Total No. of Questions : 12]

SEAT No. :

P4266

[Total No. of Pages :7

[5353]-509
T.E. (Civil) (Semester - II)
STRUCTURAL DESIGN - II
(2015 Pattern)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q. 9 or Q.10 and Q.11 or Q.12.***
2) ***Figures to the right indicate full marks.***
3) ***IS 456-2000 and non programmable calculator are allowed in the examination.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Mere reproduction from IS Code as answer, will not be given full credit.***
6) ***If necessary assume suitable data and indicate clearly.***

Q1) A rectangular RC beam 230 mm wide and 420 mm effective depth is reinforced with 4 No. 12 mm diameter bars in tension. Find moment of resistance by WSM approach. If same R. C. C. beam section is used as cantilever beam having effective span as 1.75 m find out the intensity of uniformly distributed load excluding self weight that can be placed on it. Use material M20 grade concrete and Fe 250 grade steel. **[5]**

OR

Q2) Calculate moment of resistance of a doubly reinforced RC beam section 230 mm × 525 mm overall reinforced with 3 bars of 16 mm diameter on tension side and 3 bars of 12 mm diameter on compression side. The effective cover to both tension and compression steel is 30 mm. The grade of concrete is M20 and steel is Fe 250. Use WSM approach. **[5]**

Q3) A simply supported beam over a span of 6 m carries working load of 45 kN/m. The overall depth of beam is restricted to 600 mm for headroom requirement. Design suitable rectangular section for this beam for flexure only. Take grade of concrete as M20 and steel as Fe 415. Assume effective cover as 50mm. Use LSM approach. **[7]**

OR

Q4) Design a corridor slab over a passage of size 15.70 m × 3.20 m at an entrance of a public building. The slab is simply supported by 300 mm wide beams and carries superimposed load 3.25 kN/m^2. Use M20 grade of concrete and Fe 415 grade of steel. Assume mild exposure condition. Show details of reinforcement. **[7]**

P.T.O.

Q5) For an assembly hall of size 16 m × 8.5 m floor beams are spaced @ 4 m c/c and have a simply supported span of 8.5 m. These beams support the floor slab 140 mm thick. The size of beam is 230 mm × 500 mm overall. Design an intermediate beam as T-beam for flexure with following data:

Live load on slab = 4 kN/m^2; Floor finish = 1.5 kN/m^2;

Wall on beam = 230 mm thick brick wall with 3.00 m height;

Concrete Grade = M 20; Steel Grade = Fe 500

Assume effective cover to steel as 50 mm. Use LSM approach. **[8]**

OR

Q6) Figure 1 shows the layout of a typical floor for an office building. The live load and floor finish are 4 kN/m^2 and 1.5 kN/m^2, respectively. Design slab panel S_1 using LSM approach. The grade of concrete is M20 and steel is Fe 250. Show details of reinforcement. **[8]**

Q7) a) A reinforced concrete beam has a support section with a width of 230 mm and effective depth 500 mm. The support section is reinforced with 3 number 20 mm diameter bars on the tension side. 6 mm diameter-2 legged vertical stirrups are provided at a spacing of 150 mm c/c. Using M20 grade concrete, Fe 250 grade steel calculate the shear capacity of the beam section. **[7]**

b) A rectangular RC beam 300 mm × 700 mm overall is subjected to factored sagging bending moment of 175 kNm, factored shear force of 75 kN and factored twisting moment of 20 kNm. Design the reinforcement for given section using M20 grade of concrete and Fe 415 steel. **[10]**

OR

Q8) Using IS code coefficients design a continuous beam B_{17}-B_{21}-B_{25}-B_{29} of a typical floor for an office building shown in figure 1. All slab panels are 150 mm thick. The live load and floor finish for slabs are 4 kN/m^2 and 1.5 kN/m^2, respectively. This continuous beam also supports 230mm thick brick masonry wall of 3.25 m height. Use LSM approach. Show details of tension as well as shear reinforcement. **[17]**

Q9) A rectangular RC beam 300mm × 600 mm overall is fixed at one end and simply supported at the other end. It has a span of 6 m. It carries working superimposed load (exclusive of self weight) of 42 kN/m. Design the reinforcement at fixed support and near mid-span for following two cases:

a) without allowing redistribution of moment; b) allowing 30% redistribution of moments. Use M20 grade of concrete, Fe 415 steel and effective cover of 35 mm. **[16]**

OR

Q10) Design a short RC column and its isolated footing by LSM approach using M20 concrete and Fe 415 steel to carry a working axial load of 750 kN and working moment of 75 kN-m about major axis bisecting the depth of column. The unsupported length of column is 3.00 m and both ends of column are pinned. Take SBC of soil as 225 kN/m^2. Show details of reinforcement in plan and sectional elevation. Use given interaction charts. **[16]**

Q11) Design a short axially loaded column and its isolated footing for carrying a working axial load of 1000 kN. The effective length of column is 3.30m. Use M20 grade of concrete and Fe500 grade of steel. SBC of soil is 200 kN/m^2. **[17]**

OR

Q12) Design a bi-axial rectangular short column by LSM approach with material M20 and Fe 415 steel to carry a working moment load of 900 kN, working moment of 60 kN-m about major axis bisecting the depth of Column and 20 kN-m about minor axis bisecting the width of column. The unsupported length of column about major and minor axis is 3.6 m and 3.2 m; respectively. Also design the footing for this column only for flexure and punching shear. Take SBC of soil as 200 kN/m^2. Show details of reinforcement in plan and sectional elevation. Use given interaction charts. **[17]**

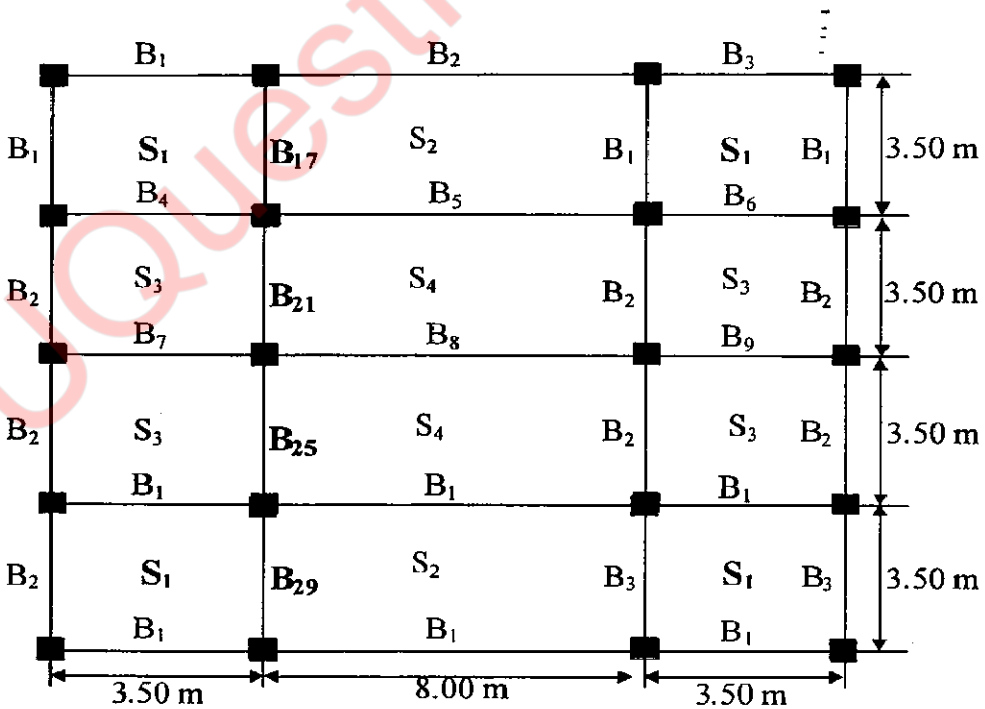

Figure 1: Typical floor plan of office building

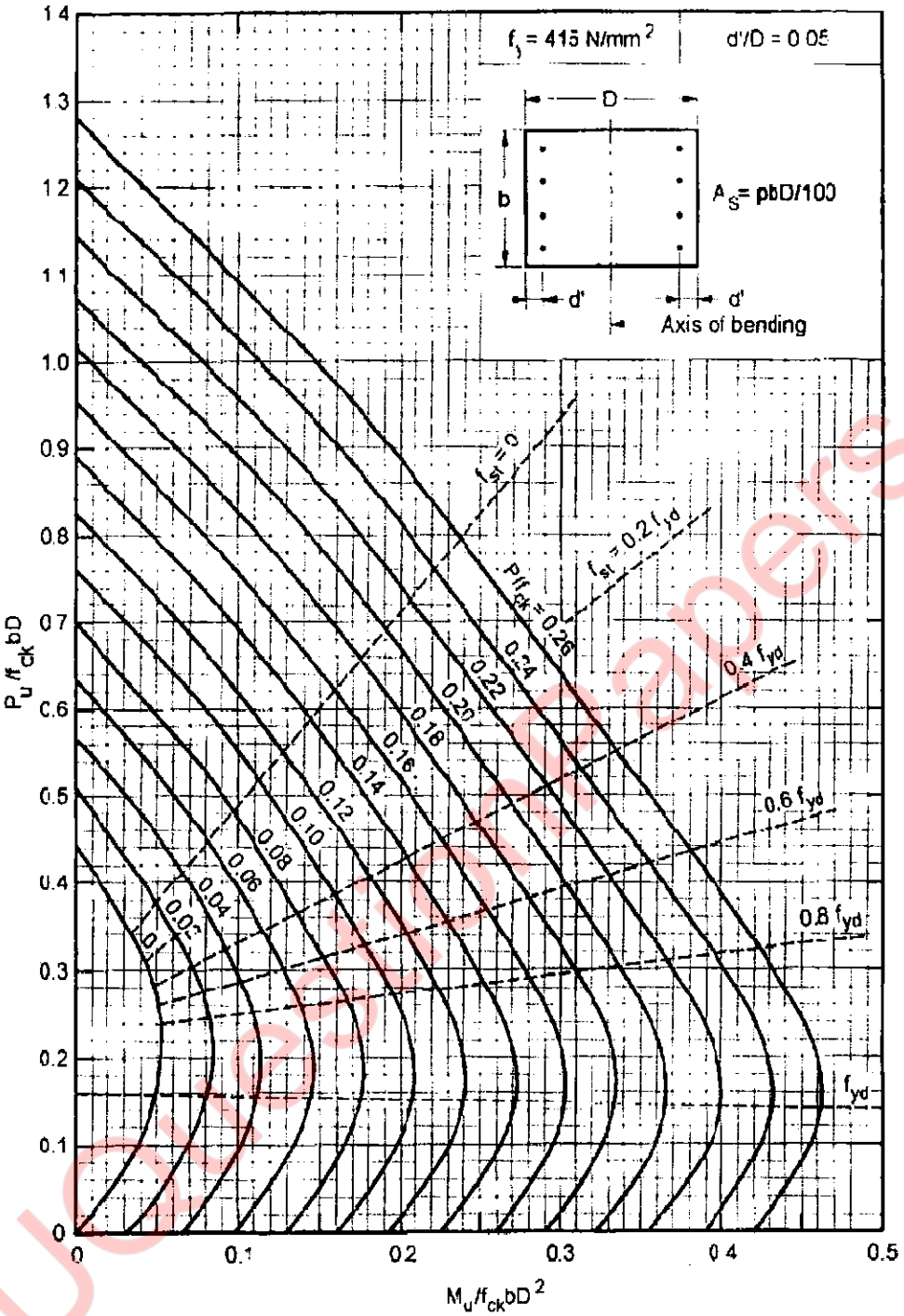

Chart No 1: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on opposite sides

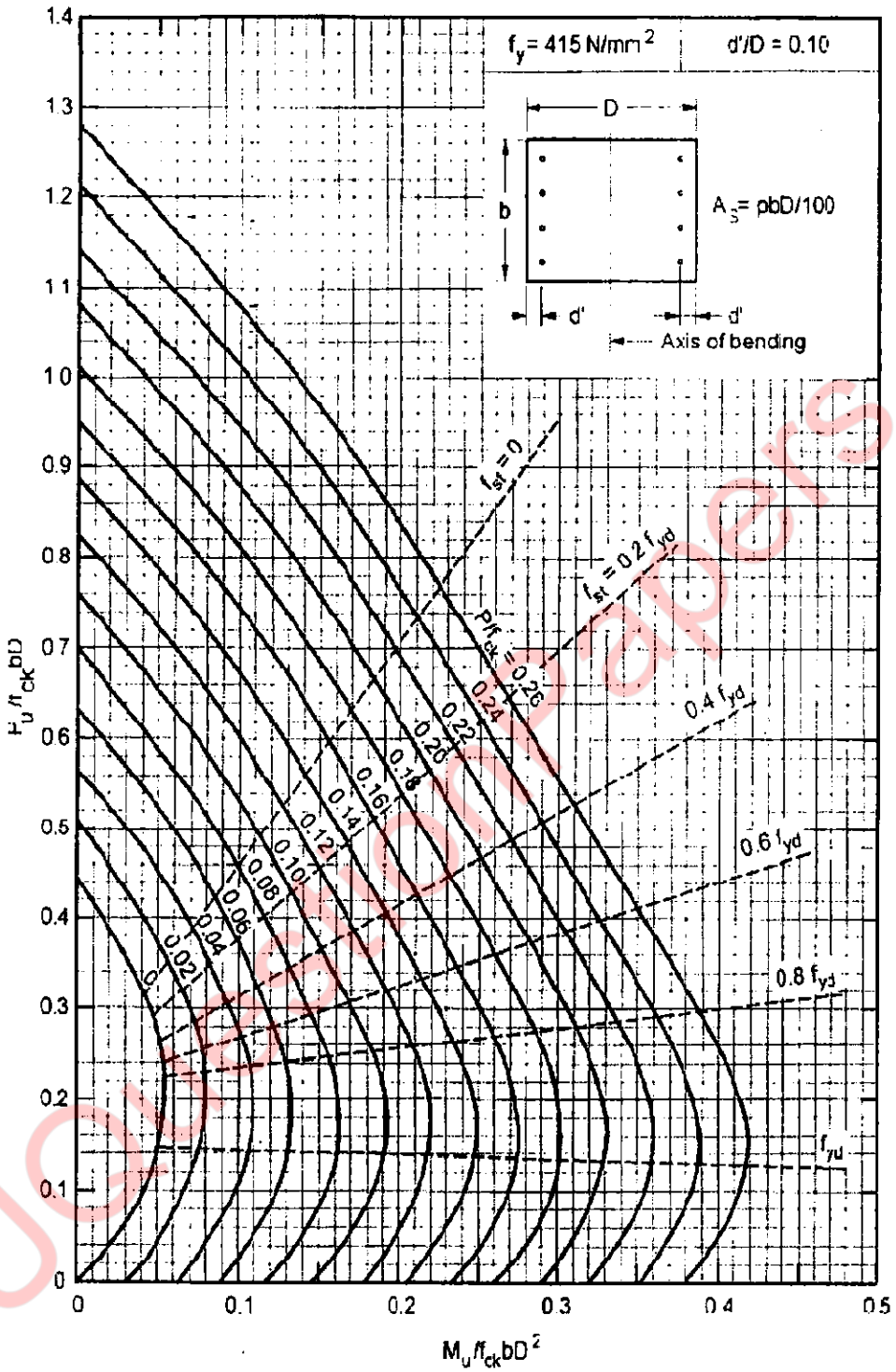

Chart No 2: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on opposite sides

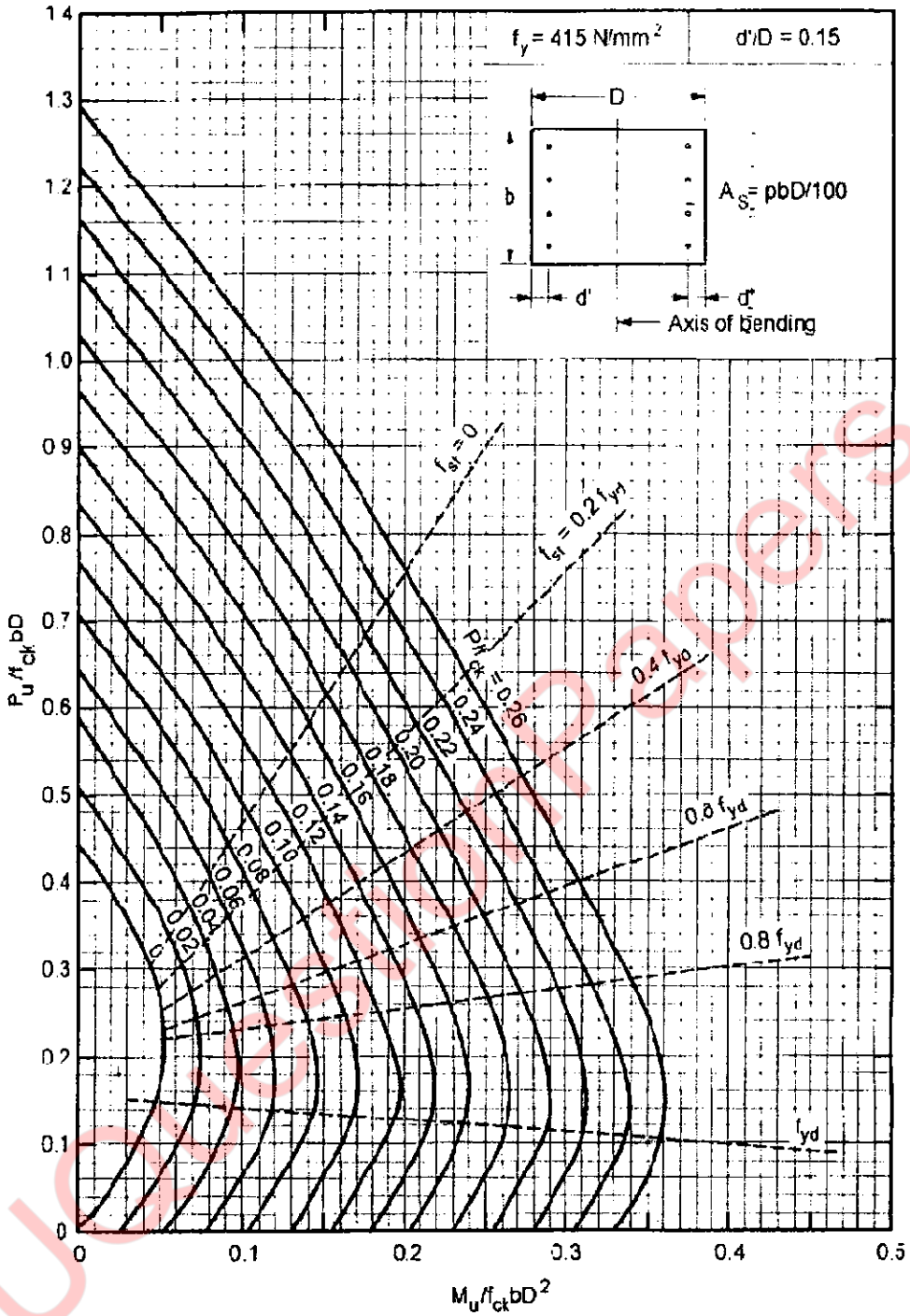

Chart No 3: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on opposite sides

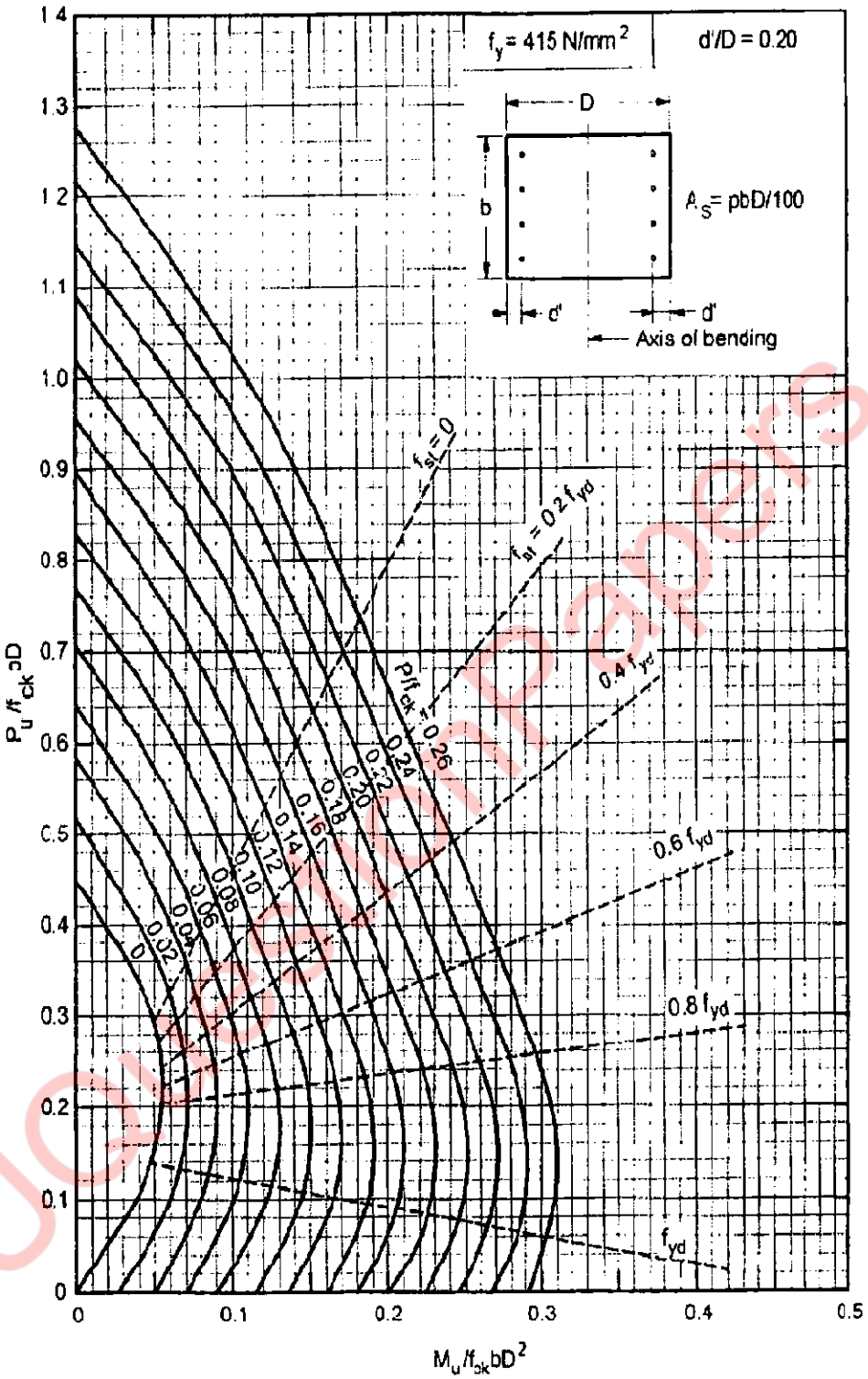

Chart No 4: Interaction chart for combined bending and compression on rectangular section with equal reinforcement on opposite