Time: 3 Hrs **Marks:80**

NB: 1) Question No. 1 is compulsory
2) Attempt any 3 of the remaining 5 questions
3) Assume suitable data wherever necessary
4) Numbers to right indicate full marks.

1. Answer any 4:

a) Define Density index and placement water content 05

b) The results of laboratory tests conducted on soil shows % passing through 75 Micron is 14% and passing through 4.75 mm is 92%. D_{10}=0.14mm, D_{30}=0.33mm, D_{60}=1.0mm, w_L=16% and w_P=8% Classify the soil as per IS classification system 05

c) Define (i)Activity (ii)Toughness index(iii) derive the relation between bulk density and dry density starting from basics 05

d) A 3m thick soils stratum has a coefficient of permeability of $3x10^{-7}$ m/sec. A separate test gives porosity 40% and bulk density of 21kN/m^3 at a moisture content of 31% .Find the head at which the upward seepage will cause quicksand condition. what is the flow required to maintain critical condition 05

e) Elaborate the necessity of soil exploration and mention the stages in sub soil investigation 05

f) A partially Saturated soil sample obtained from an earth fill has a natural moisture content of 22% and Unit Weight of 19.62kN/m^3.Assuming specific gravity of solids as 2.7 compute: (a) degree of saturation; (b) void ratio; (c) If subsequently the soil gets saturated find its unit weight 05

2. a) Derive the expression for finding Moisture content by Pycnometer method 05

b) A compacted fill is to be constructed using one of the two potential borrow areas A and B. The Insitu properties are as follows 10

Property	Borrow Area A	Borrow Area B
void ratio	0.8	0.68
specific gravity	2.65	2.65
Water Content	17.5%	14%

Compacted volume of embankment will be 50000m^3 its Unit Weight is 20kN/m^3 at a placement water content of 20%. Soil from the borrow area is to be Excavated and transported to the site in trucks of 10m^3 capacity. During excavation and dumping of soil in trucks, soil increased its volume by 10%. At the site the additional water content is added and compacted by Pneumatic tyred rollers. Cost of excavation, transportation and compaction is ₹400/truck from borrow pit A and ₹500/truck from B. Water charges per truck is ₹150/truck of same capacity .Determine which borrow area is economical.

c) Define Stokes law and explain the corrections applied in hydrometer analysis 05

3. a) A series of tests on soil sample indicates the following Index properties: liquid limit= 53.9%, plastic limit= 23.4%, natural water content= 51.2%, D_{60}=0.0050 mm,D_{10}= 0.0007mm. undisturbed compressive strength = 180kN/m^2, Remoulded compressive strength = 85kN/m^2 Find(i) Uniformity coefficient(ii) plasticity index(iii) liquidity index(iv) sensitivity of soil(v) Classify the soil as per IS classification system. 10

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b) Derive the relation between shrinkage limit, void ratio and specific gravity 05

c) The plastic limit of soil is 25% and its plasticity index is 8% when the soil is dried from its state at plastic limit the volume change is 25% of its volume at plastic limit .Similarly the corresponding volume change from liquid limit to dry state is 34% of its volume at liquid limit find shrinkage limit and shrinkage ratio. 10

4. a) Define Darcy's law and derive the expression for finding coefficient of permeability for stratified soil deposits in vertical direction. 05

b) A well is fully penetrated into a 16 m thick layer of sand which is underline by a rock layer water is pumped out of the well at constant rate of 450000 litre per hour .The water level in two observation wells situated at 15m and 30m from the test well are found to be 3.7 m and 2.6 m respectively below the ground level. Find the Coefficient of permeability of the soil and also calculate the radius of influence of the test well and the drawdown in the test well. 10

c) List out the uses of flow net .Given a flow net of cofferDam Foundation has 6 flow channels and 18 equipotential drops.The head of water lost during seepage is 6 m. If the coefficient of permeability of foundation is $4x10^{-5}$ m/min ,Then the seepage loss per metre length of dam will be 05

5. a) A layer of saturated clay 4 m thick overlain by a sand layer 5m Deep. The water table is 3 m below the surface. The saturated unit weight of clay is 19kN/m^3 and saturated unit weight of sand is 20kN/m^3 and bulk density of sand above the water table is 17kN/m^3. If a 4 m Deep sand layer of density=20kN/m^3 is placed over the surface, find the effective stress at the centre of the clay layer (i) Immediately after the fill has been placed.
(ii)Many years after the fill has been placed. Also draw the pressure distribution diagrams for total , neutral and effective stress after a long run 10

b) A falling head permeability test was carried out on a 15 cm long sample of silty clay. The diameter of the sample and stand pipe were 9.8 cm and 0.75cm respectively. The water level in the stand pipe was observed to fall from 60 cm to 45cm in 12 minutes. Find (i) Coefficient of permeability in meter/ day (ii) Height of water level in stand pipe after 20 minutes. 05

c) Explain briefly different types of seepage failures on hydraulic structures along with their prevention measures 05

6. a) The results of an IS Standard Proctor Test are as follows: 10

Trial No.	1	2	3	4	5
Moisture content (%)	10	12	14.3	16.1	18.2
mass of mould +wet soil(g)	2925	3095	3150	3125	3070

volume of mould=1000ml ,mass of mould=1000g. The specific gravity of the soil particle is 2.65. Plot the following: a) moisture content - dry density curve, b) zero air voids curve and c) 80% saturation line. Determine the optimum moisture content and the corresponding maximum dry density d) Also find the degree of saturation at OMC.

b) explain the effect of compaction on engineering properties of soil 05

c) what is Undisturbed and disturbed samples explain any two design features required for getting Undisturbed sample 05

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Time: 3 Hours **Maximum Marks: 80**

Instructions:

1. **Question No.1 is compulsory**
2. **All questions carry equal marks**
3. **Attempt three questions out of the remaining five questions**
4. **Figures to the right indicate full marks.**
5. **Assume suitable data if required and state it clearly**

1.		Attempt any **four out of five** of the following **(each question carries 5 marks)**	**20**
	(a)	Define the bulking of sand. State its effects on the concrete mix.	
	(b)	List four properties of high-performance concrete.	
	(c)	Define workability and name two tests used to measure it.	
	(d)	What are bleeding and segregation?	
	(e)	What is zero slump concrete?	
2.	**(a)**	Describe the role of pozzolanic materials with any two examples.	**7**
	(b)	Explain the effect of water-cement ratio on strength and durability of concrete.	**7**
	(c)	Explain the slump cone test, including a neat sketch and a step-by-step procedure.	**6**
3.	**(a)**	State and explain six factors that affect the durability of concrete.	**7**
	(b)	Explain plastic shrinkage cracks and remedial measures.	**7**
	(c)	What is the grading of aggregate? Explain with a neat example.	**6**
4.	**(a)**	Define Hot weather concrete. what are the effects of hot weather on concrete? What precautions should be taken during hot weather concreting?	**10**
	(b)	Explain the stepwise procedure of mix design as per IS 10262.	**10**

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5. (a) Design a concrete mix by IS 10262: 2009 for the following data: **13**

i. Characteristic compressive strength required in the field at 28 days grade designation = M 25
ii. Standard Deviation = 4.0
iii. Nominal maximum size of aggregate = 20 mm
iv. Shape of C.A aggregate = Angular
v. Degree of workability required at site = 50-75 mm slump
vi. Type of exposure = mild
vii. Method of concrete placing = Pumpable concrete
viii. Specific gravity of cement = 3.15
ix. Specific gravity of C.A = 2.84
x. Specific gravity of F.A = 2.64
xi. Aggregates are assumed to be in a saturated surface-dry condition.
xii. F.A belongs to Zone II

Table 2 Maximum Water Content per Cubic Metre of Concrete for Nominal Maximum Size of Aggregate
(*Clauses* 4.2, A-5 *and* B-5)

Sl No.	Nominal Maximum Size of Aggregate	Maximum Water Content [1]
	mm	kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

NOTE — These quantities of mixing water are for use in computing cementitious material contents for trial batches.

[1] Water content corresponding to saturated surface dry aggregate.

Table 3 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate
(*Clauses* 4.4, A-7 *and* B-7)

Sl No.	Nominal Maximum Size of Aggregate	Volume of Coarse Aggregate[1] per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
	mm	Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.50	0.48	0.46	0.44
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.75	0.73	0.71	0.69

[1] Volumes are based on aggregates in saturated surface dry condition.

(b) Write a note on applications of steel and polypropylene fiber-reinforced concrete. **7**

6. (a) Describe the significance of curing. List various curing methods. **6**

(b) Write a short note on concreting under extreme weather: Cold **8**

(c) Write a short note on pumpable concrete and its mix considerations. **6**

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(Time : 3 Hours) **(Total Marks 80)**

Note: 1. Q.No.1 is compulsory.
2. Attempt any three questions out of remaining five questions.
3. Assume any data if required stating clearly.

Q.No.1 Attempt any four questions **5x4=20**

(a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.

(b) Draw the neat sketch of hydroelectric power plant.

(c) Explain briefly classification of hydraulic turbine.

(d) Derive conditions for most economical rectangular channel section.

(e) Draw and explain briefly Specific Energy Curve.

Q.No.2.(a) (a) A jet of water of diameter 25 mm strikes hinged square plate at its centre with a velocity of 15 m/s. The plate is deflected through an angle of 20^0. Find the weight of the plate. If the plate is not allowed to swing what will be the force required at the lower edge of the plate to keep the plate in vertical position **10**

(b) A jet of water of diameter 75 mm strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of the jet. The jet is deflected through of 165^0. Assuming the plate smooth, find: (i) Force exerted on the plate in the direction of jet (ii) Power of the jet (iii) Efficiency of the jet **10**

Q.No.3 (a) A Pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The Pelton wheel develops 100 KW shaft power. The velocity of bucket is 0.50 times the velocity of the jet, overall efficiency is 90% and coefficient of the velocity is equal is 0.98 **10**

(b) A Kaplan turbine working under a head of 22 m develops 12000 kW shaft power. The outer diameter of the runner 3.5 m and hub diameter 1.75 m. The guide blade angle at the extreme edge of the runner is 35^0. The hydraulic and overall efficiencies of the turbines are 88% and 83% respectively. If the velocity of whirl is zero at outlet, determine
(i) runner vane angles at inlet and outlet at the extreme edge of runner and (ii) Speed of the turbine **10**

Q.No.4 (a) A single stage centrifugal pump with impeller diameter of 30 cm rotates at 2000 rpm and lifts water at the rate of 4 m^3/s to a height of 32 mt with an efficiency of 75%. Find the number of stages and diameter of each impeller of a similar multistage pump to lift water the rate of 5 m^3/s to a height of 220 mt when running at 1500 rpm. **10**

(b) (i) Explain Hydraulic Crane **5x2=10**
(ii) Write short notes on Hydraulic Press

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Q.No.5(a)	Derive the conditions for most economical trapezoidal channel.	**10**
(b)	A concrete lined circular channel of diameter 3 m has a bed slope of 1 in 500. Workout the velocity and flow rate for the condition of (i) Maximum Velocity and (ii) Maximum Discharge. Take Chezy's Constant =50	**10**
Q.No.6 (a)	Derive the expression for gradually varied flow and state assumptions.	**10**
(b)	(i) Explain briefly various surface profiles with neat sketches. (ii) The discharge of water through a 6 mt wide rectangular channel is 20 cumec when the depth of flow is 2 mt. Calculate (i) Specific Energy of the flowing water (ii) Critical depth (iii) Critical Velocity and Minimum Specific Energy	**5x2=10**

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(3 hours) **[Total Marks-80]**

N.B. (1) **Question no. 1 is compulsory**
(2) Attempt **any THREE**questions out of remaining five

1. Attempt any FOUR **4 x 5 = 20 Marks**

a) Differentiate between lifts and escalators.
b) Explain in detail types of pipes.
c) Explain Single Phase/ 3 Phase system.
d) Explain Drainage system. Draw and explain the systems of plumbing for drainage in residential buildings.
e) What is grouting? Write its application in repair.
f) Write short notes on Septic tank with neat sketch.

2. **a)** Explain the different types of wires and wiring systems. What points will you consider while making choice of wires and wiring systems? **[10]**

b) What is Condition Survey? Explain the stages of conducting Condition Survey of a RCC structure. **[10]**

3. **a)** Enlist the semi destructive and nondestructive methods. Explain any **TWO** in detail. **[10]**

b) Enlist and explain various causes of Deterioration in Concrete Structures. **[10]**

4. **a)** Explain Earnest Money Deposit and Security Deposit **[10]**

b) What are the methods of corrosion protection? Explain in detail. **[10]**

5. **a)**Explain the common repair materials used for repair or rehabilitation or strengthening of the concrete structures and also the selection criteria of repair materials. **[10]**

b) Discuss about the firefighting systems installed in buildings. **[10]**

6. **Attempt any FOUR** **4 x 5 = 20 Marks**

a) Enlist and explain protective devices in electrical installation.
b) Discuss the properties of Water Proofing materials and explain any one water proofing method in detail.
c) Explain the working principle of lifts.
d) Explain the temporary support structures.
e) What are the causes of seepage in concrete structures?

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(Time: 3 Hours) **[Total Marks: 80]**

Note: i. Q. No. 1 is **compulsory**
ii. Attempt **any 3** out of remaining 5

1. Solve any four (20 M)
   A. Discuss on disadvantages of Roadways, Railways and Airways.
   B. Explain various surveys related to highways.
   C. Explain O&D study
   D. Compare rigid and flexible pavement and draw neat sketch of both pavements showing each layer.
   E. Write a note on Soil Stabilisation.
   F. Explain development of pothole in rigid pavement.

2. A. Write a note on: (10 M)
      i. Level of service
      ii. Types of Conflict points at four-legged intersection.

   B. Solve the following: (10 M)
      i. Draw layout of an airport with two intersecting runways and mention the purpose of each element of airport.
      ii. Draw layout of artificial Harbour and mention the purpose of each element.

3. A. What is camber? What are its types? Find out the amount of camber to be provided on a 4-lane divided State Highway. (10 M)
   B. Explain Lane distribution factor. Also find Million standard axle (msa) for construction of a two-lane road having initial traffic 600 cvpd in both directions. Rate of growth is 7.5 %, VDF is 3, construction period is 2 years & Design period is 20 years. (10 M)

4. A. Write a note on: (10 M)
      i. Types of traffic signals
      ii. Road markings
   B. Explain stepwise procedure for construction of Bituminous concrete pavement. (10 M)

5. A. Discuss on Super elevation and Negative super elevation. Also, If a 5^0 curve diverges from a 3^0 main curve in reverse direction in a layout of B.G yard. If speed on Branch line is 40 kmph, find the speed of Main line. (10 M)
   B. Write a note on: (10 M)
      i. Highway drainage.
      ii. Types of Harbors

6. A. Enlist different tests carried out in Transportation Engineering Laboratory and explain any one in detail. (10 M)
   B. Solve the following: (10 M)
      i. Write a note on Water Bound Macadam road.
      ii. Find out the stress due to wheel load 5100 kg. Take $E = 3 \times 10^5$ kg/cm^2, h = 18 cm, μ = 0.15, k = 6 kg/cm^3, a = 15 cm.

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Time: 3 Hours **Maximum Marks-80**

Please Note:

(1) All questions carry equal marks.

(2) Question No. 1 is compulsory, attempt any three out of the remaining five questions.

(3) Use of IS 456:2000 is permitted

(4) Assume suitable data if required and state it clearly.

Q1) Attempt any **4 out of 6** from following questions. Each question carries 5 marks. **20**

(a) What is Raft footing? When it is provided? Draw section and plan of raft footing.

(b) Differentiate between One Way slab and Two way slab also give IS recommendation.

(c) Write short note on Limit State of Collapse and Limit State of Serviceability.

(d) What is necessity of providing shear reinforcement?

(e) Explain function of transverse reinforcement in a column with IS Specification.

(f) Discuss the Codal recommendation for curtailment of reinforcement in Slab, Column and beam.

Q2) (a) A rectangular beam of width 350 mm subjected to uniformly distributed load of 15kN/m over an effective span of 8m. Design the singly reinforced beam. Use M20 and Fe 250. **Adopt Working Stress Method** **10**

(b) Calculate the limiting moment of resistance area of steel for an Isolated reinforced T-beam having:-

Flange width= 1600mm

Effective depth= 350mm

Thickness of flange= 100mm

Width of web= 250mm; Use M20 and Fe500. **Adopt Limit State Method.** **7**

(c) What are advantages of T-beam over rectangular beam **3**

Q3) (a) Design doubly reinforced beam for: Size of beam = 250 mm x 450 mm (effective), Bending Moment = 65000 N.m & effective cover = 50 mm. Use M20 and Fe415. **Adopt Working Stress Method.** **8**

(b) Design a rectangular beam 230mm x 600 mm over an effective span of 5m. The superimpose load on the beam in 50 kN/m. Effective cover to reinforcement is take as 50mm. Use M20 concrete and Fe 415 steel. Sketch details (plan & section at midspan and section at support). **Adopt Limit State Method.** **12**

Fy (N/mm^2)	d'/d			
	0.05	0.1	0.15	0.2
415	355	353	342	329

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Q4) (a) A simply supported beam 300 mm x 600 mm (effective) is reinforced with 5-25mm φ bars. It carries a uniformly distributed load of 80kN/m including its self-weight over an effective span of 6m. Out of 5 bars 2 are bent up near support. Design shear reinforcement of beam. Use M20 and Fe415. Let width of bearing be 400mm. Sketch the details. **10**

(b) A simply supported slab of a corridor of hospital building has a clear span of 2.5 m and is supported on beam 230mm width. Design the slab, if beam carrying a live load of 5kN/m2. Use M20 and Fe 415. Sketch the details (plan and section) **10**

Q5) (a) Design the reinforcement for column of size 300 mm x 400 mm having an effective length of 3.5m. An axial load of 1000kN and moment of 150 kN-m about the major axis of column are acting on the column. Use M25 and Fe 415. d'=40m **12**

(b) Explain the Combined rectangular pad footing and slab beam footing and draw reinforcement details (Plan and section of bottom and top reinforcement). **8**

Q6) (a) Design rectangular footing of uniform thickness for an axially loaded column of size 300 mm x 600 mm load on column is 1150kN. Safe bearing capacity of soil is 200kN. Use M20 concrete and Fe 415 steel. **12**

(b) Design a short RCC column to carry axial load of 1600 kN. It is 4m long, effectively held in position and restrained against rotation at both the ends. Use M20 concrete and Fe 415 steel **8**

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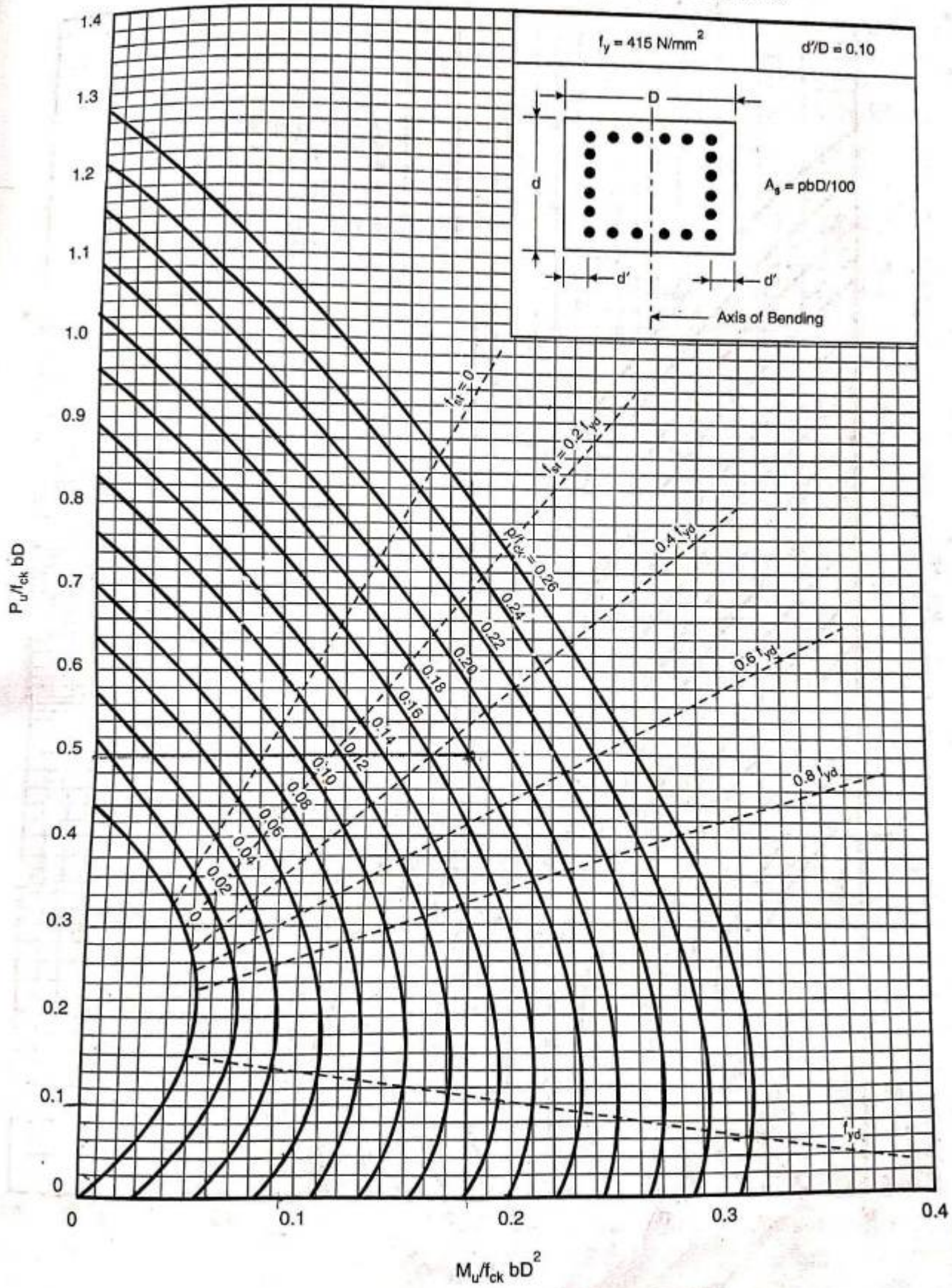
Chart 13.4. (Chart 44 of Design Aids) Compression With Bending—Rectangular Section—Reinforcement Distributed Equally on Four Sides



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