2023-24

DEPARTMENT OF CIVIL ENGINEERING

B. Tech. III Year V Semester (Civil)

CEC 3110/CE 311 - Design of Concrete Structure-I

End Semester Exam.

Time: 2 Hours

Maximum Marks: 60

Note:

i) Attempt all questions in the order these appear in the question paper. Marks are indicated against each question.

ii) Notations used bear their usual meaning. Assume any other data suitably, if not given.

iii) Use of IS: 456-2000 and other relevant codes is permissible.

Q. No.		Question	CO	Marks
1.	(a)	A reinforced concrete beam of rectangular section of size 250 × 550 mm overall is to be designed for a factored moment of 225 kNm. Compute the reinforcement required at an effective cover of 50 mm. Assume concrete grade as M20 and steel grade as Fe415.	1	(05)
1.	(b)	Design a simply supported reinforced concrete beam of rectangular section with a clear span of 6.5 m. The beam is subjected to a uniformly distributed live load of 20 kN/m and a superimposed load of 15 kN/m at the service state. The support width is 500 mm. Provide nominal clear cover to meet the requirement of fire resistance rating of 1.5 hours and durability requirements for moderate exposure. Mention the relevant clauses of the IS: 456-2000 for cover. Use M20 grade concrete and Fe 415 grade steel. Also show the reinforcement details using neat sketch.	1	(10)
		OR		
1'.	(b)	Design a simply supported RC floor slab with clear dimensions of 4 m × 8.5 m with 230 mm thick wall all round. The specified floor loading consists of live load of 4 kN/m^2 and load due to floor finish of 1.5 kN/m^2. Provide nominal clear cover to meet the requirement of fire resistance rating of 1.5 hours and durability requirements for moderate exposure. Mention the relevant clauses of the IS: 456-2000 for cover. Use M20 grade concrete and Fe 415 grade steel. Also show the reinforcement details using neat sketch.	1	(10)
2.	(a)	Describe critical sections for calculating nominal shear stress in RC beams as given below: (i) Simply supported subjected to uniformly distributed load (ii) Cantilever subjected to uniformly distributed load	2	(03)
2.	(b)	An RC Beam of rectangular section 300×550 mm, is simply supported over a span of 8m and carries a factored load of 60 kN/m (including its self weight), over complete span. The beam is reinforced with 5# 20 mm bars on tension face, of which 2 bars are cut near ends and 3# 20mm bars on compression face. Design shear stirrups. Assume M20 mix concrete and Fe415 steel both for main and shear stirrups.	2	(12)

contd....2o

3.	(a)	Enumerate the functions of transverse reinforcement in RC columns.	3	(03)
3.	(b)	Using the attached Design Chart, design an RC column of rectangular section with D/B ratio = 1.5 approximately, 5m long, effectively held in position and restrained against rotation at both ends, reinforced uniformly along all the edges and subjected to uniaxial bending with P_u= 1750 kN and M_u =125 kNm. Assume M25 mix and Fe415 grade steel. Also design ties and show in neat sketch.	3	(12)
		OR		
3'.	(b)	An RC short column of 4.5 m effective length, 300×500 mm section, reinforced with 10 nos. of 20 mm dia. bars, uniformly distributed along all the faces, is made in M25 mix concrete and Fe415 grade steel and subjected to ultimate axial load of 1600 kN along with biaxial moments M_{ux} and M_{uy} as 100 kNm and 60 kNm respectively about minor and major axes. Check the safety of column assuming both d'/B and d'/D as 0.1. Use the Chart as attached herewith.	3	(12)
4.		Design a sloping footing for a rectangular column 300×400 mm carrying an axial service load of 1200 kN. One side of the footing is restricted to 3 m. The net bearing capacity of the soil is 120 kN/m^2. Use M20 mix and Fe 415 grade steel.	4	(15)

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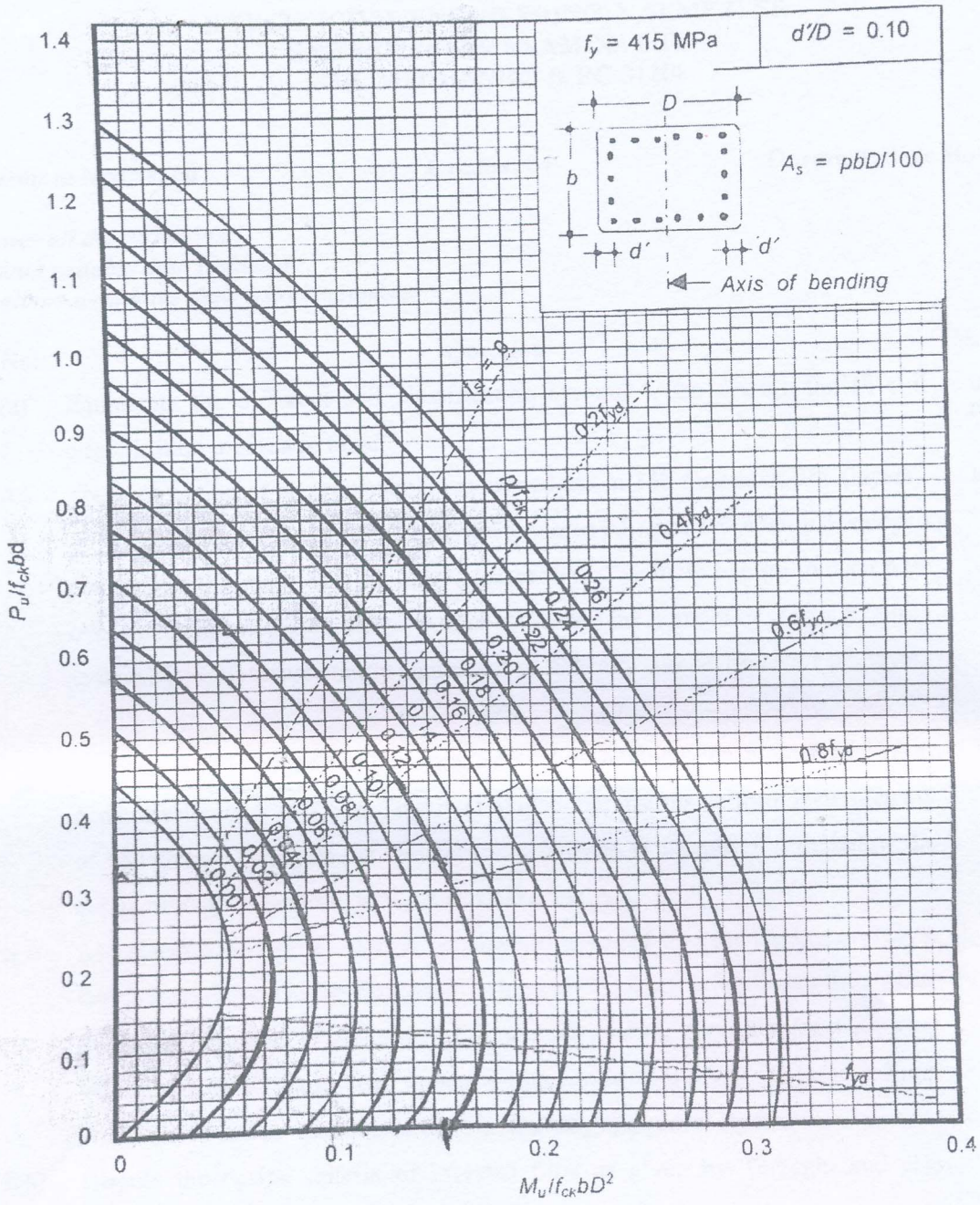

Design Chart

2023-24
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
CEC 3130
ENVIRONMENTAL ENGINEERING-II

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.	Question	CO	M.M.
1 (a)	Discuss in detail the procedure adopted for the disposal of sewage from residential area to the point of disposal/sewage treatment plant.	CO 2	05
1 (b)	Differentiate between drop manhole and inverted siphon.	CO 2	02
1 (c)	Calculate the size of a sewer for a proposed colony in 100 hectares of land. The sewer is to be laid at a minimum slope.	CO 2	04
1 (d)	Explain with the help of sketches the different types of traps.	CO 2	04
2 (a)	Determine the number of CSTRs required in series arrangement to reduce the concentration of a pollutant from 2000 mg/L to 35 mg/L. Take the value of k as 10 per hour.	CO 3	04
2 (b)	Explain Thomas Slope Method for the determination of K and L_0. Explain why seeding is done in BOD experiment.	CO 1,3	06
2 (c)	Find the terminal settling velocity of a grit particle of size 0.18 mm specific gravity 2.65 settling in wastewater at 20^0C. Take ρ_w as 998 Kg/m^3 and μ at 20^0C as 1.002×10^{-3} N.S/m^2.	CO 3	05
	OR		

Contd....2.

2' (c)	Derive the equation used for the determination of effluent concentration in a CSTR receiving continuous input of tracer undergoing decay @ k per day.	CO 1,3	05
3 (a)	Define kinetic coefficients used in biological treatment of wastewater. Also write their significance.	CO 3	04
3 (b)	Derive expressions for the following in Activated Sludge Process (i) oxygen requirement (ii) recirculation ratio (iii) nutrient requirement (iv) excess cells	CO 3	05
	OR		
3'.(b)	Design a facultative pond for the treatment of 10 MLD of flow. Assume inlet BOD to Pond as 120 mg/L and temperature as 25°C. What is the mechanism of BOD removal in facultative ponds?	CO3	05
3.(c)	Design a septic tank as per recommendations of IS 2470 part-1 for a residential colony having 50 users. Assume frequency of desludging as three years. As per table 3 of IS 2470 peak discharge for 50 users shall be 108 lpm.	CO2, 3	06
4.(a)	What is TCLP test? How it is performed? What is the significance of TCLP test in selection of waste for municipal Landfills?	CO4	05
4.(b)	What are the different functional elements of solid waste management? Briefly discuss the economics of transfer station in solid waste management.	CO4	05
	OR		
4.(b')	How Noise is measured? What are the different measures to control noise pollution?	CO 1, 4	05
4.(c)	Calculate the heating value of a waste having composition $C_6H_4S_2O_5$. What is the mechanism of combustion in incineration plant?	CO 4	05

2023-24
B.TECH. III YEAR EXAMINATION
DEPARTMENT OF CIVIL ENGINEERING
ENGINEERING HYFRAULICS I (CEC-3140)

Maximum Marks: 60 **Credits: 04** **Duration: Two Hour**

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.	Question	M.M.	COs
1(a)	For a steady laminar flow in a horizontal circular pipe, derive an expression for the shear stress at any radial distance from the axis and pressure drop along the pipe. A pipe of 25 cm diameter carries air at an average velocity 5 m/s. Calculate the friction factor and boundary shear stress assuming the flow to be fully rough – turbulent . Take ρ =1.22 kg /m^3 , υ =1.5 x 10 $^{-5}$ m2 /s , k=0.50 mm..	[10]	CO1
1(b)	A small sphere falling in a liquid is governed by various flow, fluid and the geometrical properties. Express the phenomenon in dimensionless form using method of repeating variables	[05]	CO1
2 (a)	Define displacement thickness. Obtain the Von Karman momentum Integral equation.	[07]	CO2
	OR		
2' (a)	Explain in detail Hydrodynamically Smooth and Rough Boundaries. What are the different applications of the Magnus Effect?	[07]	CO1 CO2
2 (b)	Find out boundary layer thickness (∂), shear stress (τ_0), coefficient of skin fraction or local coefficient of drag (C_D^*) and coefficient of drag (C_D) for the following velocity distribution in the boundary layer: $$\frac{u}{U} = 2\frac{y}{\partial} - \frac{y^2}{\partial^2}.$$	[08]	CO2
3(a)	Define any two terms: (i) intensity of the turbulence (ii) Kinematic eddy viscosity (iii) Darcy-Weisbach friction factor.	[05]	CO1
3(b)	A water supply system consists of three resevoirs A,B and C connected to a common junction J as shown in the Figure1. If the Diameters of all the three pipes are same as 0.30m, estimate the discharge in each pipe with the following data-	[10]	CO3

contd...2o

Pipe	Length(m)	f	connectivity
1	200	0.02	AJ
2	125	0.016	BJ
3	250	0.016	CJ

OR

3'(a) Discuss Water Hammer phenomenon.Describe various stages of water hammer pressure wave in a pipe line connected to a reservoir with neat sketches. [08] CO3

3'(b) Calculate the velocity of propagation of a pressure wave in a steel pipe ($E=2.07X10^5$ MPa) of 2.5 m diameter carrying kerosene(RD=0.8 and $K=1.43x10^3$ MPa.).The pipe thickness is 2 cm. [07]

4(a) Define and derive the expression of the specific speed of a turbine. [07] CO4

4(b) Sketch a single-stage reciprocating pump. Discuss the working of a single-stage reciprocating pump. [08] CO4

A single-acting reciprocating pump operating at 150 r.p.m. has a piston diameter of 250 mm and stroke of 300 mm. The suction and delivery heads are 4 m and 20 m, respectively. If the efficiency of both suction and delivery strokes is 75 percent, determine the power required by the pump.

OR

4(b)' The impeller of a centrifugal pump having external and internal diameters 450 mm and 250 mm, respectively, width at outlet 50 mm and running at 1250 r.p.m., works against a head of 46 m. The velocity of flow through the impeller is constant and equal to 3.0 m/s. The angle between relative velocity and tangential velocity (β_2) is 40° at the outlet. [08] CO4

Determine:

(i) Inlet vane angle,

(ii) Work done by the impeller on water per second, and

(iii) Manometric efficiency.

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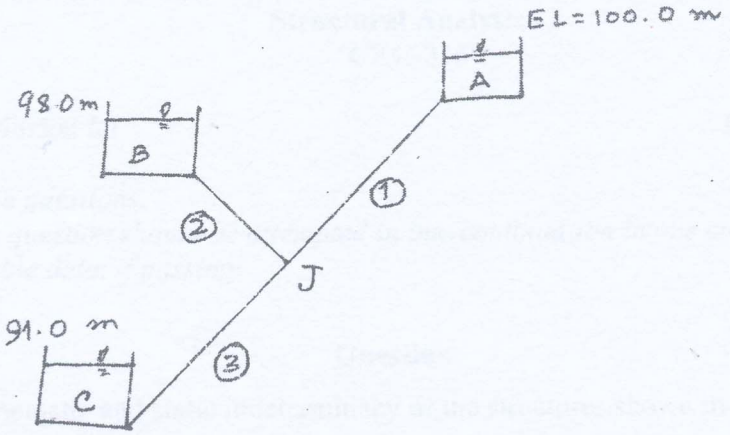


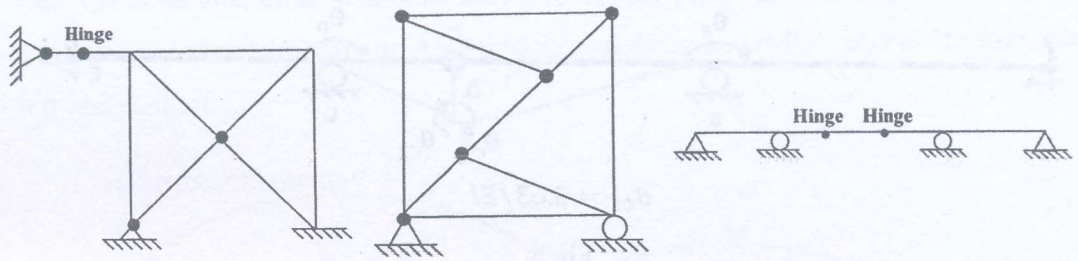
Figure 1

2023-24
DEPARTMENT OF CIVIL ENGINEERING
BTech V SEMESTER (END SEMESTER EXAMINATION)
Structural Analysis - I
CEC-3150

Maximum Marks: 60 **Duration: Two Hour**

Answer all the questions.
All parts of a question should be attempted in one continuation in one copy
Assume suitable data, if missing

Q. No.	Question	M. M	CO
1 (a)	Find the kinematic and static indeterminacy of the structures shown in Fig. 1.	(06)	CO1



(i) (ii) (iii)

Fig. 1

1(b)	Draw BMD and SFD for the beam shown in Fig. 2 if support B sinks by 1 cm. Use Mohr's theorem. Take E = 200 GPa, I = 8000 cm^4. EI is constant throughout the span.	(09)	CO1

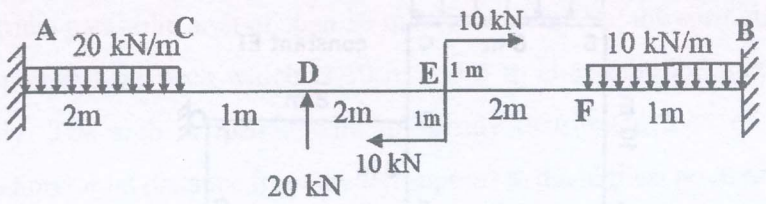


Fig. 2

OR

1(b')	Draw BMD for the beam shown in Fig. 3 if support C rises by 1 cm. Use three moment equation. Take E = 200 GPa, I = 10000 cm^4. EI is constant throughout the span.	(09)	CO1

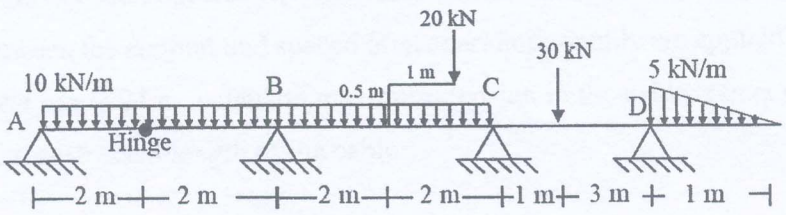


Fig. 3

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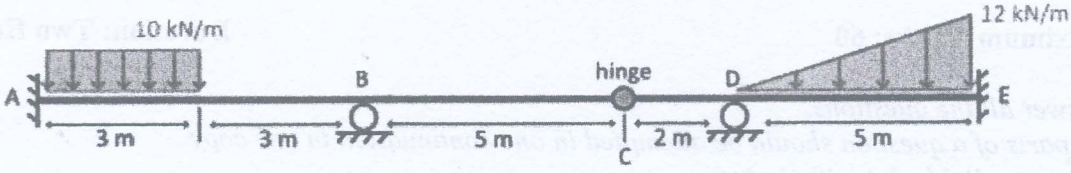
2 Analyze the continuous beam using the slope deflection method and determine the support reactions/moments. The beam is shown in Fig.4. [*Hint*: The deflected shape of the given beam is also shown below.] **(15)** CO2



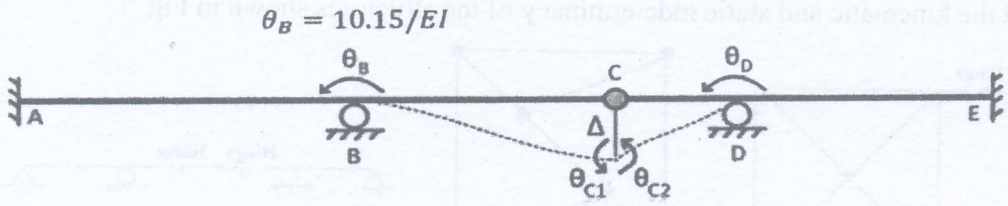


Fig.4

OR

2′ Analyze the frame using the moment distribution method and determine the support reactions/moments. The frame shown in shown below. (Fig. 5) **(15)** CO2

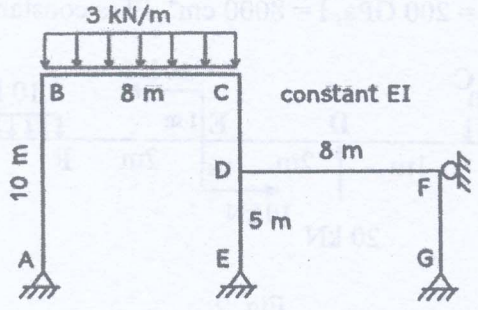


Fig. 5

3 Using the force method, analyze the truss shown below. (Fig. 6) **(15)** CO3

Contd ....3.

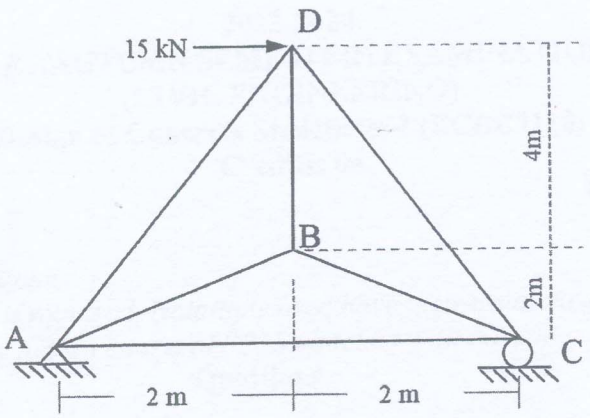


Fig. 6

4 Find the horizontal thrust and draw the BMD for the parabolic arches shown in Fig. 7. Take EI as constant throughout. Also find normal thrust and radial shear at 5m from the left end support. **(15)** CO4

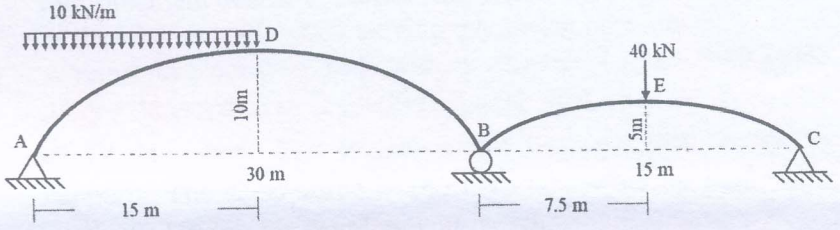


Fig. 7

OR

4' (a) A symmetrical parabolic arch of span 30 m has two hinges at the springings and one at a highest point of the arch which is 10 m and 5 m above the left and right support respectively. The arch is loaded with uniformly distributed load of 25 kN/m run covering a horizontal distance from the left support to the highest point of the arch. Find the reactions at the support. Also find normal thrust and radial shear at 5m from the left end support. **(7)** CO4

4' (b) A light cable of negligible weight is suspended between the two points spaced 300m apart horizontally with the right support 12 m higher than the left support. Four vertically gravity loads of 400 kN, 200 kN, 400 kN and 1200 kN (from left to right) centred between the support and spaced 60m apart horizontally are applied to the cable. If the largest sag is 24 m, calculate maximum tension in the cable, sag at each applied load and the unstressed length of the cable. **(08)** CO4

2023-24
B.TECH. (CIVIL ENGINEERING) V SEMESTER
END SEMESTER EXAMINATION
SOIL MECHANICS (CEC-3120)

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.	Question	M.M.	COs
1(a)	Enumerate the different soil classification systems. Also discuss the IS soil classification method in detail.	07	CO1, CO2,CO4
1(b)	The compaction of an embankment is carried out in 350 mm thick lifts (layers). The rammer used for compaction has the foot area 0.07 m^2. The energy developed per drop of the rammer is 65 kg-m. Assuming 60 % more energy in each pass over the compacted area due to overlap, calculate the number of passes required to develop compactive energy equivalent to IS heavy compaction for each layer.	08	CO1
	OR		
1(b')	A water tank is supported by a ring foundation having outer diameter of 10 m and inner diameter of 7.5 m. The ring foundation transmits uniform load intensity of 160 kN/m^2. Compute the vertical stress induced at a depth of 4 m, below the centre of ring foundation, using Boussinesq analysis.	08	CO1
2(a)	At a construction site a 2m thick clay layer is followed by a 3m thick gravel layer which is resting on impervious rock. A load of 28 kN/m^2 is applied at the surface due to construction. If the water table is at the surface, draw diagrams showing variation of total, neutral and effective stress with depth. Assume saturated unit weight as 18 kN/m^3 and 20.5 kN/m^3 for the clay and gravel layers.	08	CO1, CO2
2(b)	Discuss the design criteria of inverted filter as given by Terzaghi and also elaborate the different classes of filter.	07	CO2

Contd.... 2.

3(a)	Define the term 'compressibility' of soil. Also discuss the various factors affecting compressibility of soil.	07	CO2, CO3
	OR		
3(a')	Discuss the mechanism of consolidation using Terzaghi's mechanistic model.	07	CO2, CO3
3(b)	A saturated soil stratum 6 metres thick is sandwiched between a pervious and an impervious stratum. It has a compression index of 0.28 and a coefficient of permeability of 3.5×10^{-4} cm/sec. Its void ratio at a stress of 150 kN/m² is 1.2. Determine: a) the change in void ratio due to an increase in stress to 210 kN/m² b) settlement of the soil stratum due to the above increase in stress and c) time required for 50 per cent consolidation. Assume time factor T_v for 50 percent consolidation as 0.20.	08	CO1, CO2
4(a)	In foundation design problems and retaining wall problems, how the angle of internal friction between soil and the structural material can be determine though the Direct Shear Test?	07	CO3
4(b)	A series of shear tests were performed on a soil. Each test was carried out until the sample sheared and the principal stresses for each test were as follows:	08	CO2, CO4

Test No	Major Principal Stress (kN/m²)	Minor Principal Stress (kN/m²)
1	600	200
2	900	300
3	1200	400

Plot the Mohr's circle and determine the Mohr-Coulomb Parameters.

OR

4(b')	A CD triaxial compression test was conducted on a sand specimen using a confining pressure of 42 kPa. Failure occurred at a deviator stress of 53 kPa. Calculate the normal and shear stresses on the failure plane at failure. Also calculate the angle made by the failure plane with the horizontal. Solve the problem graphically and confirm the solution analytically.	08	CO2, CO4

2023-2024
B. E. (AUTUMN SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
Design of Concrete Structures-I (ECEC3110)
Credits: 04

Maximum Marks :60 **Duration: Two Hours**

Note: *Attempt all questions.*
Assume suitable data, if required. Notations used have their usual meaning. Use of IS 456-2000 is permitted. Only design charts of SP16 attached with the paper are allowed.

Q.No.	Questions	CO's	M.M.
Q.1 (a)	Give three reasons for providing cover to tension steel in a R.C. beam.	CO-1	[03]
Q.1 (b)	For a simply supported beam of effective span 7.5m the live load is 30 kN/m, width of the beam is 350 mm, concrete grade M20, steel grade Fe415. Design the cross-section. Show the reinforcement details with neat sketches. List the relevant clauses of the IS 456-2000 while solving the design problem.	CO-1	[12]
Q.2 (a)	A reinforced concrete M25 simply supported rectangular beam of size 300×500 mm is reinforced with 3#20 mm diameter bars of Fe 415 steel. The reinforcement bars are bent at 90° at supports. The shear force is 105 kN under working load at the supports. Design for development length.	CO-2	[07]
Q.2 (b)	A R.C. beam has an effective depth of 450 mm and width of 300 mm. It contains 2#20 mm diameter bars of Fe 500 grade bars in tension and M20 mix. Design the shear reinforcement with vertical stirrups needed for a factored shear force of 250 kN. Also show the details of shear reinforcement in a section.	CO-2	[08]
	OR		
Q.2'	The slab of a residential building is 4.0 m × 5.0 m. The slab is continuous on all edges. The width of the support is 230 mm. Assuming an imposed load of 3 kN/m^2 and load due to floor finish of 1.0 kN/m2, Design the floor slab. Use M20 concrete and Fe 415 steel. Assume mild exposure.	CO-2	[15]
Q. 3 (a)	Discuss salient points of typical P_u-M_u interaction curves for designing RC Columns.	CO-3	[03]
Q. 3 (b)	Using attached Design chart, design a RC column of square section, effective length 4.5 m, reinforced uniformly along all the edges and subjected to uniaxial bending with P_u = 1500 kN and	CO-3	[12]

contd....2.

M_u = 150 kNm. Assume M20 mix and Fe415 grade steel. Also design ties and show the reinforcement details with neat sketch.

(OR)

Q. 3' A square R.C. column 350 mm × 350 mm in size and 4.0 m long is hinged at both the ends and is supposed to carry an axial load P_u = 900 kN along with bi-axial moments M_x and M_y as 60 kNm. Assuming 8#20 mm dia. bars of Fe 415 steel grade, provided uniformly along four edges, and M20 mix concrete with clear cover of 40 mm, check the safety of the column as per equation suggested by IS 456:2000. Use chart as shown in Fig. 1. **CO-3** **[15]**

Q. 4 Determine the depth and area of steel in footing for an isolated column 400 mm × 400 mm, supporting a service load of 2200 kN and reinforced with 8 # 25 mm dia. Assume safe bearing capacity of soil as 250 kN/m^2 at a depth of 1.5 m below the ground. Use M20 concrete and Fe 415 grade steel for the footing and M30 concrete and Fe 415 grade steel for the column. **CO-4** **[15]**

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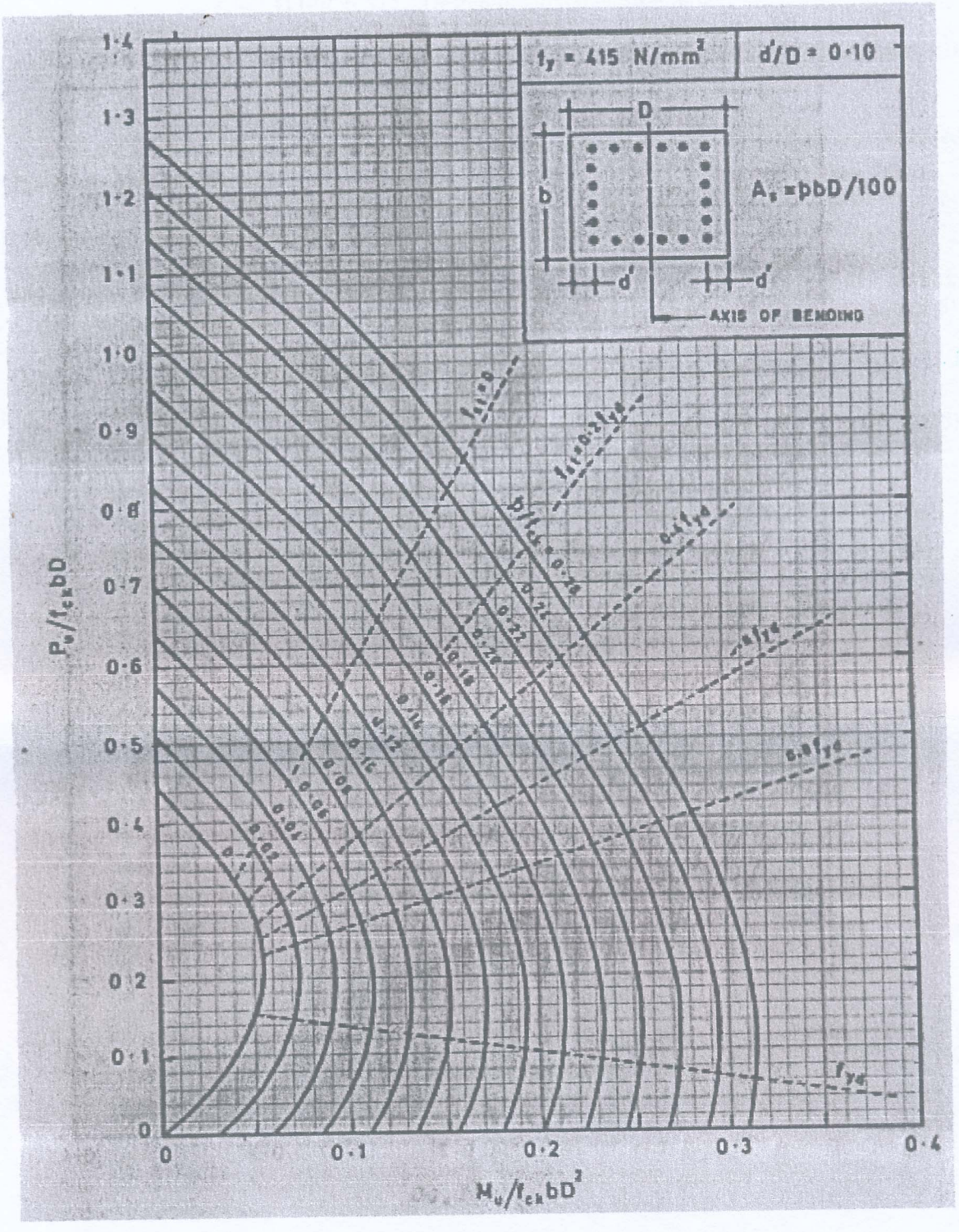
f_y = 415 N/mm²
d'/D = 0·10
D
b
d'
d'
$A_s = pbD/100$
AXIS OF BENDING
$P_u/f_{ck}bD$
$M_u/f_{ck}bD^2$
0
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·8
0·9
1·0
1·1
1·2
1·3
1·4
f_{yd}

Fig. 1