L-4/T-1/WRE **Date: 04/05/2024**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B.Sc. Engineering Examinations 2022-2023

Sub: **WRE 419** (Irrigation and Drainage Engineering)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

Assume reasonable value where necessary.

SECTION – A

There are **FOUR** questions in this section. Answer **Q. No. 1** any **TWO** from the rest.

1. (a) What is drainage coefficient? Why do you think drainage of irrigated land is beneficial? **(8)**

(b) Write down the functions of (i) under sluices, (ii) divide wall, and (iii) fish ladder. **(9)**

(c) What is the classifications of irrigation water having the following characteristics: concentration of Na, Ca and Mg are 23.0, 3.2 and 1.6 meq/*l* (milli-equivalent per liter) respectively and the electrical conductivity is 220 μmhos/cm at 25°C? Also find (*i*) what problems might arise in using on fine textured soils and (ii) what remedies do you suggest to overcome this problem? **(10)**

(d) A tile drain has to be designed for a drainage area of 30 ha located in Sylhet with the data given below: **(18)**

Tile grade = 1.42%	Depth of root zone = 1.85 m
Size of the soil pores = 0.08 mm	Surface tension = 0.054 N/m
Annual rainfall = 240 cm	Length of each tile = 200 m.
Manning's roughness coefficient, n = 0.011	Permeability of soil = 0.001 cm/s

Depth of impervious layer from land surface=5.0 m

If 1% of the annual rainfall depth to be drained from irrigated land by 24 hours, determine the size and spacing of tile drain. Also sketch your design.

2. (a) Explain why Rabi is the main irrigation season of Bangladesh and favorable for high yield. **(6)**

(b) Discuss why and when irrigation is necessary and what are the merits and demerits of irrigation. **(8)**

(c) What are the main causes of water logging? How water logging can be improved? **(8)**

(d) Determine the discharge required to irrigate a strip of land of 0.20 ha from a tube well in one hour. The infiltration capacity of the soil may be taken as 4.0 cm/hr and the average depth of the flow on the field as 12 cm. Also determine the maximum area that can be irrigated from this tube well. **(8)**

Contd..... P/2

WRE 419

3. (a) Distinguish between (i) Subsurface irrigation and furrow irrigation (ii) Border strip irrigation and check basin irrigation (iii) Aqueduct and Super-passage. **(12)**

(b) The head regulator of a canal has 3 openings each 4.0 m wide. The water is flowing between the upper and lower gates. The vertical opening of the gate is 1.2 m. The head on the regulator is 0.52 m (Afflux). If the upstream water level is dropped by 0.20 m, find the adjustment of the upper gates to maintain the canal discharge unaltered. **(8)**

(c) Why the spacing of tile drainage is important? Find the equation for the optional spacing. **(10)**

4. (a) "Sprinkler irrigation is an excellent method but not widely used in our country" Explain. **(8)**

(b) Describe different types of canal-falls with neat sketches. **(14)**

(c) Estimate the leaching requirement when the EC value of saturated extract of soil is 9.0 mmhos/cm at 15% reduction in the yield of a crop. The EC of irrigated water is 1.25 mmhos/cm. What will be required depth of water to be applied to the field if the consumptive use of the crop is 85 mm? **(8)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE.**

5. (a) Sketch a layout of irrigation canal network for a command area. **(5)**

(b) Kennedy and Lacey stated their theories on designing stable channels in alluvium, which maintain their cross-section and slope with time. The basic concept of silt transportation is the same in both theories. However, there are still some discrepancies. Do you agree with the statement? Justify. **(7)**

(c) Bangladesh's rivers mainly flow through alluvial soils. Considering the geomorphology of our country, should berms and counter berms be provided when designing a canal section? Give proper reasons in favor of your answer. **(8)**

(d) An irrigation channel with a full supply level of 4 m above the existing ground level is provided, with banks 3 m wide at the top. The side slopes are 2H:1V, and the slope of the hydraulic gradient line through the bank soil is 5:1. Assuming a freeboard of 1 m, calculate the minimum width and height of the counter berm needed to ensure that the seepage of water does not pose any problem for the safety of the canal banks. **(15)**
(Assume any missing value).

6. (a) How duty can be influenced by the efficiency of irrigation method for agricultural field? Consider other external factors remain unchanged. **(4)**

Contd..... P/3

WRE 419

(Contd ..... Q. No. 6)

(b) The discharge available form a tubewell is 120 m^3/hr. Assuming 3200 h of working of the tubewell for a year, estimate the culturable area that this tubewell can command. The intesity of irrigation is 50 percent and average depth of rabi and Kharif crop is 48 cm. **(8)**

(c) Climate variability is an important driver of irrigation water use in many regions. Discuss the impact of meteorological variables on the consumptive use of plants. **(8)**

(d) Wheat is to be grown at a particular place between 1 November to 15 March. The mean pan evaporation and effective rainfall in the respective month are given below:

Month	November	December	January	February (1-28)	March (1-15)
Pan Evaporation (cm)	15.2	13.1	9.6	10.5	9.8
Effective Rainfall (cm)	0.5	1.7	3.6	2.7	Nil

The values of consumptive use coefficient (K) at various growth stages are as follows: **(15)**

Percentage of Growing Season	10	20	30	40	50	60	70	80	90	100
K	0.15	0.27	0.40	0.52	0.65	0.77	0.88	0.90	0.70	0.60

Determine (i) the monthly consumptive use (ii) field irrigation requirement assuming that water application efficiency is 70%.

7. (a) Distinguish between **(6)**

(i) field capacity and permanent wilting point

(ii) available water and readily available water

(iii) field irrigation requirement and gross irrigation requirement.

(b) Bangladesh has a vast network of irrigation canal system because the country's economy is heavily dependent on agriculture. Which canal alignment is most suitable for Bangladesh, considering the country's topography and economy? Explain as to why. **(5)**

(c) A cultivator irrigates everyday 0.5 ha of land from a stream discharging 50 lps. The moisture content of the soil before irrigation is 15% and has to be raised to 20% by irrigation. The peak consumptive use of the crop is 5 mm/day, and the depth of the effective root zone is 1m. The dry density of the soil is 1400 kg/m^3. Assuming no rainfall has occurred during the period of peak water use, and 20% loss of water due to evaporation and percolation on the field, determine: **(12)**

i. The depth of watering

ii. The duration for which the stream has to be kept turned

iii. When next watering is required?

iv. What is the total area that can be irrigated from the stream?

Contd..... P/4

WRE 419

(Contd ..... Q. No. 7)

(d) Determine the discharge required at the head of the storage reservoir (dead storage, live storage and gross storage), given following data. **(12)**

Command area: 2 lac ha

Irrigable area: 60%

Main canal: Conveyance losses 20%, time factor 0.7, extra for peak use 20%

Reservoir: Evaporation and seepage losses 10%, carry-over storage 5%

Crop	Period	Intensity (%)	Total depth of water (m)
Sugarcane	10th June to 9th June	40	3.0
Paddy	10th June to 22nd Nov.	40	1.4
Dry crop	10th Jan to 9th May	20	0.6

What is the approximate capacity factor for the main canal?

8. (a) Why is measurement of soil water important? Briefly describe the neutron method of measuring soil moisture. **(7)**

(b) The centrifugal pump is the most common kind of pump used globally for water supply and irrigation. Do you agree with the statement? **(9)**

Discuss the benefits, draw backs, and operating principles of centrifugal pumps in the context of Bangladesh.

(c) A 35 KW capacity irrigation pump needs to be installed with a water discharge of 52.0 1/s through a pipe diameter of 20 cm, and the Darcy-Weisbach friction factor for the pipe material is 0.07. The suction head is 10 m, and the delivery head is 7.5 m. If the delivery efficiency of the staff is 76% and motor efficiency is 84%, calculate the efficiency of the pump. **(9)**

(d) Bangladesh has an agricultural economy in which rice is the dominant crop. It the proper crop management systems are followed, rice productivity and total rice production in Bangladesh still have scope to increase. **(10)**

Can implementing AWD and SRI techniques, to a broader extent, boost rice production in Bangladesh? Justify.

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L-4/T-1/WRE

Date: ~~28/04/2024~~ 19/05/2024

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2022-2023

Sub: **WRE 423** (River Engineering and Basin Management)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) Distinguish River Basin Management and Integrated Water Resource Management. Describe major issues in any river basin. **(11)**

   (b) What are the general design criteria in designing earthen dams/levees? Explain why seepage analysis is important in designing earthen dams/levees? **(12)**

   (c) Drainage congestion in the Southern West part of our country is a major hazard. What are the main reasons for such drainage congestion in that part of the country? What remedial measures can be taken to reduce such drainage congestion? **(12)**

2. (a) Describe Five principles of International Water Law with case studies, if needed. **(11)**

   (b) What does it mean by "Living with Flood"? What are the major concepts to estimate flood resilience of a community? **(12)**

   (c) To protect a flood prone area beside the Teesta River, it is decided to construct levees on both side of the river. To design the levee length, height and locations, a mathematical modeling study is to be suggested. What kind of hydrodynamic model (1D or 1D/2D or 2D) would you recommend? Justify your answer. **(12)**

3. (a) Distinguish between "Risk" and "Vulnerability". What are the significances of flood risk mapping in terms of flood mitigation measures? **(11)**

   (b) Write down the comparisons between the Helsinki Rules (1966) and International Watercourses Law (1997). **(12)**

   (c) Construction of a levee is under consideration for a river reach vulnerable to flood damages. The estimated damages from various river stages and cost of levee protection below the given stages are given as follows. The return periods of the flood at mid height of the intervals are 10, 15, 25, 30, 75, 150, and 300 years, respectively. Select the most satisfactory river stage for the design of the levee. **(12)**

Peak Stage (m)	Total damage below indicated stage (Million $)	Project cost (Million $)
6.0	0	0.4
6.5	4	0.6
7.3	10	0.8
8.0	20	1.0
8.5	32	1.3
9.1	45	1.6
9.7	60	1.8
10.3	80	2.0

Contd P/2

WRE 423

4. (a) Discuss different environmental impacts of a reservoir. Elaborate various design considerations in choosing a reservoir location and dam type? **(11)**

(b) Distinguish between Financial Analysis and Economic Analysis in context to River Basin Management. **(12)**

(c) The Ganges Treaty (1996) will be expired in 2026. According to your judgment, what are the main strength and weakness of the current treaty and what modifications can be suggested if any further agreement has to be signed? **(12)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) What is the difference between river engineering and river management? **(6)**

(b) Briefly discuss the characteristics of confluence and bifurcation of a river system. Give examples of each for the rivers of Bangladesh. **(9)**

(c) (i) What are the Shield's criteria for the initiation of motion? (ii) Calculate the boundary shear stress required to move 1 mm sand if the threshold for grain movement on the bed is 2 mm? Use figure 1 for necessary information and Assume reasonable values for any missing data. **(20)**

6. (a) Describe categories of stream with sketch. **(6)**

(b) Write short notes on (i) Natural Cutoff, (ii) Alluvial Fans, (iii) Sinuosity and (iv) Anabranching. **(12)**

(c) (i) Explain the mechanism of helicoidal flow that occurs in a bend (ii) A meandering river channel with radius of curvature 3 km has a bankfull flow area of 1000 m^2 and longitudinal slope is 1 m in 3 km. Calculate (*i*) the channel forming discharge and (*ii*) Transverse gradient. **(17)**

7. (a) What are the main components of bed material load. Discuss with neat sketches. **(10)**

(b) A river system without an upstream structure has a straight reach and design discharge of 4000 cumecs. If the median grain size of bed material is 0.15 mm, calculate the mean scour depth below the channel invert. **(10)**

(c) Briefly discuss the causes of deterioration of water ways in Bangladesh. How the waterways can be improved? **(10)**

(d) "Dredge material disposal and management is crucial for a dredging project in Bangladesh"– Justify the statement. **(5)**

8. (a) Discuss the conditions that affect river bank stability. What are the different erosion characteristics of river banks? **(10)**

(b) The following data is from a bridge site of a river, **(25)**

Maximum Discharge = 5000 cumecs

Highest Flood Level = 104 m,

River Bed Level = 100 m,

Average Diameter of river bed material = 0.1 mm. Design a river training structure including the launching apron to train the river.

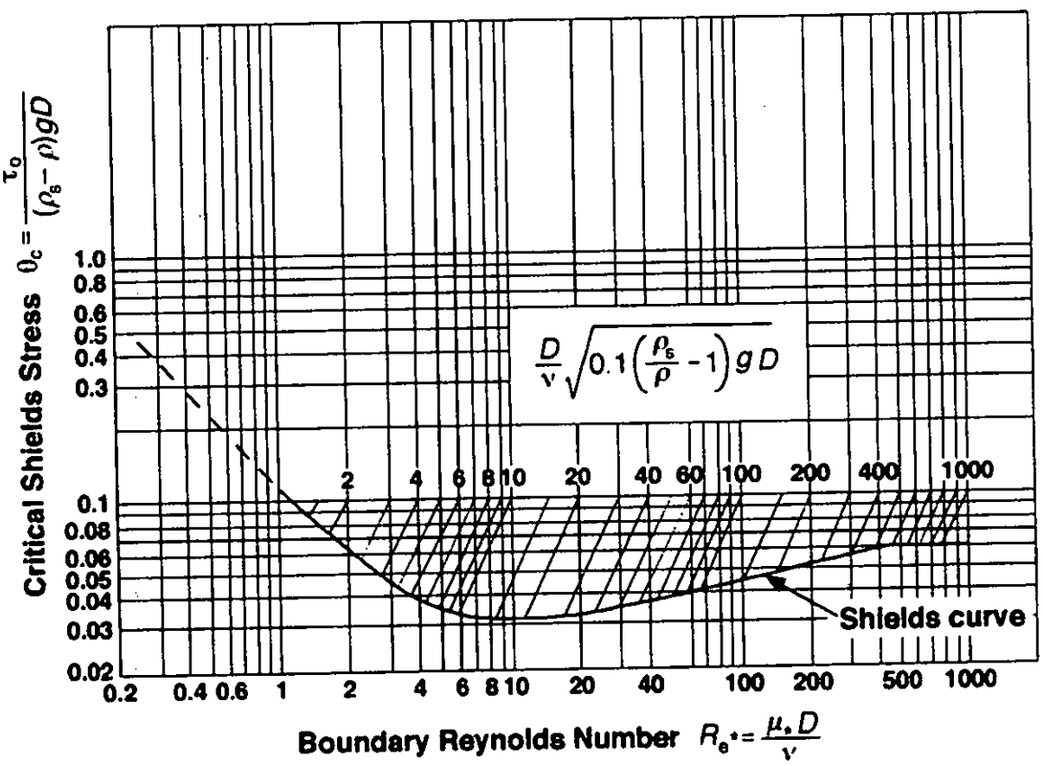


Figure 1 for Q 5(c)

L-4/T-1/WRE **Date : 18/04/2024**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2022-2023

Sub : **CE 325** (Design of Concrete Structures II)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Why the factor 'α' is introduced in the column capacity equation? **(4)**

(b) A flat plate floor system (without edge beam) as shown in Figure 1 has to carry a factored load of 325 psf (including self-weight of slab). Given, effective depth of slab (d) = 6.50 inch, panel size (typical, c/c distance between columns) = 22 feet × 18 feet, column size = 20 inch × 18 ich, f'_c = 4000 psi, and f_y = 60 ksi. **(20)**

(i) Check whether shear reinforcement (to resist punching shear) is needed or not for an interior column.

(ii) If needed, design the shear reinforcement over an interior column using bent bar. Also, draw a neat sketch after final design (both plan and elevation).

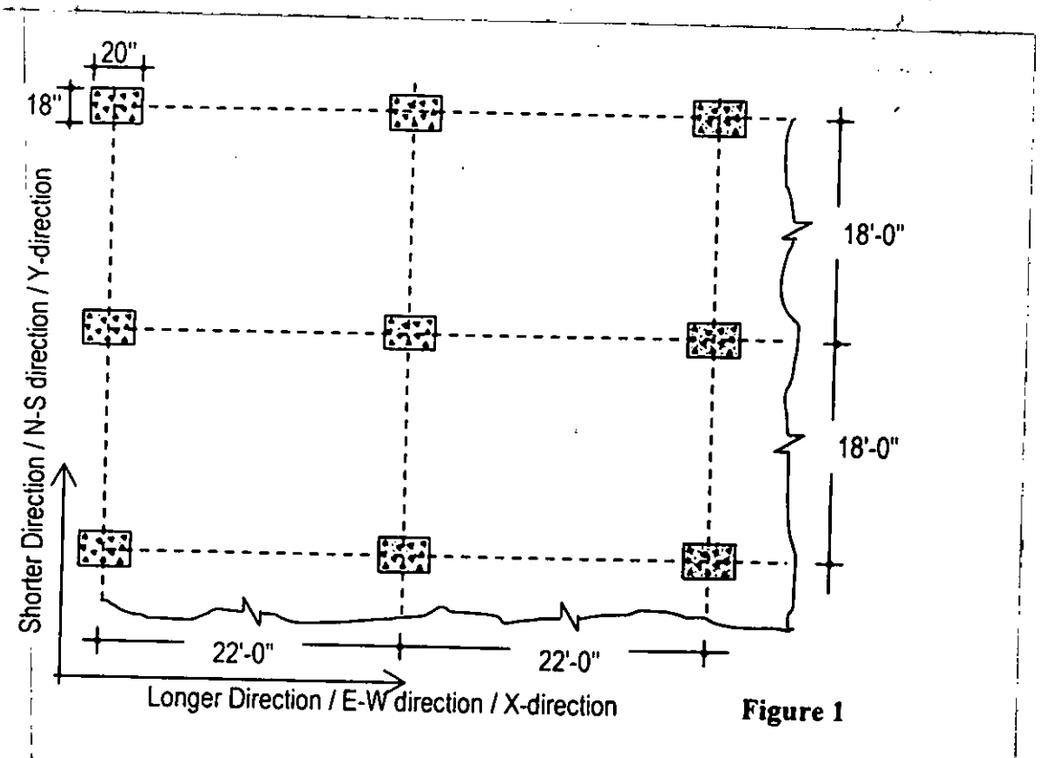


Figure 1

Contd P/2

CE 325/WRE

Contd ... Q. No. 1

(c) Compute frictional loss of the post-tensioned beam having two parabolic tendons (as shown in Figure 2) at location A-A. Given: jacking stress = 190 ksi, μ (friction co-efficient) = 0.15 and k = (Wobble co-efficient) = 0.00015/foot. **(11)**

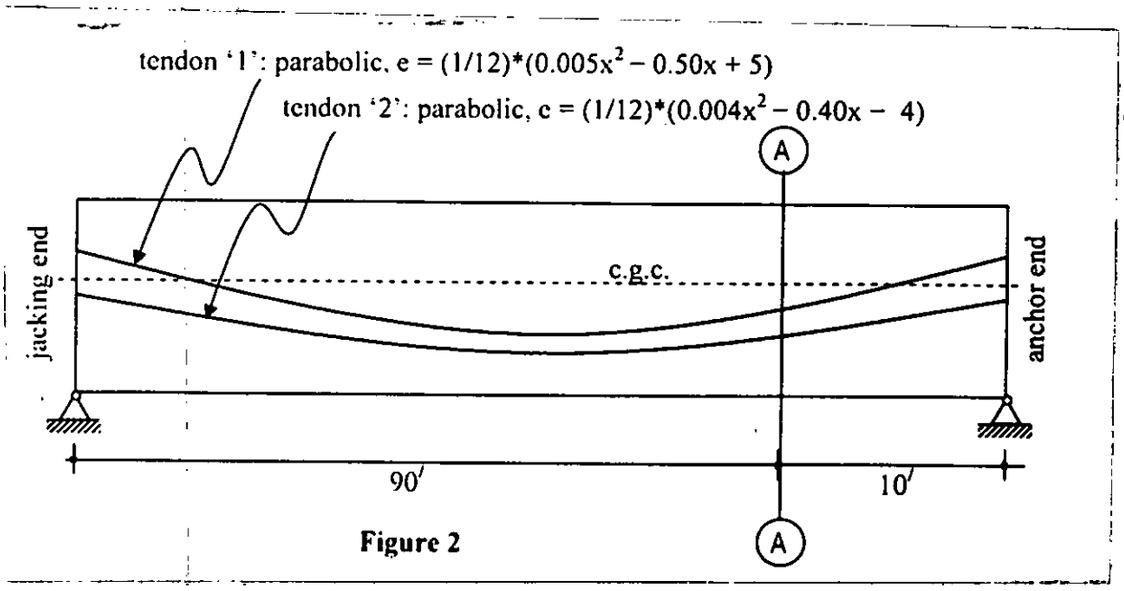


Figure 2

2. (a) What are dimensional limits of beams and columns in SMRF? **(3)**

(b) A reinforcement concrete rectangular tied column (16 inch × 22 inch) of a building is reinforced with eight No. 6 and six No. 7 bars as shown in Figure 3. The column is subjected to following axial loads and bi-axial moments (unfactored). Check the adequacy of the column section using Bresler Reciprocal Load method. Given: f'_c = 4 ksi, f_y = 60 ksi and interaction diagram is supplied at the end. **(20)**

(*unfactored)	Dead load	Live load
Axial force*	120 kip	160 kip
Moment* about X-X axis	44 kip-ft	67 kip-ft
Moment* about Y-Y axis	94 kip-ft	113 kip-ft

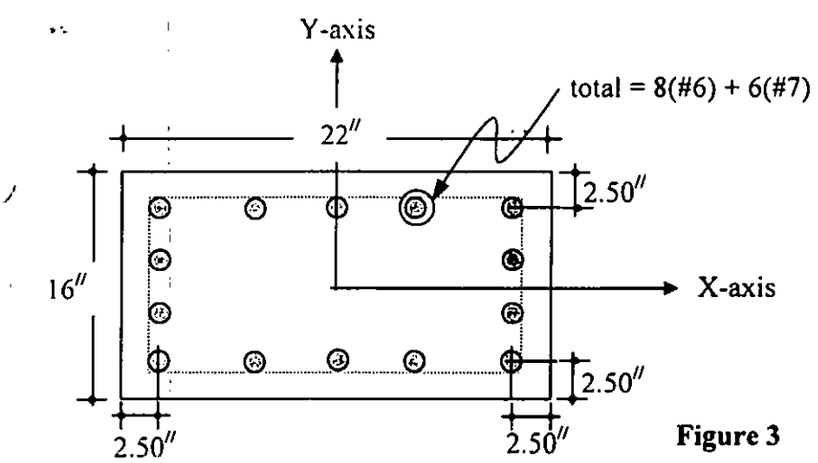


Figure 3

Contd P/3

CE 325/WRE

Contd ... Q. No. 2

(c) Compute elastic shortening loss of the pre-stressed concrete simple beam at location A-A as shown in Figure 4. **(12)**

(i) If the beam is a pre-tensioned one.

(ii) If the beam is a post-tensioned one and all tendons are tensioned simultaneously.

(iii) If the beam is a post-tensioned one and tendons are tensioned in pairs.

Given: initial pre-stress = 200 ksi, pre-stressing strand = 14 nos. 0.60 inch nominal diameter (270 grade 7-wire strand, A_{ps} = 0.2160 inch^2), f'_{ci} = 4500 psi, E_{ps} = 28500 ksi, beam cross-sectional area (A) = 1920 inch^2, moment of inertia of the beam section (I) = 1450000 inch^4, centroid to top $(\bar{y}_{top})$ = 26 inch and to bottom $(\bar{y}_{bottom})$ = 34 inch and eccentricity of tendon at end (over support) = 0 inch.

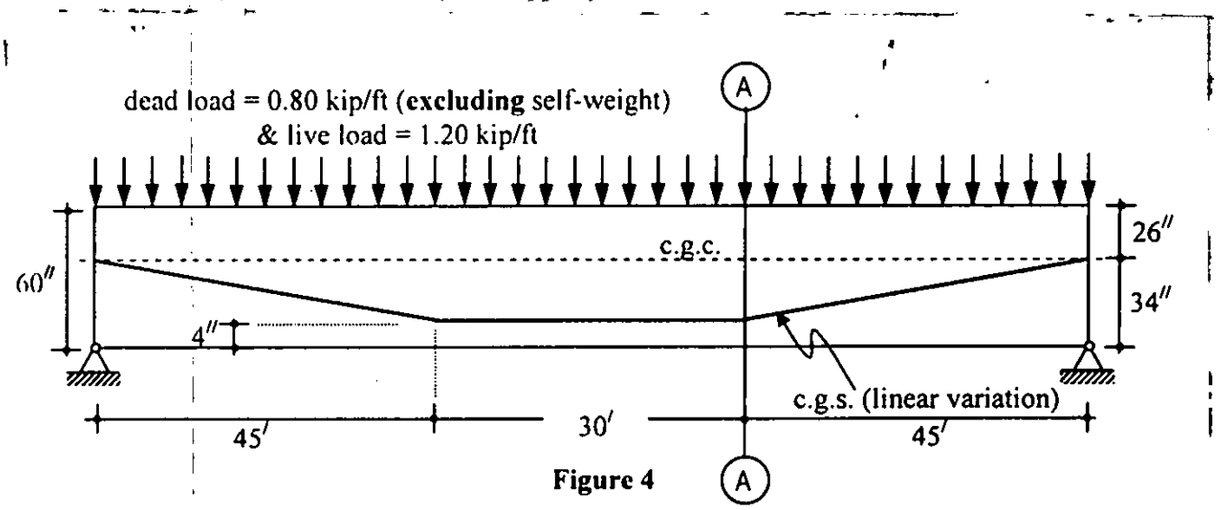


Figure 4

3. (a) Why is comparatively high strength concrete necessary for prestressed concrete? **(5)**

(b) A 16 × 22 inch column is reinforced with eight No. 9 bars as shown in Figure 5. Construct the nominal strength interaction diagram for the column with five points corresponding to pure axial load, pure bending, balance condition, ε_s = 0.001 (tensile) and ε_s = 0.004 (tensile). Also, find corresponding 'φ' values for the above points. Assume bending about major/strong axis. Given: f'_c = 4 ksi, f_y = 60 ksi and E_s = 30000 ksi. **(30)**

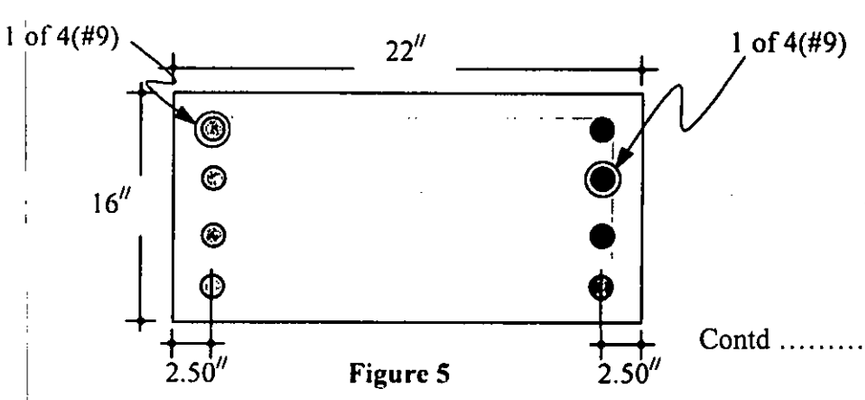


Figure 5

Contd P/4

CE 325/WRE

4. (a) Draw and write down ACI/BNBC code detailing requirements for beams for a special moment resisting frame. **(8)**

(b) A reinforced concrete circular column as shown in Figure 6 (gross diameter = 22 inch) of a building is subjected to following axial loads and moments (unfactored). Determine the necessary longitudinal reinforcements for the column. Given: f'_c = 4 ksi, f_y = 60 ksi and interaction diagram is supplied at the end. **(12)**

(*unfactored)	Dead load	Live load
Axial force*	190 kip	250 kip
Moment*	90 kip-ft	149 kip-ft

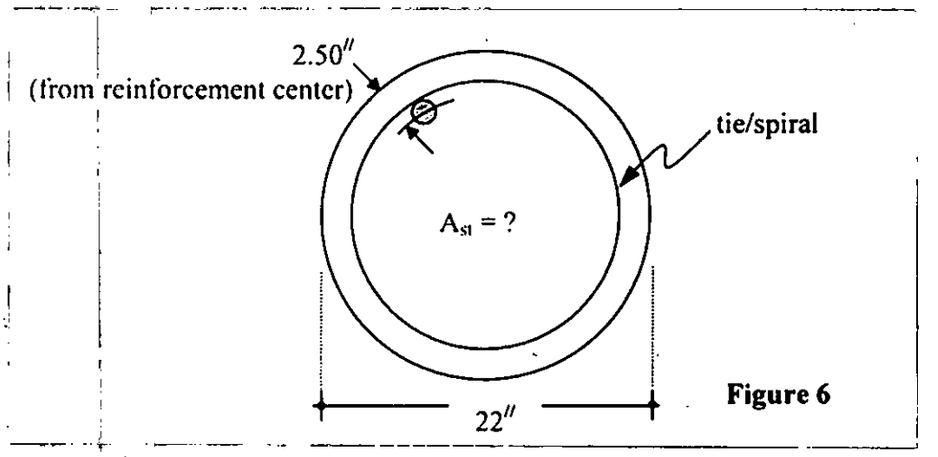


Figure 6

(c) Make a preliminary design of prestressed concrete pre-tensioned beam to resist a total moment = 400 kip-ft and girder moment = 50 kip-ft. Given, effectiveness ratio = 15% and grade of strand = 270 (f_{pu} = 270 ksi.). Given: f'_c = 6000 psi and f'_{ci} = 70% of f'_c. **(15)**

$$f_{c\,(transfer)} = 0.60 f'_{ci},\ f_{t\,(transfer)} = 3\sqrt{f'_{ci}},\ f_{c\,(service)} = 0.45 f'_c \text{ and } f_{t\,(service)} = 7.50\sqrt{f'_c}$$

$$S_{top} \geq \frac{M_T - RM_G}{Rf_{t(transfer)} - f_{c(service)}} \text{ and } S_{bottom} \geq \frac{M_T - RM_G}{Rf_{t(service)} - f_{c(transfer)}}$$

$$A_c \geq \frac{F_{pi}h}{f_{t(transfer)}y_{bottom} - f_{c(transfer)}y_{top}} \text{ and } A_c \geq \frac{F_{pe}h}{f_{t(service)}y_{top} - f_{c(service)}y_{bottom}}$$

Contd P/5

CE 325/WRE

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

Assume any reasonable value of missing data.

5. (a) A 6-story residential building in Dhaka is to be designed using a flat plate floor system. The columns are 14″ × 14″ in size and spaced at 24 ft c/c in one direction and 22 ft c/c in the other direction. Using the Direct design method, design a typical interior slab panel and show the reinforcements with neat sketches. Given, live load = 40 psf, floor finish = 25 psf, and partition wall load = 50 psf. Use f'_c = 4 ksi and f_y = 60 ksi. **(35)**

6. (a) Design a wall footing to support a 12-in.-wide reinforced concrete wall with a dead load D = 20 k/ft and a live load L = 15 k/ft. The bottom of the footing is to be 4 ft below the final grade, the soil weighs 100 lb/ft^3, the allowable soil pressure, q_a, is 4 ksf. Use f_y = 60 ksi and f'_c = 3 ksi, normal-weight concrete. Check development length. **(17)**

(b) A square spread footing supports an 18-in.-square column supporting a service dead load of 400 kips and a service live load of 270 kips. The column is built with 5000-psi concrete and has eight No. 9 longitudinal bars with f_y = 60,000 psi. Design a spread footing to be constructed by using 3000-psi normal-weight concrete and Grade-60 bars. For shallow foundations, the allowable bearing pressure on the soil is 6000 psf. The bottom of the footing is 6 ft below grade. Show the reinforcements in the plan and section with a neat sketch. **(18)**

7. (a) Design a rectangular combined footing for the two columns shown in Fig. 7(a). Given the allowable bearing capacity of the soil, q_a = 5 ksf, concrete: f'_c = 3000 psi, normal-weight, and f_y = 60 ksi. The bottom of the footing is to be 6 ft below grade. Show the reinforcements in the plan and section. **(25)**

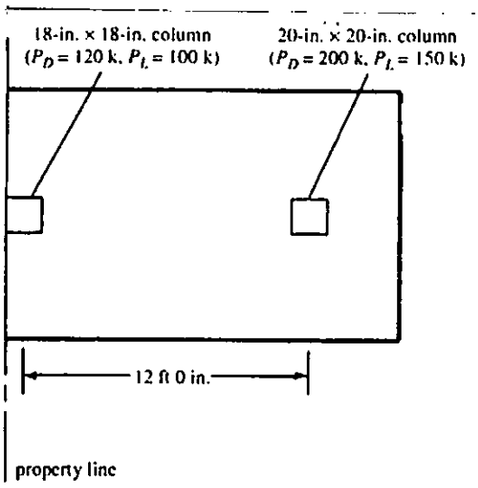


Fig. 7(a)

Contd P/6

CE 325/WRE

Contd ... Q. No. 7

(b) The plan of a pile cap with 16 number 18 in. diameter piles and the column (22 in × 22 in) is on center as shown in Fig. 7(b). Calculate the flexural shear at the critical section for an effective depth of 18 in. **(10)**

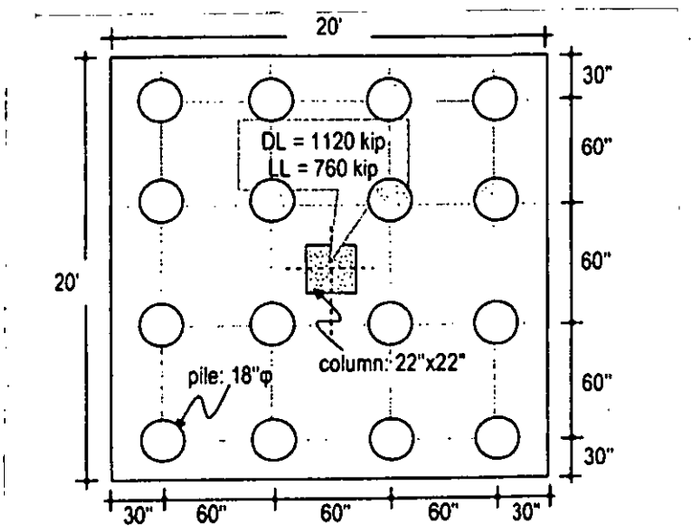


Fig. 7(b)

8. (a) Describe different failure modes of low-rise shear walls. **(12)**

(b) A four-storied reinforcement concrete shear wall is subjected to factored loads, as shown in Fig. 8(b). The wall is 16 ft long and 10 inch thick. Design reinforcements for the wall at the first level between the base and the first floor. Given, f'_c = 3.5 ksi and f_y = 60 ksi. Show reinforcements both in plan and elevation. **(23)**

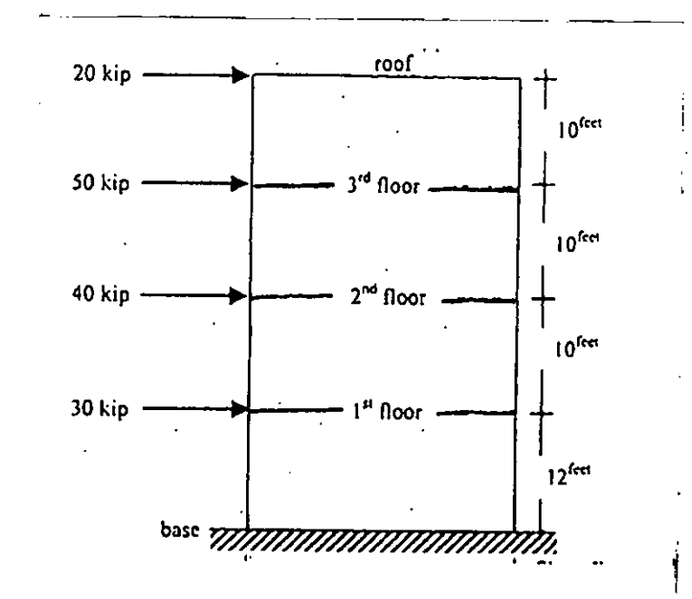


Fig. 8(b)

Contd P/7

$$\frac{\ell_d}{d_b} = \frac{3}{40}\frac{f_y}{\lambda\sqrt{f'_c}}\frac{\psi_t\psi_e\psi_s}{\frac{c+K_{tr}}{d_b}}$$

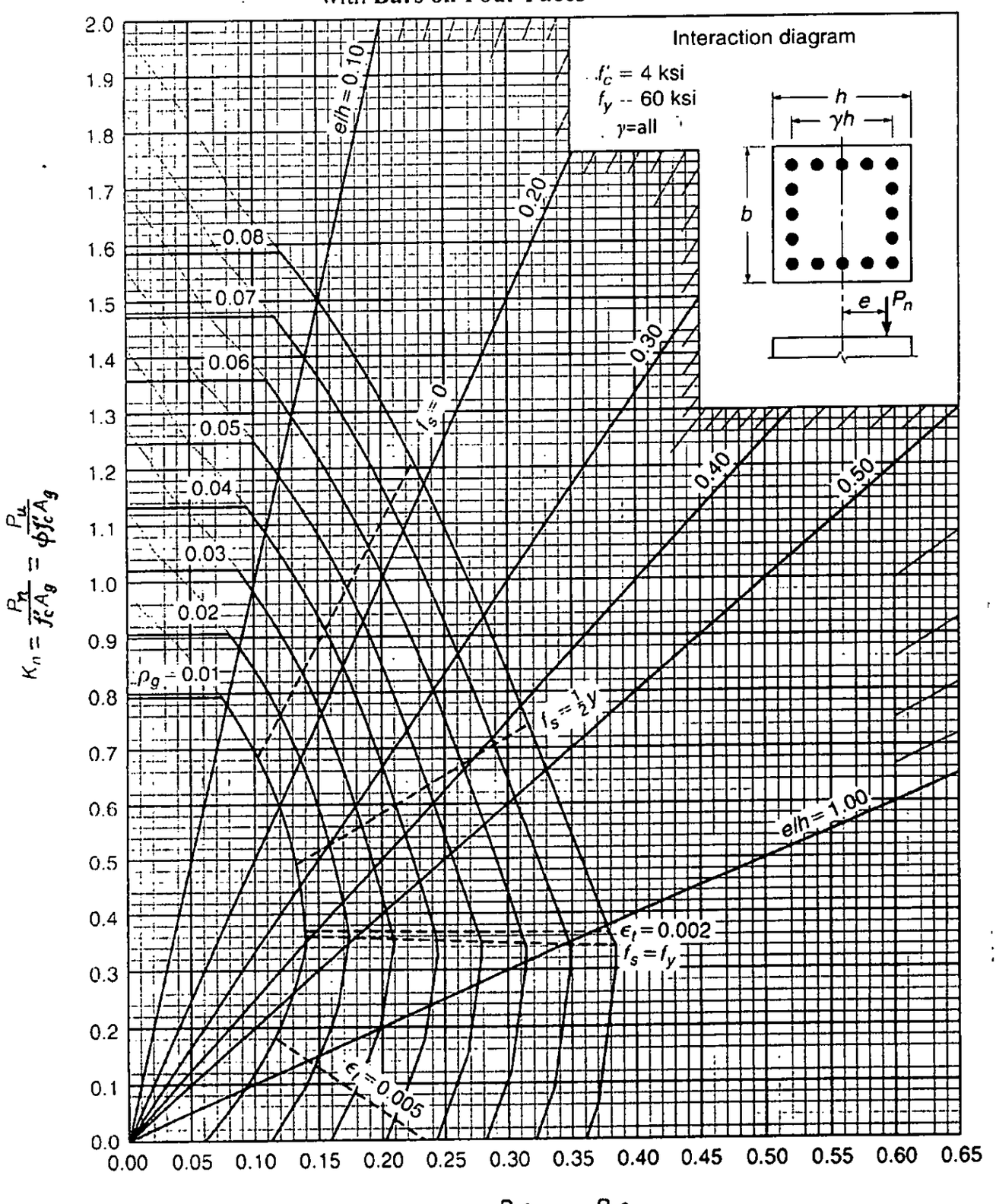
$$A_w \geq [0.0025 + 0.5\left(2.5 - \frac{h_w}{l_w}\right)\left(\frac{A_u h}{S_2 h} - 0.0025\right)S_1 h$$

$$A_w \geq 0.0025 S_1 h$$

$$M_u = \phi\left[0.5 A_{st} f_y l_u\left(1 - \frac{z}{l_w}\right)\right]$$

$$\frac{z}{l_w} = \frac{1}{2 + \frac{0.85\beta_1 l_w h f'_c}{A_n f_y}};\ \beta_1 = 0.85.$$

Appendix 1: Column Strength Interaction Diagram for **Rectangular Section** with **Bars on Four Faces**



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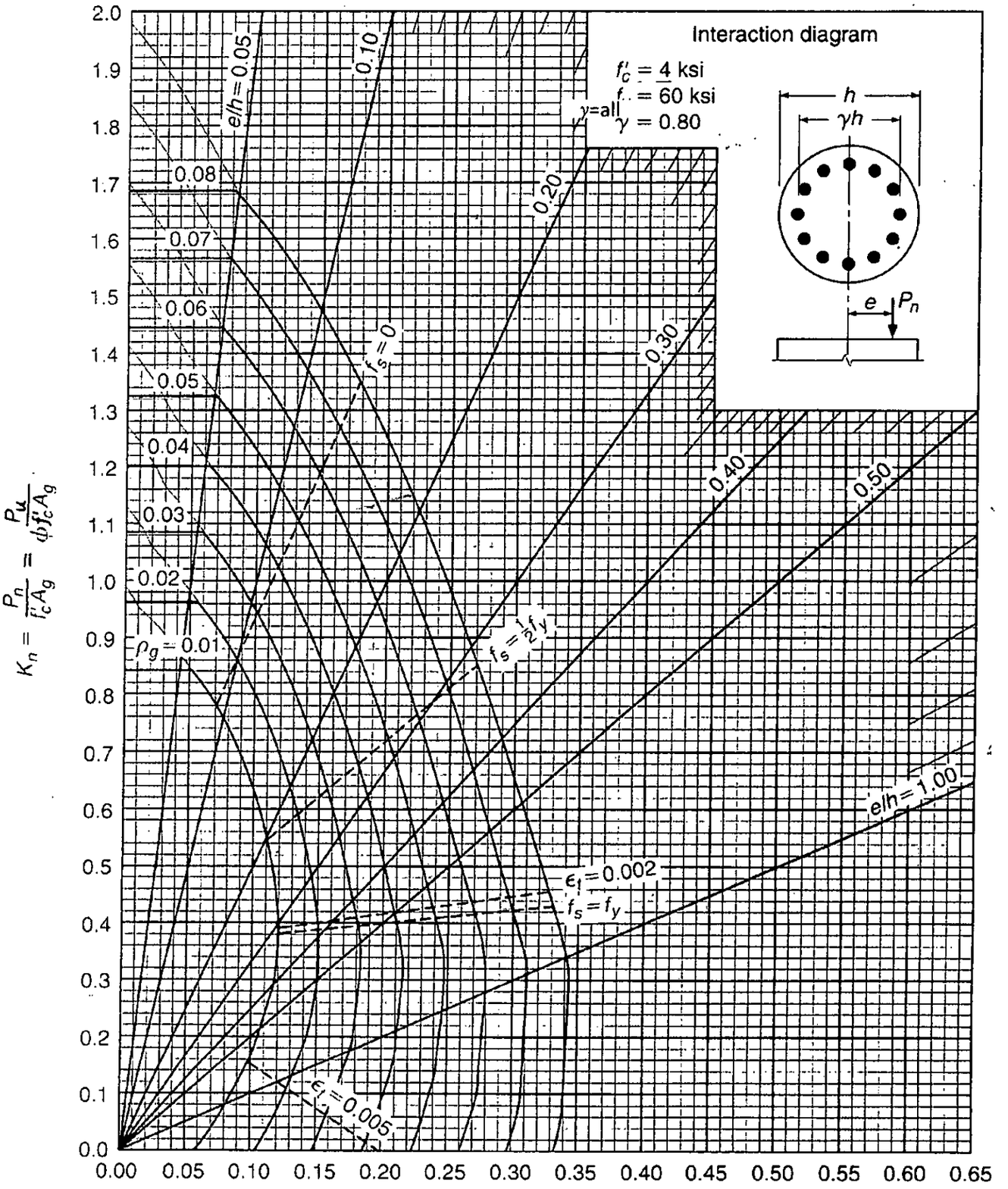
Appendix 2: Column Strength Interaction Diagram for **Circular Section**



L-4/T-1/WRE **Date: 25/03/2024**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2022-2023

Sub: **CE 425** (Structural Analysis and Design II)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FIVE** questions in this section. Answer any **FOUR** question.

(Symbols and notations have their usual meanings)

1. In the beam shown in figure 1, support 'C' settled downward 0.15 ft. Analyze the beam using Stiffness Method. Also draw the shear force and bending moment diagram for the beam. Assume, EI=4000 k-ft^2. **(26 $\frac{1}{4}$)**

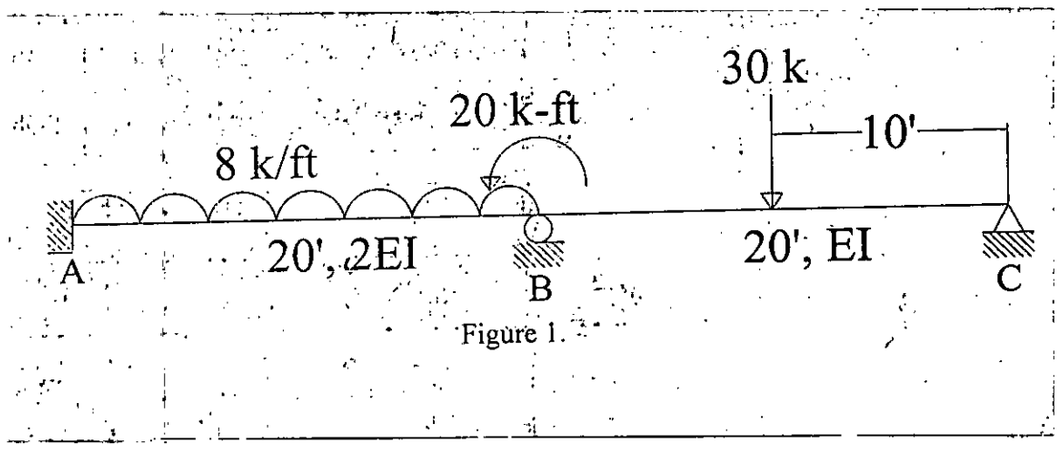


Figure 1.

2. Analyze the plane grid in figure 2 using Stiffness Method. Also determine the vertical reaction bending moments at support A. Assume, EI=4000 k-ft^2 and GJ= 1500 k-ft^2. **(26 $\frac{1}{4}$)**

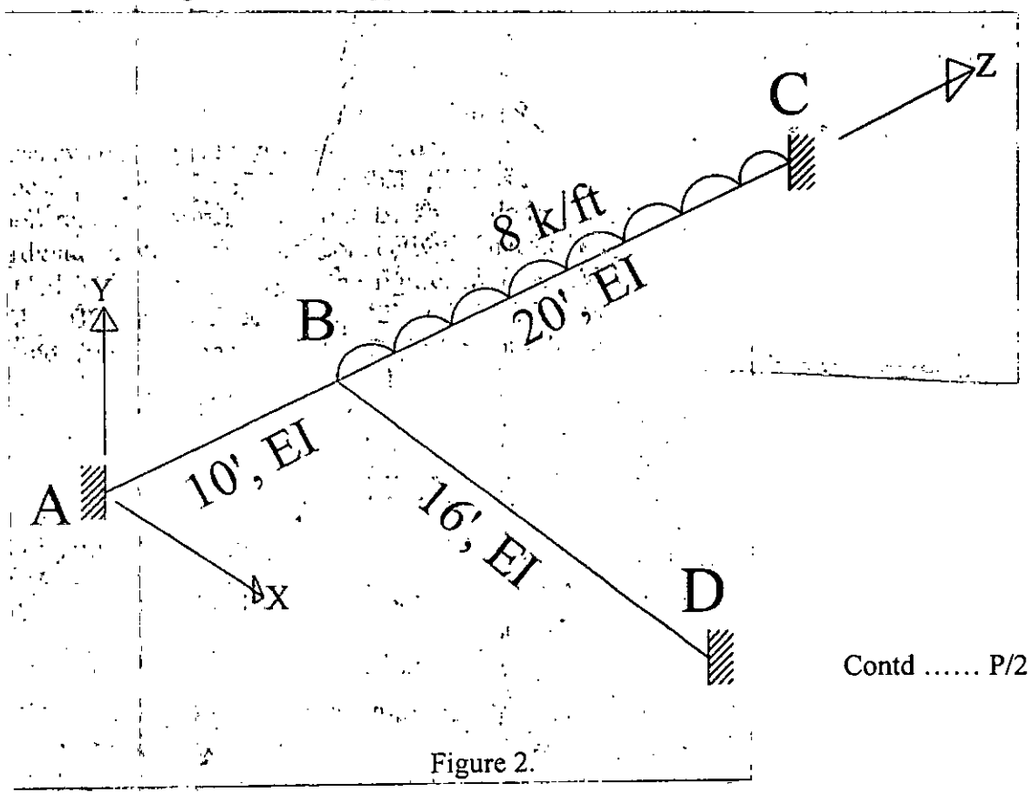


Figure 2.

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3. A truss system is given in figure 3. Compute the elements of the global stiffness matrix for the truss system. Using the global stiffness matrix, solve the matrix to determine the support reactions at support A and B. The node indices to be used for computing the join co-ordinate matrix, member connectivity matrix and member destination vector are provided within the circle in the figure. Member AB runs between nodes '1' and '2'. Member BC runs between nodes '2' and '3'. Assume, Modulus of Elasticity, E= 1000 k/ft^2 and cross sectional area, A= 0.1 ft^2 for both the members AB and BC. **(26 1/4)**

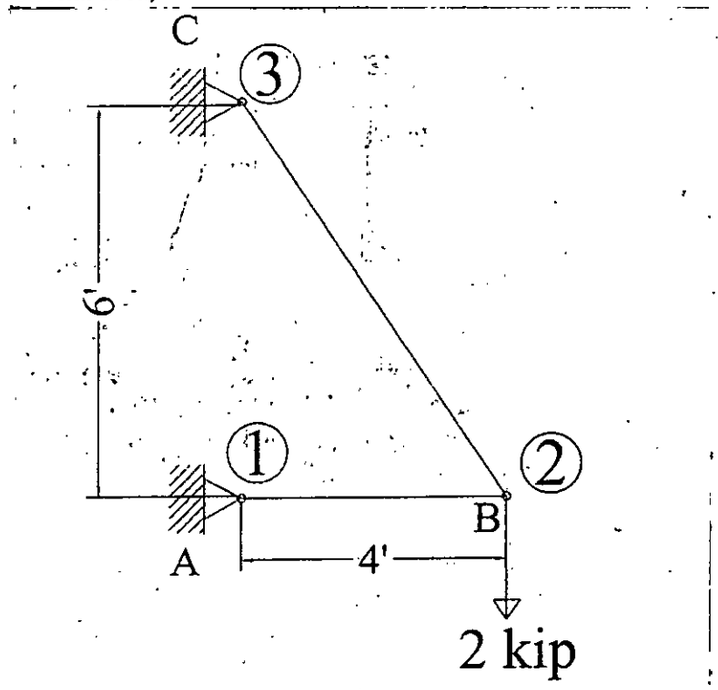

Figure 3.

4. Analyze the sway frame given in figure 4 using Moment Distribution Method and determine the moments at each joint of the frame. Assume, EI is constant for all the members of the frame. **(26 1/4)**

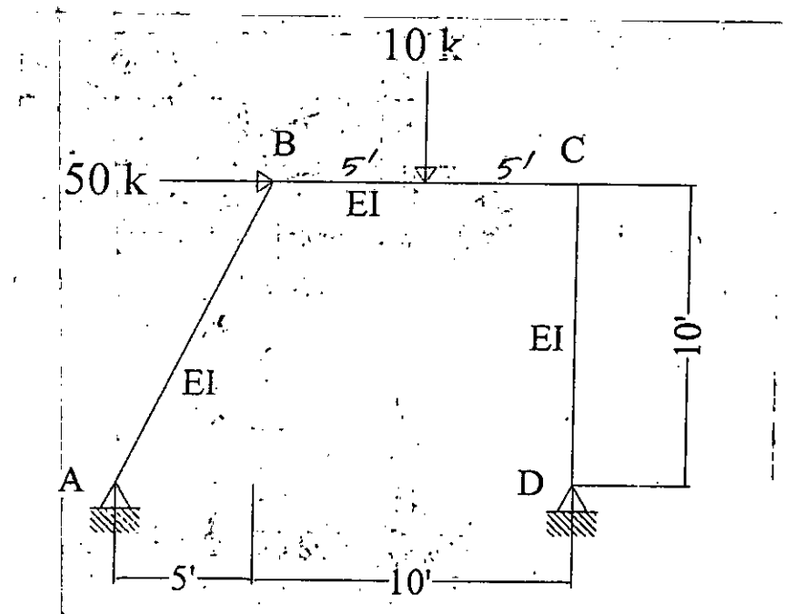

Figure 4.

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5. Analyze the non-sway frame in figure 5 using Moment distribution Method. Draw the shear force and bending moment diagrams for the frame. Assume, EI is constant for all the members of the frame. **$(26\frac{1}{4})$**

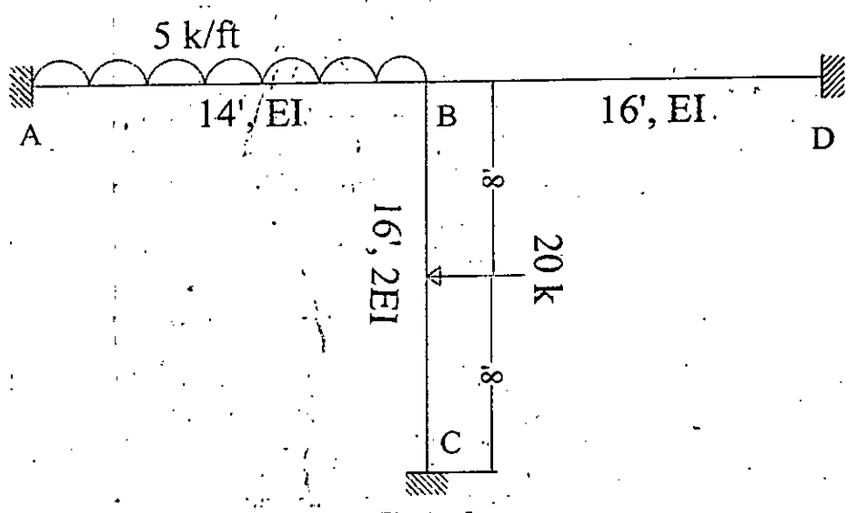

Figure 5.

SECTION – B

There are **FIVE** questions in this section. Answer any **FOUR** questions.
(Assume reasonable values for missing data, if any)

6. Analyze and draw the bending moment diagram for the frame shown in figure 6 using the **Flexibility Method.** The EI value for the beam is twice the value for the columns. **$(26\frac{1}{4})$**

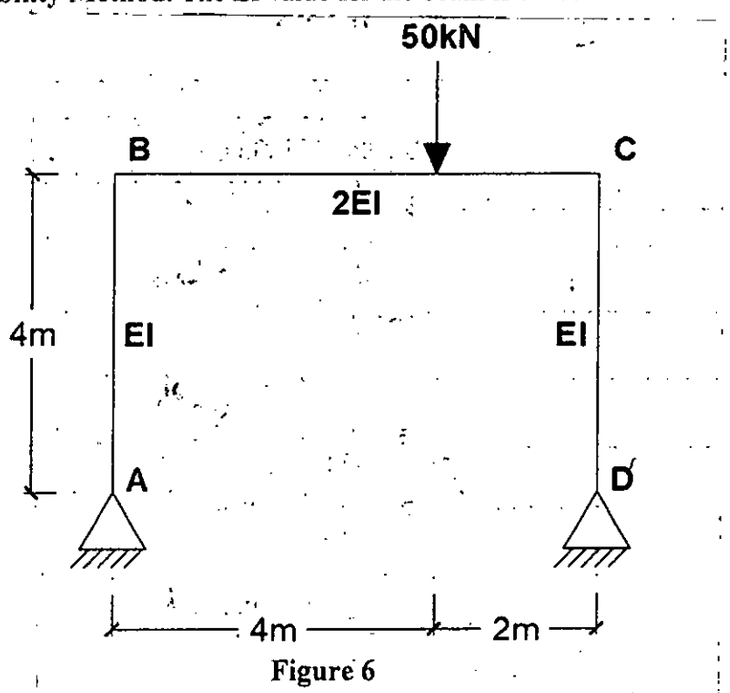

Figure 6

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7. For the beam shown in Figure 7, support "D" is subjected to a rotation of 0.06 radian in the anti-clockwise direction. Analyze the beam using the **Moment Distribution Method** and draw the shear force diagram and the bending moment diagram for the beam. Assume EI = 3500 k-ft^2. $(26\frac{1}{4})$

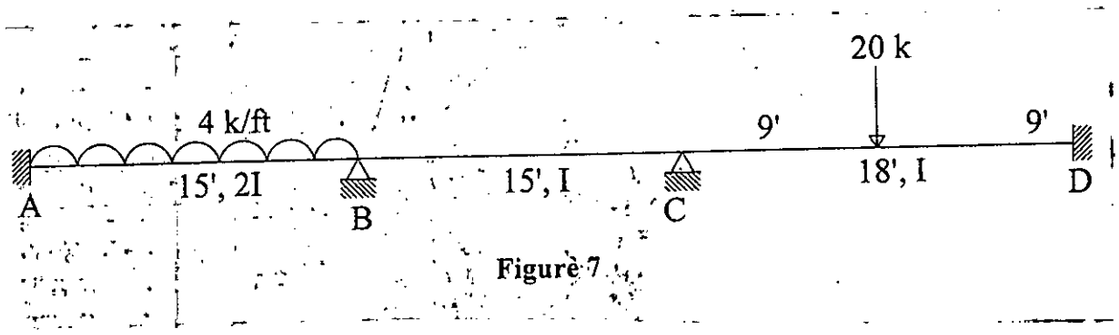

Figure 7

8. Determine the bar forces in the pin-jointed steel truss shown in Figure 8 using the **Flexibility Method.** The cross-sectional area of each member is 500 mm^2. $(26\frac{1}{4})$

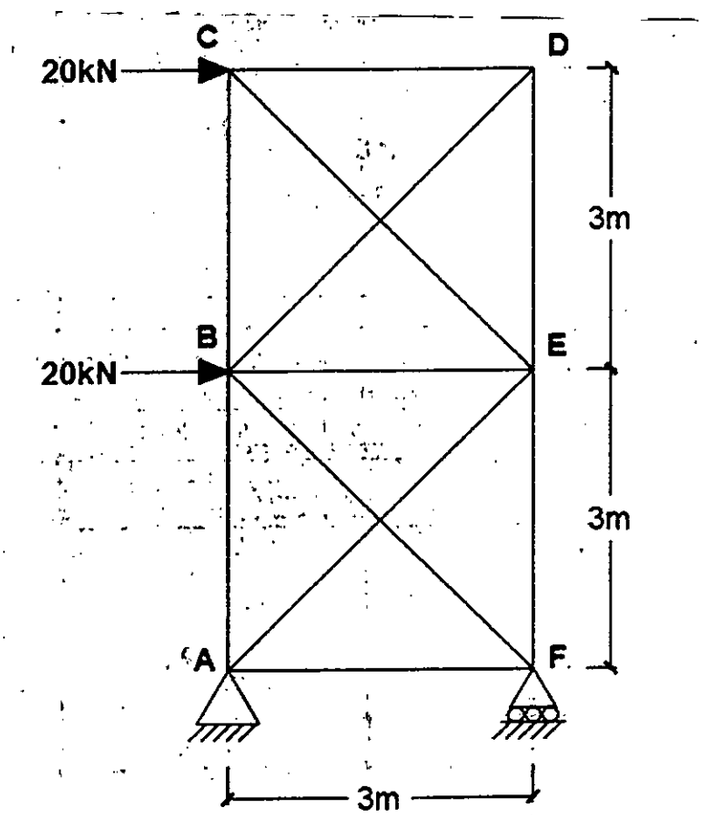

Figure 8

Contd P/5

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9. Draw qualitative Influence Lines for R_A, R_B, R_C, R_D, M_A, M_X, M_B, M_Y, M_C, M_Z, V_X, V_Y, and $V_{C\,(Left)}$ of the continuous beam shown is figure 9. Symbols R, V, and M represent reaction, shear, and moment at different points. $(26\frac{1}{4})$

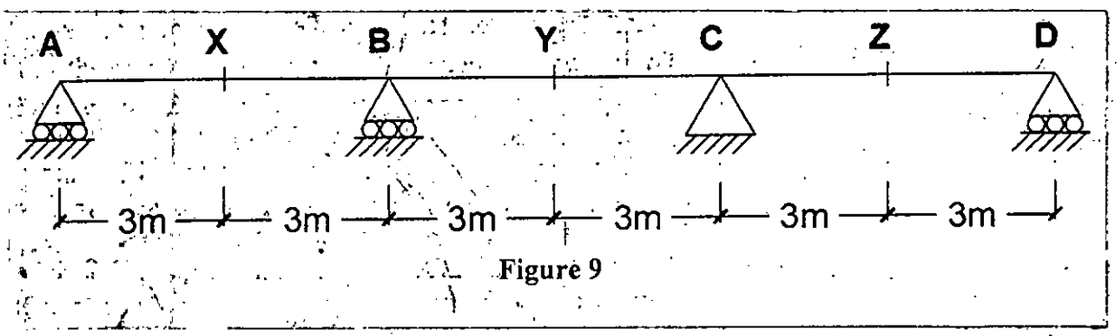

Figure 9

10. Compute the axial force in the tie rod CD attached at the midpoint of the bean AB shown in figure 10 using the **Flexibility Method.** Also, draw the bending moment diagram of the beam AB. Cut the tie rod and select its bar force as redundant. The cross-sectional area and moment of inertia of the beam are 20 in^2 and 600 in^4, respectively. $(26\frac{1}{4})$

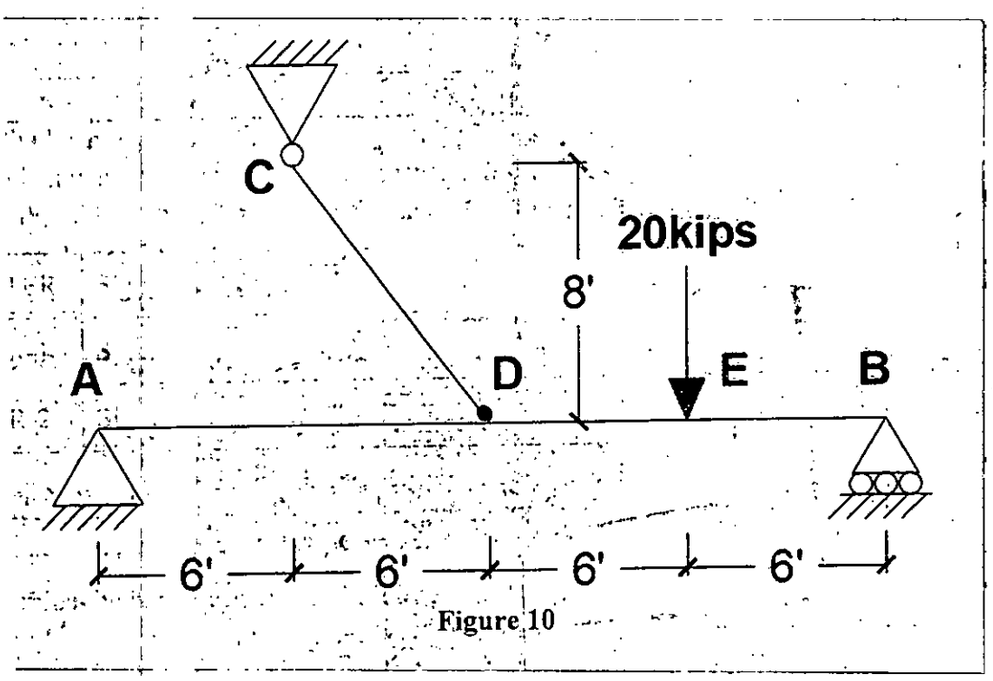

Figure 10
