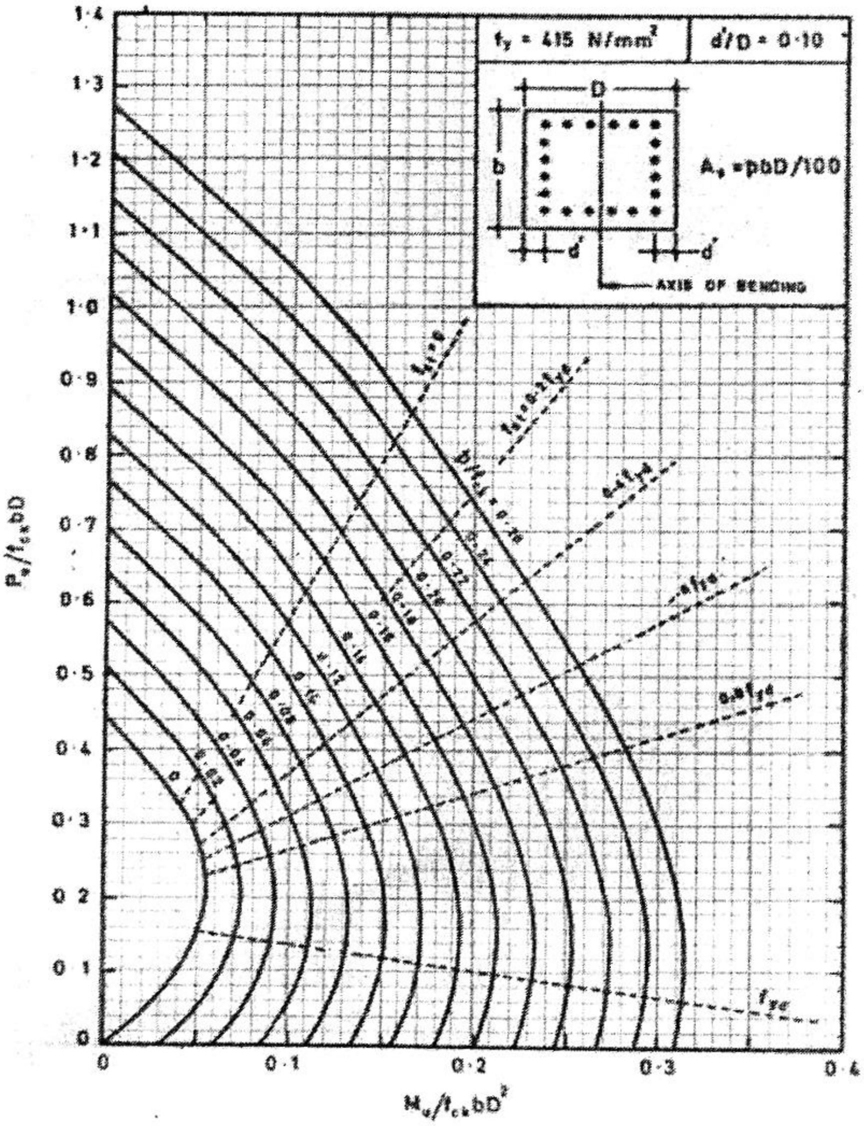
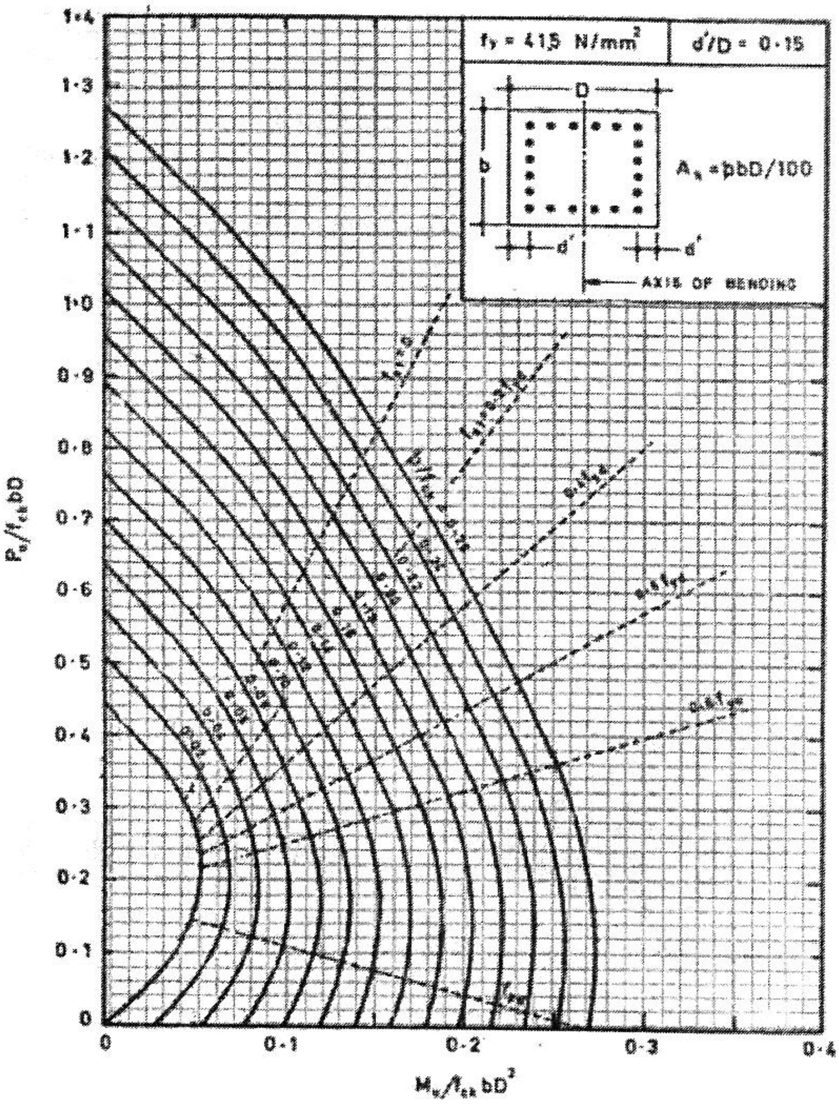
Chart 44 COMPRESSION WITH BENDING—Rectangular Section — Reinforcement Distributed Equally on Four Sides



COMPRESSION MEMBERS

129

Chart 45 COMPRESSION WITH BENDING — Rectangular Section — Reinforcement Distributed Equally on Four Sides



130 DESIGN AIDS FOR REINFORCED CONCRETE

B.E. (Civil Engineering) Seventh Semester (C.B.S.)

Advanced Concrete Structures

P. Pages : 3 **NRJ/KW/17/4571**

Time : Four Hours Max. Marks : 80

* 0 9 5 8 *

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9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.
11. Use of IS456:2000 and IS3370 may be consulted.

1. A circular water tank of capacity 350 m^3 is covered with a circular dome and resting on ground having rigid joint at base. Depth of tank is 3.5 m with free board of 0.5m. Live load on the dome as 2 kN/m^2 including load due to floor finish. Design the following components. **13**

1) Top dome
2) Top ring beam at the junction of wall and dome.

Use M20 grade of concrete and mild-steel.

OR

2. Design R.C.C. rectangular water tank with an open top is required to store 80,000 litres of water. The inside dimensions of tank may be taken as 6mx4m. The tank rests on walls on all the four sides. Design the side walls of the tank using M20 grade of concrete and mild steel. Use approximate design method. Assume rigid joint at base. **13**

3. Design an isolated footing for a column carrying an ultimate load of 800 kN and ultimate moment of 100 kN.m about an axis bisecting the depth of column. (major axis). The size of column is 300x600mm. SBC of soil is to be taken as 250kN/m^2. Use M20 grade of concrete and Fe415 HYSD bars. **13**

OR

4. Design a biaxially loaded RCC column subjected to ultimate load of 300 kN, ultimate moment of 60kN.m about major (x-axis) axis and 45 kN.m about minor (y-axis) axis. The unsupported length of column is 3.5m. The size of column is 250x450mm. Use M20 grade concrete and Fe415 HYSD bars. Interaction curve may be consulted. **13**

5. A continuous beam of two span 8m each caring a factored dead load of 10 kN/m and factored live load of 20 kN/m. Draw BMD envelope after 30% moment redistribution. **13**

OR

6. A) Sketch the bending moment envelope after 30% maximum redistribution for a fixed ended beam carrying 2 point loads of 10 kN each at one-third points and a uniformly distributed load of 2 kN/m over a span of 9m. **9**

B) Explain redistribution of moments state its advantages. **4**

7. Design stem (Vertical wall) of a cantilever retaining wall to retain earth embankment 3.25m above general ground level. The embankment is sloping at an angle 18º to the horizontal. The weight of the earth is 18 kN/m^2 and its angle of repose is 30º. The safe bearing capacity of soil is 200 kN/m^2 at a depth of 1m below the ground level. Assume the coefficient of friction between concrete and soil equal to 0.6. Use M20 grade of concrete and Fe415 HYSD bars. Perform all necessary stability checks. Show the details of reinforcements in the stem. **14**

OR

8. Design stem (Vertical wall) of a counterfort retaining wall for following requirements. **14**

i) Height of wall above ground level = 5.5m.
ii) S. B. C. of soil at site = 160 kN/m^2.
iii) Density of soil = 18 kN/m^3
iv) Angle of internal friction = 33º
v) Spacing of counterforts = 3 m c/c

Use M20 grade of concrete and Fe 415 HYSD bars. Perform all necessary stability checks. Show the details of reinforcements in the wall.

9. An assembly hall 20m long and 12m wide between the centre of columns is supported by a <u>Hinge</u> base portal frame spaced at 4 m c/c, the height of column up to centre of beam is 5.5 m. Design one intermediate portal frame taking live load as 1.5 kN/m^2, floor finish as 0.75 kN/m^2. Use M20 grade of concrete and fe415 steel. Design the column and hinge of the portal frame only. **14**

OR

10. Design dog legged stair case (waist type slab) for an office building of 2.6mx4.5m to suit the following data: **14**

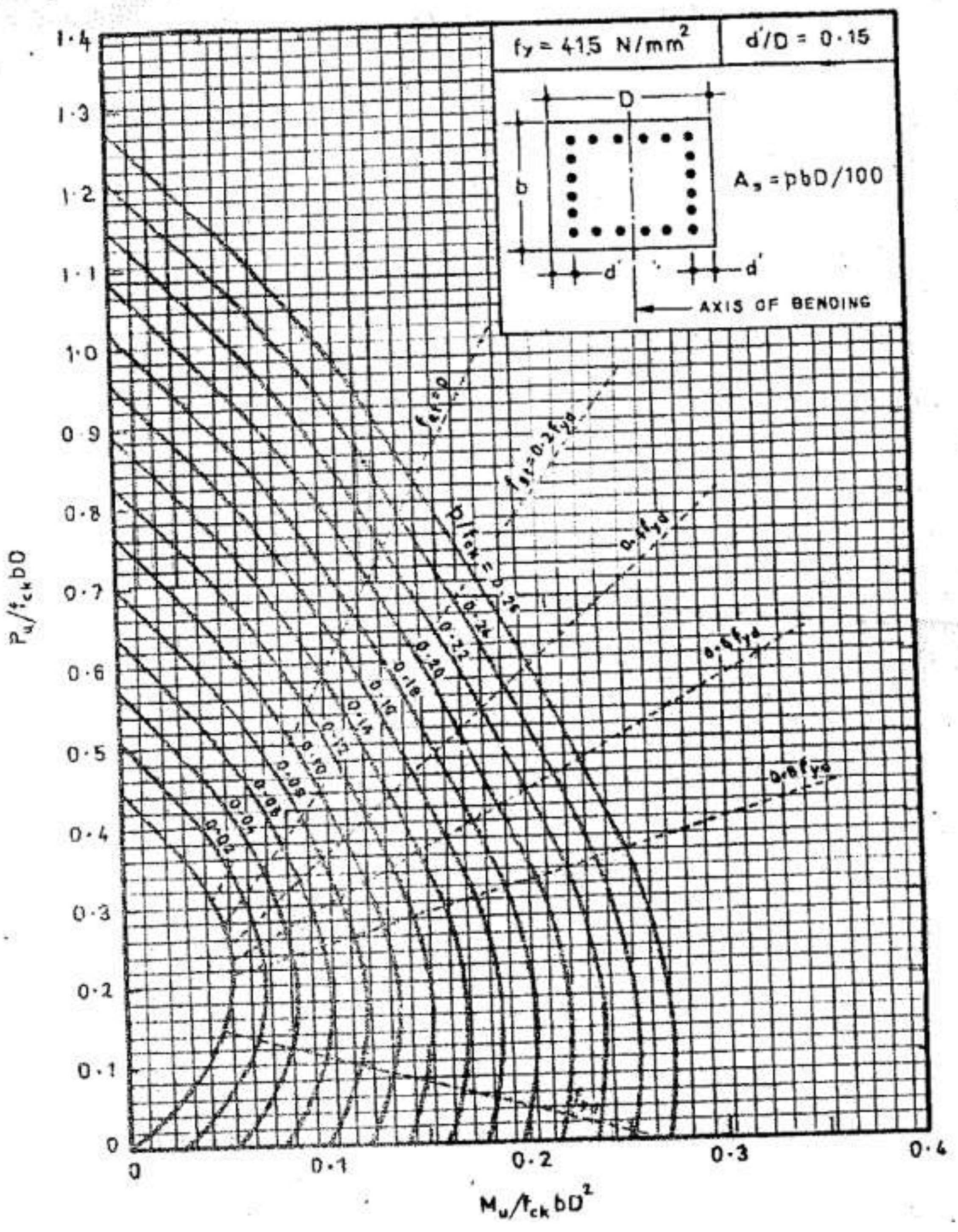
Height between floor : 3.6 m, Risers = 150 mm, Tread = 250 mm, Length of landing = 2.75m, width of flight = landing width = 1.2m, Provide 100 mm bearing at each end. One end of the flight is resting on plinth beam and other on the landing beam at the end of the flight. L. L. = 4kN/m^2

11. Design a combined footing for two column C_1 & C_2 of size 800x800 mm and 600x600 mm carrying loads of 1500 kN and 1000 kN respectively. The width of footing is restricted to 2.2 m. The columns are spaced at 4 m c/c. The SBC of soil is 160 kN/m^2 Use M20 grade of concrete and fe415 steel. **13**

OR

12. Design a combined footing for two columns A and B carrying load of 800 kN and 1200 kN at 4.8m apart. Column A is 350x350 mm and B is 450x450 mm. The length of footing is restricted to 6m. The SBC of soil is 140 kN/m^2 · Use M20 grade of concrete and fe500 steel. **13**

SHORT COMPRESSION WITH BENDING – Rectangular Section – Reinforcement Distributed Equally on Four sides



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B.E. Seventh Semester (Civil Engineering) (C.B.S.)

Advanced Concrete Structures

P. Pages : 4 **NKT/KS/17/7432**

Time : Four Hours Max. Marks : 80

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9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use of IS 456:2000 & IS3370 is permitted.

1. A Circular water tank of capacity 500000 liters resting on a firm ground and having rigid joint at the base. The depth of water is 4m, including a free board of 200mm. Design top dome and circular wall of tank. Use M20 grade of concreate and Fe 415 grade steel. **13**

OR

2. Design the rectangular water tank 6m x 5m with depth of storage 3.5m, resting on firm ground whose walls are fixed at base and free at the top. Design the walls of water tank by using IS code method or by approximate method. Adopt M20 concrete and Fe 415 grade steel. **13**

3. Design the reinforcement for a column with $l_{ex} = l_{ey} = 4.0\text{m}$ and size $400\text{mm} \times 300\text{mm}$. Subjected to a factored load of 1000 kN with biaxial moment of 120kN-m and 80 kN-m w.r.t. the major axis and minor axis respectively. Assume M20 concrete and Fe 415 steel. Interaction curve may be consulted. **13**

OR

4. Design an isolated footing for a column $400\text{mm} \times 300\text{mm}$ transmitting a load of 950kN and moment of 80kN-m. The SBC of soil is $190\,\text{kN}/\text{m}^2$. Use M 20 grade of concrete and Fe 415 grade of steel. **13**

5. Draw elastic moment diagram and bending moment diagram after 30% moment redistribution for a two span continuous beam of span 8m each subjected to udl of 30kN/m on entire span. **13**

OR

6. a) State the advantages of Moment Redistribution Method. **4**

b) Draw bending moment diagram for fixed beam of span 6m carrying two collapse point loads of 20kN each, acting at one third points, after 20% redistribution of moments. **9**

7. A cantilever retaining wall is to retain earth for a height of 4.0 m above ground level. The back fill is horizontal. Density of soil is $18 \text{kN}/\text{m}^3$ and SBC of soil is $200 \text{kN}/\text{m}^2$. Take coefficient of friction between soil and concrete as 0.65 and angle of repose is 30º. Use M20 concrete and Fe 415 steel. Carry out stability analysis and design the **Stem** and **Toe** slab and Sketch reinforcement details. **14**

OR

8. A counterfort retaining wall to retain 6.5 m high embankment above ground level. The foundation is to be taken 1.5m below ground level where the bearing capacity of soil may be taken as $200 \text{kN}/\text{m}^2$. The backfill is horizontal and soil have density of $17 \text{kN}/\text{m}^3$ with angle of internal friction 30º. Coefficient of friction between concrete and soil may be taken as 0.5. Design the Stem of counterfort retaining wall. Use M 25 grade of concrete and Fe 415 steel. **14**

9. The roof of 8m wide hall is supported on a portal frames spaced at 4m intervals. The height of the portal frame is 4m. The continuous slab is 100mm thick. Live load on roof is $2.5 \text{kN}/\text{m}^2$, SBC of soil = $200 \text{kN}/\text{m}^2$. The column are hinged at base. Design the Column and Hinge of the portal frame. Use M20 grade concrete and Fe 415grade steel. **13**

OR

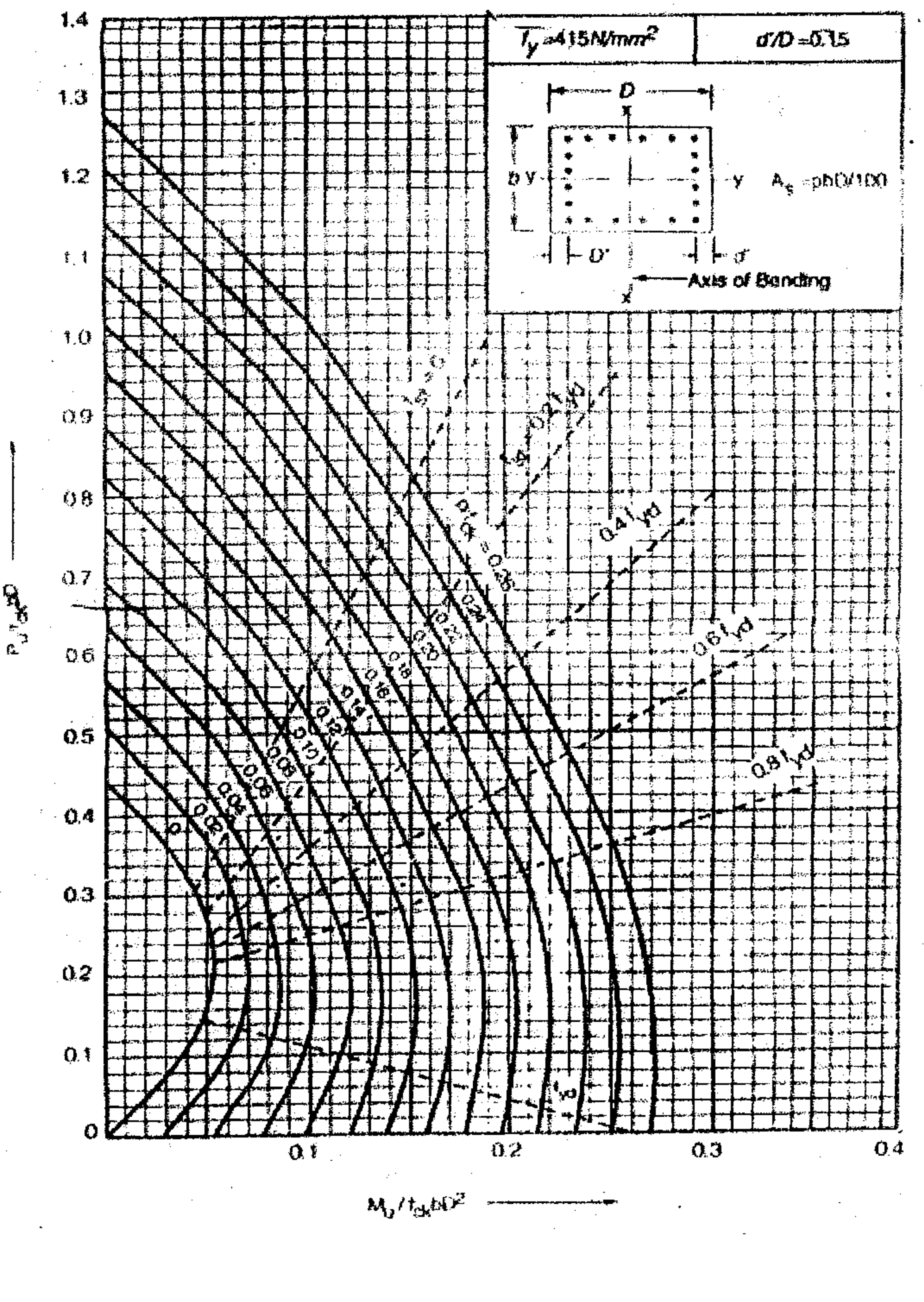
10. Design a dog legged staircase for a residential building hall measuring 2.5m x 4.0m. The distance between floor to floor is 3.6m. The weight of floor finish is $1.5 \text{kN}/\text{m}^2$ and live load may be taken as $3 \text{kN}/\text{m}^2$. Use M20 grade concrete and Fe 415 steel. Flight spans longitudinally. **13**

11. Design a combined rectangular footing for two column A and B carrying loads of 1000 kN each at service. The size of both columns is $400\text{mm} \times 400\text{mm}$. The centre to centre distance of column is 4.0m. Take SBC of soil as $180 \text{kN}/\text{m}^2$ and unit weight of soil as $18 \text{kN}/\text{m}^3$. Angle of repose = 30º Use M20 grade concrete and Fe415 steel. **14**

OR

12. Two columns A and B spaced at 5m center to center. Column A, 300mm x 300mm in size and carries load of 550kN and is on property line. Column B 400mmx400mm in size, carries a load of 800kN. The Bearing capacity of soil is $120 \text{kN}/\text{m}^2$. Design the **footing slab** for the strap beam footing. Use M20 mix and Fe415 steel reinforcement. **14**

Interaction Diagram for Combined Bending and Compression
Rectangular Section - Equal Reinforcement onFour Sides



Interaction Diagram for Combined Bending and Compression
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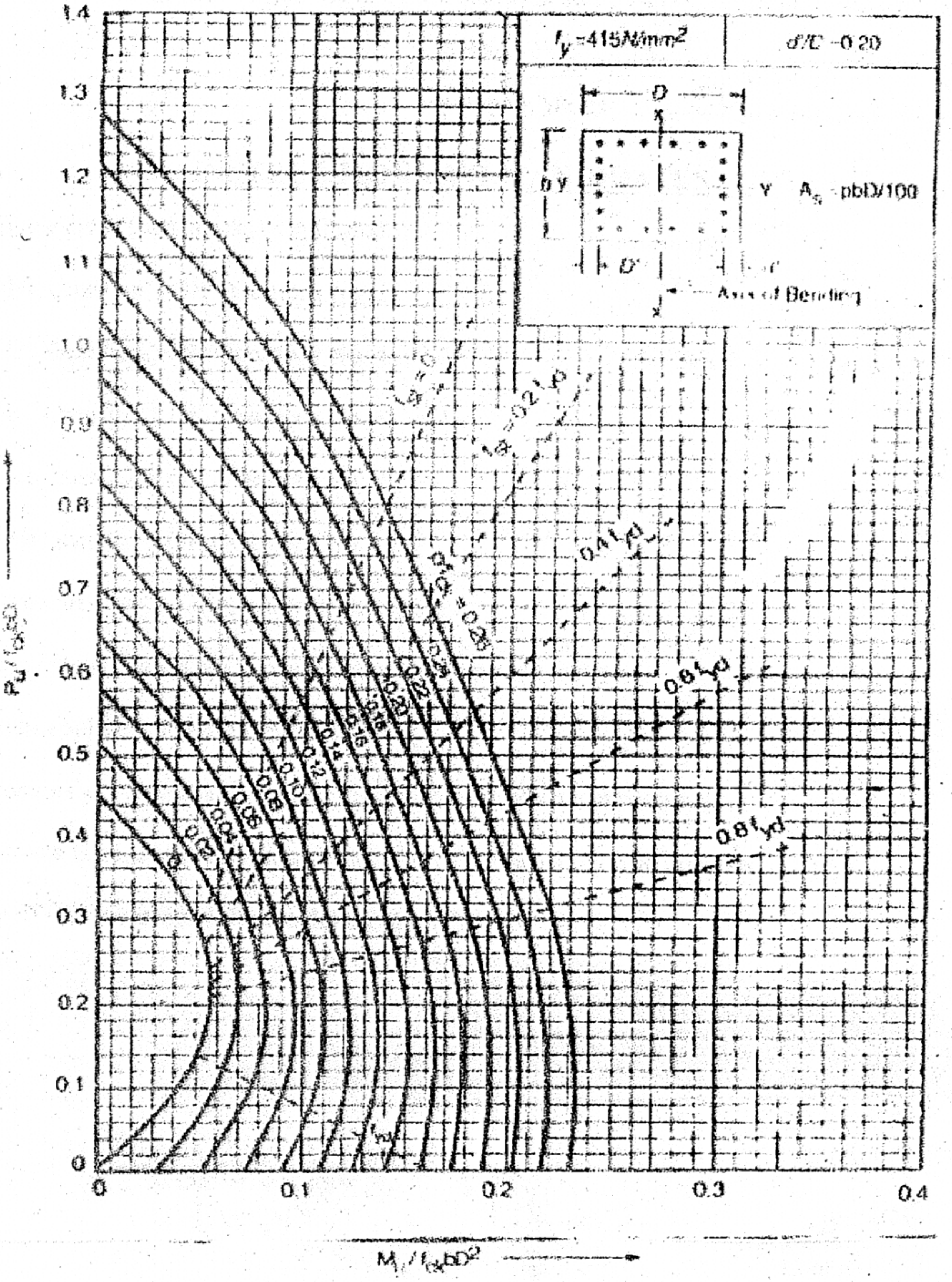

B.E.(Civil Engineering) Semester Seventh (C.B.S.)

Advanced Concrete Structures

P. Pages : 3 **KNT/KW/16/7432**

Time : Four Hours Max. Marks : 80

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9. Assume suitable data wherever necessary.
10. Illustrate your answers wherever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use of IS 456:2000 & IS 3370 IS Permitted.

1. Design the cylindrical wall of circular water tank for a capacity 3,50,000 liter. The tank is fixed at base and free at top. The depth of water is to be 3.5 m and take free board as 0.35 m use M20 grade of concrete and Fe 415 grade of steel. Draw reinforcement Details. **14**

OR

2. Design the wall of square water tank of size 6m x 6m x 3m (L x B x D) for a capacity of 85 m^3 The tank is fixed at base and free at top Use M25 grade of concrete and Fe 415 grade of steel. Draw reinforcement Details. **14**

3. Design biaxially loaded braced rectangular column to carry an ultimate axial load of 2000 kN and ultimate biaxial moment of Mux = 250 kN m and Muy = 150 kN m acting about an axis bisecting the depth and width of column respectively. The effective length about x-axis is 3 m and y axis is 2.75 m The unsupported length about both axis is 3.5 m Take column size 400 x 600 mm. Use M25 concrete & Fe 415 steel. **13**

OR

4. Design a footing for column carrying an ultimate load of 1000 kN and ultimate moment of 100 kN. m about an axis bisecting the depth of Column at its base The size of column is 300 x 600 mm and S.B.C of Soil 180 kN/m^2 Use M20 concrete and Fe 415, Draw reinforcement details. **13**

5. a) Explain redistribution of moments state its advantages. **5**

b) Draw bending moment dia. for fixed beam of span 6 m carrying 12 kN load at one third point, after 20% redistribution of moment. **8**

OR

6. A continuous beam of two span 7 m each carries a factored dead load of 10 kN/m and factored live load 25 kN/m. Draw bending moment diagram envelopes after 30% maximum redistribution. **13**

7. Design stem wall of a cantilever retaining wall for a road with the following requirement. **13**

i) Height of stem = 4.5 m
ii) Back fill is leveled
iii) Unit wt. of fill = 16 kN/m^3
iv) Angle of internal friction for fill material = 30º
v) S. B. C. of soil = 170 kN/m^2
Use M20 grade of concrete and Fe 415 grade of steel. Draw reinforcement Details.

OR

8. Design a stem of a counter-forts retaining wall of 6.8 m height The counter forts are 300 mm thick with the center to center distance between the counter-forts is 3.0 m The safe bearing capacity of soil is 180 kN/m^2, unit wt of soil is 18 kN/m^3 and the angle of shearing resistance is 30º. Use M20 grade of concrete and Fe 415 steel. Draw reinforcement Details. **13**

9. Design the beam of portal frame hinged at base to suit following data. **13**

i) Spacing of portal framed = 4 m
ii) Height of columns = 4 m
iii) Distance between column centers = 10 m
iv) Live load on roof = 1.5 kN/m^2
R. C. C. slab continuous over portal frames. SBC of soil at site = 160 kN/m^2
Adopt M20 grade of concrete and Fe 415 steel. Draw reinforcement details.

OR

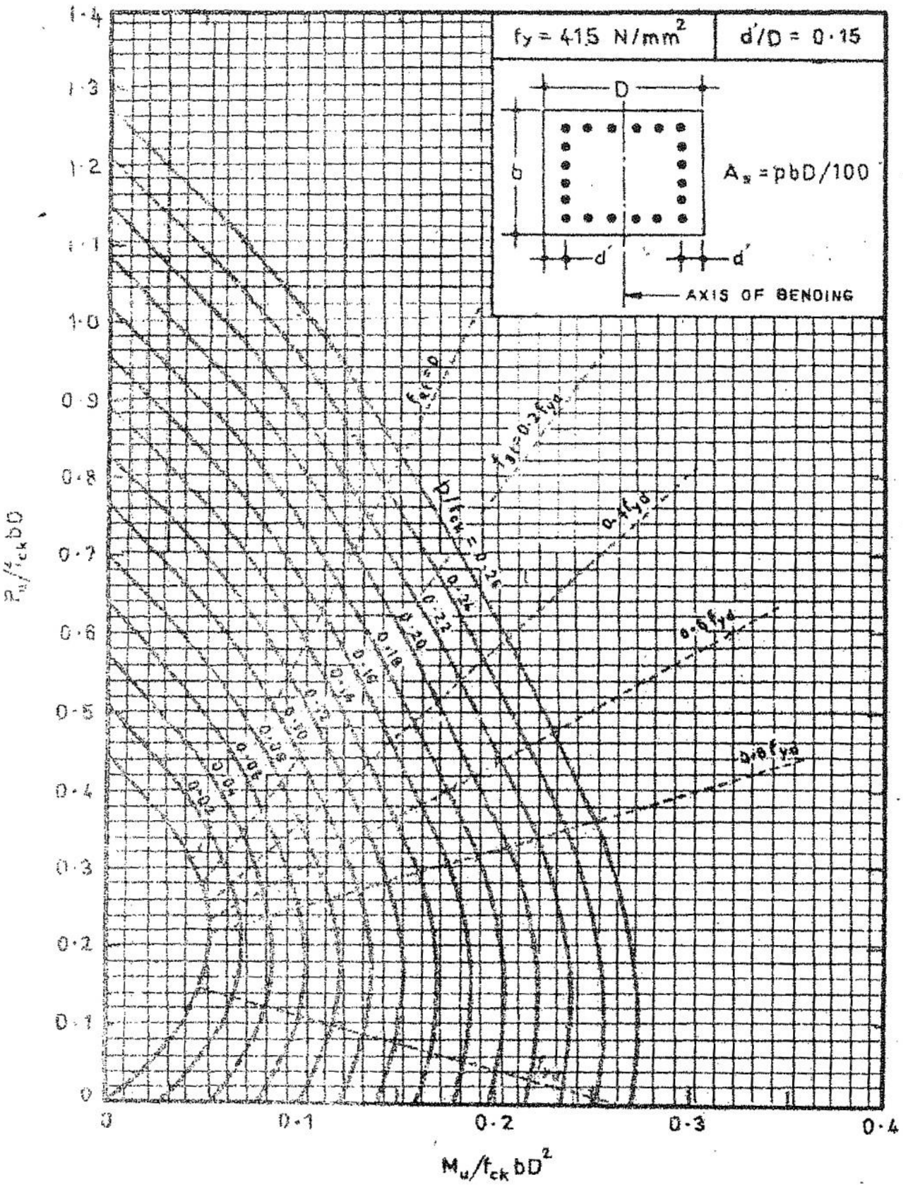
10. Design a doglegged stair case for a building in which vertical distance between floor is 3.2 m The stair case hall measures 2.5m x 5m. Take live load 2.5 kN/m^2. Use M20 grade of concrete and Fe 415 steel. Draw reinforcement details. **13**

11. Design a combined footing for two columns 3.6 m C/C a part carrying load of 850 kN and 1100 kN at service. The size of column 350 x 350 mm and 450 x 450 mm respectively. The length of footing is restricted to 5.5 m Take SBC of soil as 180 kN/m^2. Use M20 Concrete and Fe 415 steel. Draw reinforcement details. **14**

OR

12. Design a combine footing for two column 4 m C/C apart carrying load 800 kN and 1200 kN at service. The size of column 400 x 400 mm and 400 x 400 mm respectively. The width of footing is restricted to 2.0 m. Take SBC of soil as 180 kN/m^2. Use M25 grade of concrete and Fe 415 steel Draw reinforcement details. **14**

hart COMPRESSION WITH BENDING – Rectangular Section – Reinforcement Distributed Equally on Four Sides



B.E. (Civil Engineering) Seventh Semester (C.B.S.)

Advanced Concrete Structures

P. Pages : 4 **TKN/KS/16/7519**

Time : Four Hours Max. Marks : 80

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10. Illustrate your answers wherever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use of IS 456: 2000, IS 875-1987 IS 3370: 2009 is permitted.
13. Detailing carry marks.

1. Design the cylindrical Wall of a Circular Water Tank for a capacity of 400,000 liters. The tank is fixed at base and free at top. The depth of water is to be 4 m and take free board as 0.4m. Use M 25 Grade Concrete and Fe 415 types Steel. **14**
Design for Hoop Tension, Bending Moment, and provide requisite distribution steel. Design by using IS code or by approximate method.
Detail the design by neat Diagram.

OR

2. Design the wall of a Square Water Tank for a capacity of 75 m^3.The tank is fixed at base and free at top. The depth of water is 3m and the free board is 0.3 m. Use M25 Grade concrete and Fe 415 type Steel. **14**
Design the for both longitudinal and lateral bending, and provide required distribution steel.
Design by using IS Code or by approximate method.
Detail the design by neat diagram.

3. An RC Concrete Corner column 400 x 400 mm is subjected to a factored axial load of 1500 kN along with bending moments of 180 kNm and 120 kNm about its mutually perpendicular axes. The unsupported length of column with both ends are hinged is 3.5m. Use M25 grade concrete and Fe 415 type steel. **13**
Design the main reinforcement and transverse reinforcement.
Detail the design by a neat diagram.

OR

4. A RC column 300 x 500 mm is reinforced with 6 Nos. 25mm dia. Fe 415 type steel and grade of concrete is M25 as shown in figure1. Determine the design strength parameters in terms of its Axial force and Bending Moment corresponding to a neutral axis location given by xu/D as 1.2. Consider loading eccentricity is with respect to its major axis. Assume 40mm clear cover to the longitudinal reinforcement. Take the coefficients for Area of stress block and Distance of CG from highly compressed edge as 0.399 and 0.458. **13**

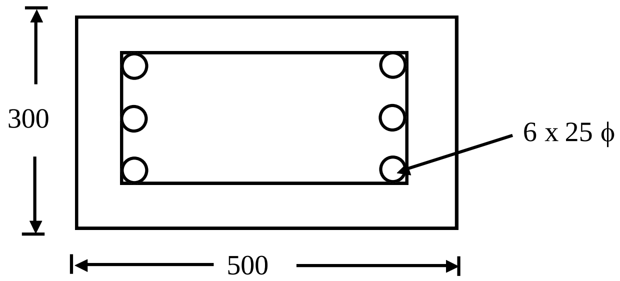


Figure 1

5. a) Describe about Moment curvature relationship, with respected to reinforced concrete sections. And draw the diagram. **5**

b) Draw Elastic Bending Moment diagram and Bending Moment diagram after 30 % moment redistribution for a two span continuous beam. It carries a characteristic udl over both the spans is 30 kN/m, Take partial safety factor for load as 1.5. Take each span as 6m.
Draw the Diagram. **8**

OR

6. a) Explain the necessity of Moment Redistribution in design of RC structures. **5**

b) Draw elastic bending moment diagram and Bending moment diagram after 30 % moment redistribution for a fixed beam of span 6m supporting two characteristic point loads of 12kN each acting at third point. Take partial safety factor for load as 1.5.
Draw the diagram. **8**

7. Design the stem of a cantilever retaining wall which is required to support a bank of earth 4m above the GL. Assume a hard strata for foundation is available at 1.3 m below GL.
The Safe bearing capacity of soil is $170\ \mathrm{kN/m^2}$, unit weigh of soil is $16\ \mathrm{kN/m^3}$ and the angle of shearing resistance is 30º. Use M20 grade concrete and Fe 415 type steel.
Curtail the main reinforcement and design distribution reinforcement also.
Detail the Design by a neat Diagram. **13**

OR

8. Design the stem of a Counter-fort retaining wall which is required to support a backfill of 7.5m above the GL. Assume a hard rock for foundation is available at 1.5m below GL. The counter forts are 500mm thick and the clear distance between the counter forts is 3.2m.
The safe bearing capacity of soil is $170\ \mathrm{kN/m^2}$, unit weigh of soil is $16\ \mathrm{kN/m^3}$ and the angle of shearing resistance is 30º.
Use M20 grade concrete and Fe 415 type steel.
Design distribution reinforcement also.
Detail the design by a neat diagram. **13**

9. Design Beam and column of an intermediate single bay - single storey portal frame. The center line dimensions of the bay and storey are 6m and 4.5m respectively. [The height of the bay is measured above the top of the footing which is assumed to be fixed]. **13**

The center to center distance of frames is 3.6m. Total service load inclusive of its self weight and finishes from the 125 mm deep slab is 10 kN/m^2. Use M20 grade concrete and Fe415 type steel.

Detail the design by a neat diagram.

OR

10. Design only the waist slab of a dog legged stair case shown in figure 2. The service live load is 5 kN/m^2 and finishes are 1.75 kN/m^2 (Projected area). The Rise and Tread of each step are 160mm and 280mm respectively and each flight is having 11 numbers of steps. The width of flight and landing are 1.25m. The landing and flight are spanning at right angles to each other. Use M25 grade concrete and Fe415 type steel. **13**

Detail the design by a neat diagram.

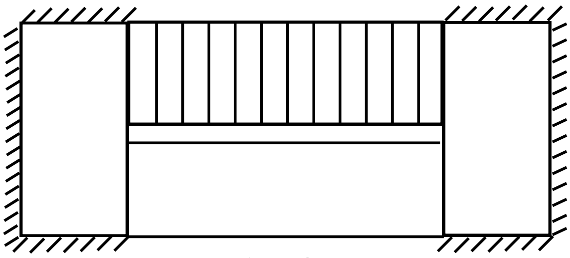


Figure 2

11. Design a combined footing and its main reinforcement for two columns 400 x 400 and 500 x 500 supporting the service loads of 900 kN and 1600 kN respectively and the center to Centre distance between them is 4.5m. The width of combined footing is restricted to 1.8m. the allowable safe bearing capacity of soil is 200 kN/m2. Use M25 grade of concrete and Fe 415 type steel. **14**

Detail the design by a neat diagram.

OR

12. Design the raft beam for two columns 400 x 400 and 500 x 500 supporting the service loads of 900 kN and 1600 kN respectively and the Centre to Centre distance between them is 4.5m. The total width of raft slab is 2m. The offsets from the Centre lines of columns are 0.72m and 1.98m as shown in figure3. Use M25 grade of concrete and Fe 415 type steel. Provide the raft beam over the entire length of the raft slab. Design of raft slab is not required and assume its thickness as 300mm. **14**

Detail design by a neat diagram.

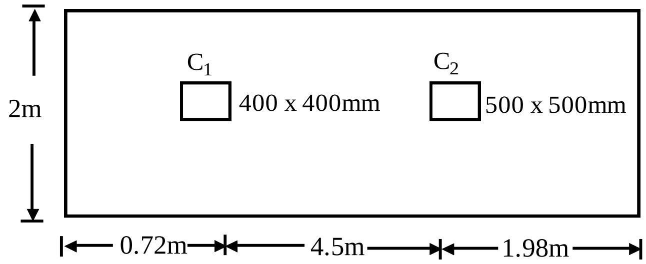
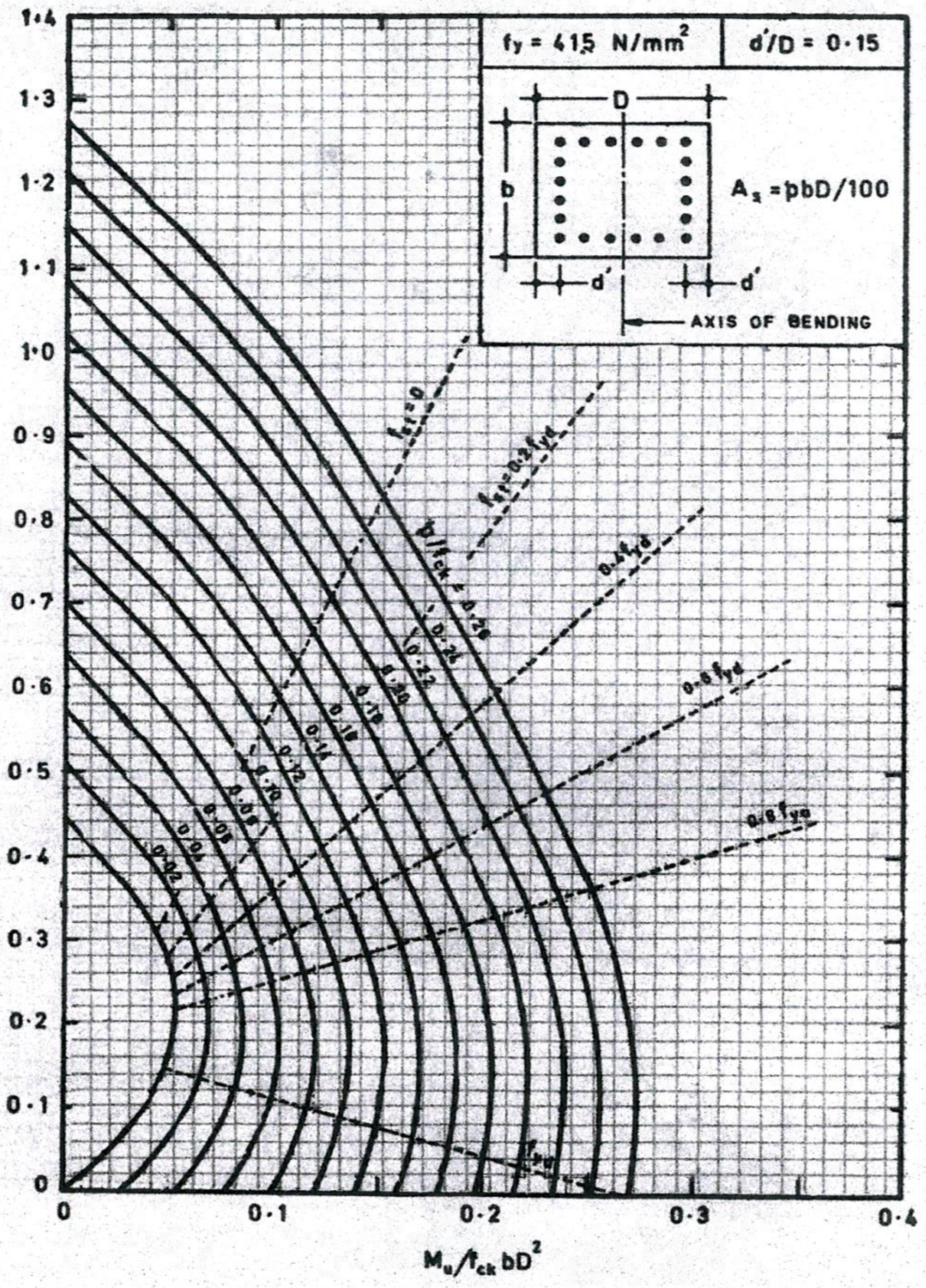


Figure 3

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



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