Set : A

Sec: A & B

3-2

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring- 2017
Program: B.Sc in Civil Engineering

Course Title: Principles of Management, Course Code: IMG 301, Credit: 2

Time: 2 Hours, Full Marks: 50

❒ **Answer any 04 (Four) Questions. All Questions carry equal marks.**

1. a) What is the message of theory Y ? 4

   b) Delineate the implications for Management of Maslow's Hierarchy of Needs Theory. 8.5

2. a) Graphically represent SWOT Analysis Framework. 4

   b) Explain SWOT Matrix. 8.5

3. a) What are the theories of Leadership ? 4

   b) Critically explain the specific factors differentiate charismatic leaders from non- charismatic leaders. 8.5

4. Describe Porter's Five Forces Model. 12.5

5. Describe the steps of decision making process. 12.5

Best of Luck

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course Code: CE 313 | **Time: 180 Minutes**
Course Title: Structural Engineering II | **Full Marks: 10x10 = 100**

Answer any 10 of the following 14 Questions. *The figures are not drawn to scale.* Any missing data can be assumed reasonably.

[1] Use Moment Distribution Method to draw the SFD and BMD of the frame shown in Fig.1. Given, EI = 30×10^6 k-in^2.

[2] Determine the minimum moment of inertia I_{BD} of the beam BD for the horizontal deflection at ***E***, $\Delta_E =$ 2.5 inches of the frame shown in Fig. 2. Given, $E_{BD} = 29000$ ksi, $EI_{AB} = EI_{DE} = 29 \times 10^5$ k-in^2.

[3] Calculate horizontal deflection at ***F*** of the frame shown in Fig. 3 by using Virtual Work Method. Given, EI = 29×10^5 k-in^2.

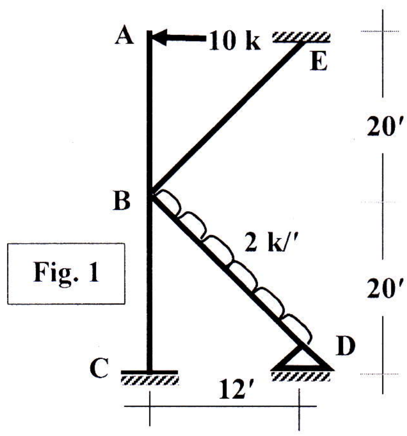


Fig. 1

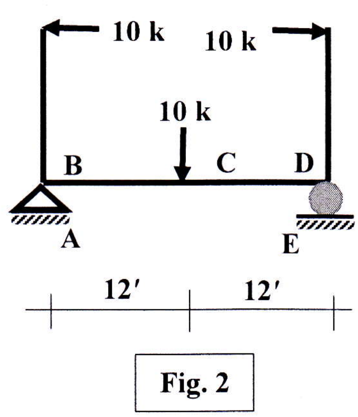


Fig. 2

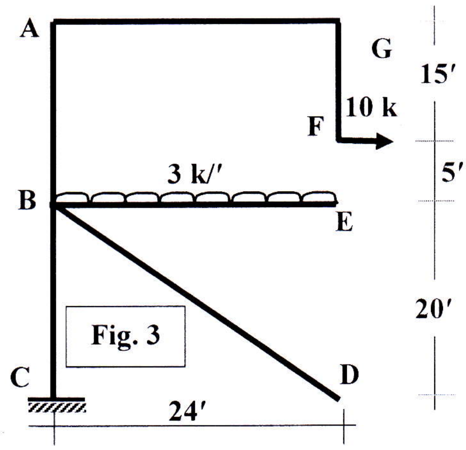


Fig. 3

[4] Use Virtual Work Method to determine horizontal and vertical deflection at ***G*** of the truss shown in Fig. 4. Given, E = 29000ksi, A = 3.25in^2.

[5] Use approximate vertical load analysis to draw AFD, SFD and BMD of the frame shown in Fig. 5.

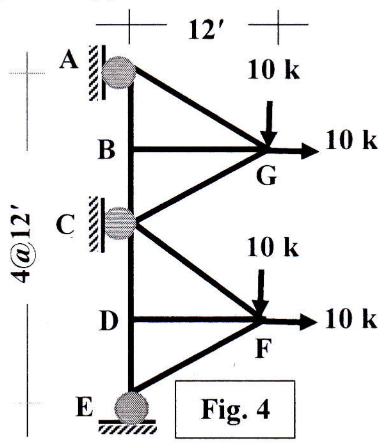


Fig. 4

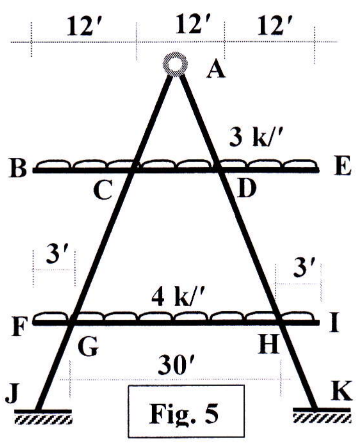


Fig. 5

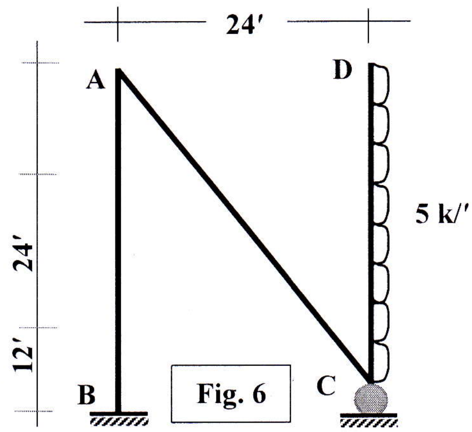


Fig. 6

[6] Use Flexibility Method to draw SFD and BMD of the frame shown in Fig. 6. Assume the support ***C*** has settled 2.3 inches. Given, EI = 30×10^6 k-in^2.

[7] Draw SFD and BMD of beam ***CDEF*** and column ***ACGK*** by using Cantilever Method of the frame shown in Fig. 7. Given, cross-sectional area of columns *ACGK* are 10in^2 and rest of the columns have area of 8.85in^2.

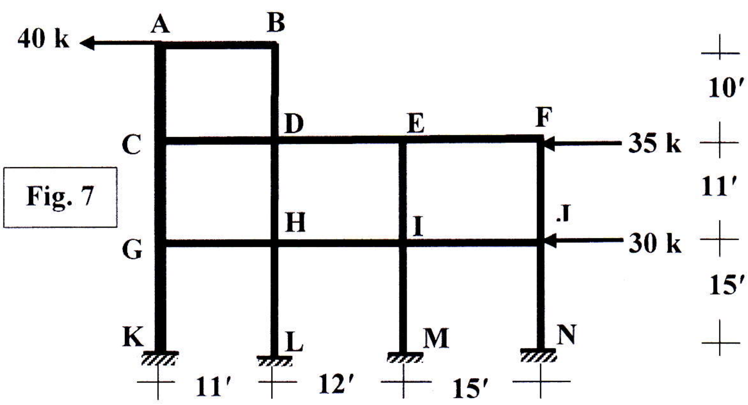


Fig. 7

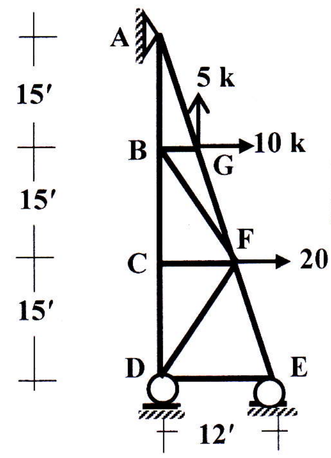


Fig. 8

[8] Use Portal Method to draw SFD and BMD of beam ***CDEF*** and column ***ACGK*** of the frame shown in Fig.7.

[9] Use Flexibility Method to determine the forces in the members *DE, BF* and *DC* of the truss shown in Fig. 8. Given, A= 3 in^2, E = 29x10^3 k-in^2.

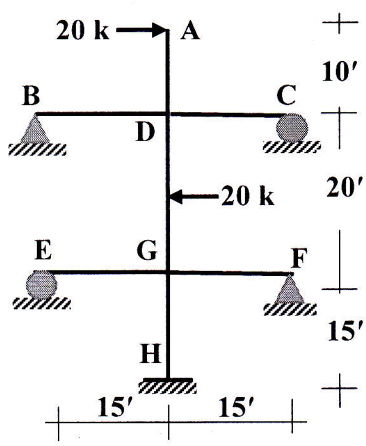


Fig. 9

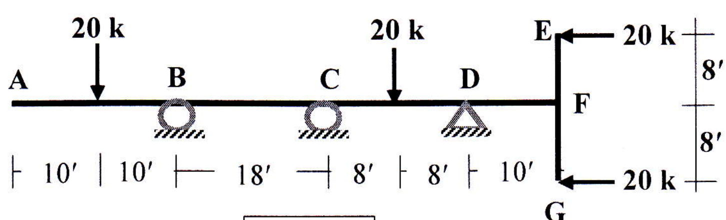


Fig. 10

[10] Assuming the support ***B*** and ***C*** has settled 1 and 2 inches respectively, use Moment Distribution Method to draw the BMD of the frame shown in Fig. 9. Given, E = 29x10^3 ksi, I = 700 in^4.

[11] Use Flexibility Method to draw BMD of the beam shown in Fig. 10. Assume the support ***C*** has settled 1.25 inches. Given, EI = 29x10^6 k-in^2.

[12] Draw BMD of the beam shown in Fig. 11 by using Moment Distribution Method. Assume that support ***C*** has settled 2 inches. Given, EI = 29x10^6 k-in^2.

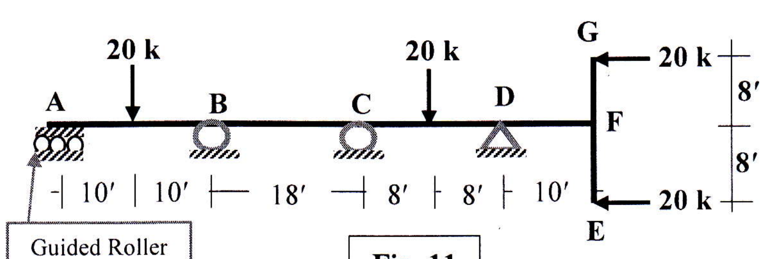


Fig. 11

[13] Analyze the statically indeterminate truss shown in Fig. 12 to determine the forces in members GE and BD. Consider diagonal members can carry tension only.

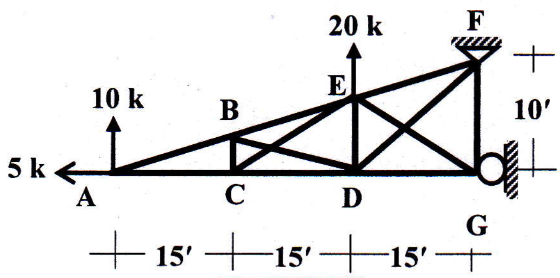


Fig. 12

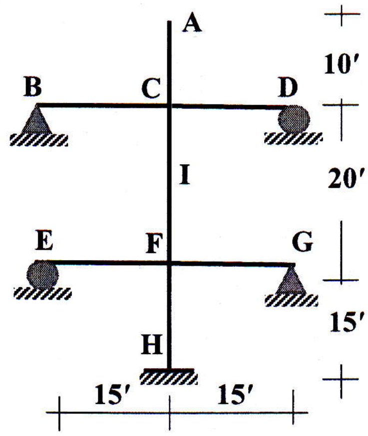


Fig. 13

[14] (a) What are the assumptions of Portal and Cantilever Methods? Use appropriate sketches wherever necessary. **(2.5)**

(b) What is the purpose of moment carryover (MC)? Evaluate that the MC factor is 0.5 for fixed ended prismatic members. **(2.5)**

(c) Draw qualitative influence lines for shear force and moment at location ***I*** of the frame shown in Fig. 13. And place dead load 1k/′ and a point load 3k for maximum shear and moment. **(5)**

University of Asia pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course Title: Transportation Engineering I (Transport and Traffic Design) — Course Code: CE 351
Time: 3 Hours — Full Marks: 150

Section A
There are **four** questions. Answer **all** of them.

1. a) Explain the reasons of delay with example. 8
   b) What are the objectives of traffic volume studies? Name the factors affecting traffic speeds? 10
   c) Compute the time-mean speed and space-mean speed from the following table: 12

Vehicle no.	Distance (m)	Travel time (sec)
1	1500	50
2	1500	55
3	1500	60
4	1500	44
5	1500	51
6	1500	44

2. a) Illustrate traffic sign according to function and provide two examples of each. 10
   b) Design a two-phase signal at an isolated cross-junction for the following data: 12
   Intergreen for N-S: 9 sec and E-W: 7 sec. Amber period: 3 sec. Red-amber period: 2 sec
   Lost time due to starting and end delays : 4 sec (N-S) and 3 sec (E-W)

	N	S	E	W
Flow(q), veh/hr	1140	1050	990	1070
Saturation flow(s) veh/hr	3100	2980	2850	3200

   c) Illustrate stopping sight distance and perception-reaction distance. 8

3. a) A vertical curve joins a - 5% grade with a +7% (sag vertical curve) grade at a section of a two-lane highway. If the length of the curve is 370 ft, what is the safe speed on this curve? Assume perception-reaction time is 2.5 sec and f=0.3. 15
   b) During leading a -6% grade at a speed of 70 km/h, a driver observes a bus overturned in the roadway ahead of him. Calculate the minimum distance at which he must have seen the object in order to avoid colliding with it 10
   c) Illustrate the requirements of a bus terminal. 5

4. a) Summarize the transport related problems in Bangladesh. 10
   b) Classify traffic calming devices in terms of speed control measures and volume control measures. 10
   c) Compare angular and parallel method of parking. 10

Section B
There are **two** questions. Answer **one** of them

5. a) Explain safe stopping sight distance in the design of horizontal curves with diagram. 15
   b) The corner of a building is close to the horizontal curve having a radius of 170 ft on a regional highway. The inside lane is 25 ft wide and the inside edge of the road is 8 ft from the corner of the building. What should be the speed limit of that section of the roadway? Assume reaction time as 2.5 second and friction factor as 0.34. 15

6. a) Write the elements of Passing Sight Distance for a two-lane highway with diagram. 15
   b) A vehicle moving at a speed of 50 mph is slowing traffic on a two-lane highway. What passing sight distance is necessary, in order for a passing maneuver to be carried out safely? Calculate the passing sight distance by hand. In your calculations, assume that the following variables have the values given: Passing vehicle driver's perception/reaction time = 2.5 sec, Passing vehicle's acceleration rate = 1.47 mph/sec, Initial speed of passing vehicle = 50 mph, Passing speed of passing vehicle = 70 mph, Speed of slow vehicle = 60 mph, Speed of opposing vehicle = 60 mph, Length of passing vehicle = 25 ft, Length of slow vehicle = 24 ft, Clearance distance between passing and slow vehicles at lane change = 20 ft, Clearance distance between passing and slow vehicles at lane re-entry = 24 ft, and clearance distance between passing and opposing vehicles at lane re-entry = 250 ft. You should also assume that the passing vehicle accelerates to passing speed before moving into the left lane. 15

Necessary equations:

$$S<L: \quad L=\frac{AS^2}{100(\sqrt{2h_1}+\sqrt{2h_2})^2}$$

$$S>L: \quad L=2S-\frac{200(\sqrt{h_1}+\sqrt{h_2})^2}{A}$$

$$S<L: \quad L=\frac{AS^2}{200[2.0+S(\tan 1^\circ)]}$$

$$S>L: \quad L=2S-\frac{200[2.0+S(\tan 1^\circ)]}{A}$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. in Civil Engineering

Course Title: Design of Reinforced Concretes II — Course Code: CE 317
Time: 3 (Three) hours — Full Marks: 140

There are 9(Nine) questions in this section. Answer any 7(Seven).

Assume reasonable values for any missing data. Symbols used have their usual meanings.

1. An L shaped residential building is to be constructed, whose floor plan is shown in the ***Fig:1***. Beams are 12″× 18″, Columns are 12″ × 12″). Floor loads also include working FF = 30 psf, RW = 55 psf. fc′= 4 ksi, fy = 60 ksi. Design the slab B and show the reinforcement in a neat sketch.

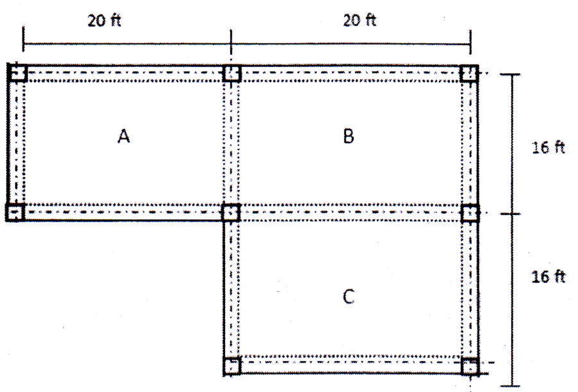


Fig: 1

2. Design the panel (D) of a flat slab (***Fig: 2***) of size 18′×16′ c/c (supported on 12″×12″ edge beams), if it carries floor finish = 30 psf, random wall = 50 psf, live load = 60 psf.
[Given: f_c'= 4 ksi, f_y = 60 ksi.]

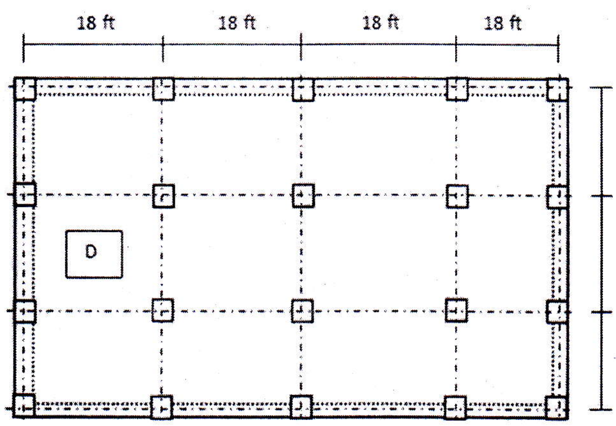


Fig: 2

3. Design a round spiral and a square column to support an axial dead load of 200 k and an axial live load 300 k. The column is also subjected to live load moment of 200 k-ft. Using column interaction diagram select reinforcement. . Given: f_c'= 4 ksi, f_y = 60 ksi.

4. Examine the adequacy of a 12″ × 20″ column shown in ***Fig: 3*** reinforced with 8 #9 bars. A factored load of 255 kips is to be applied with eccentricities e_y = 3 in and e_x = 6 in as shown. Use reciprocal load method. Given: f_c'= 4 ksi, f_y = 60 ksi.

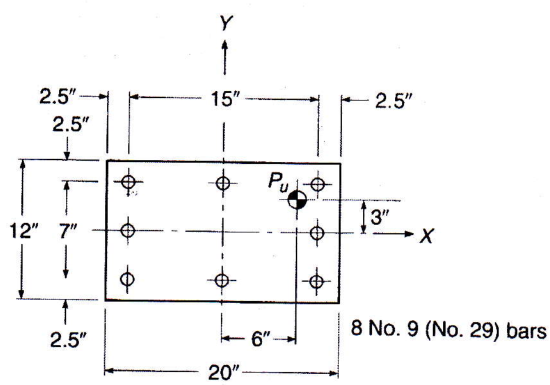


Fig: 3

5(a) Using the USD method for a square column footing

(i) Estimate footing size and factored net soil pressure

(ii) Check the thickness for punching and beam shear.

(iii) Design the reinforcement.

Given DL: 400k, LL:320k,f'c=4ksi,fy=60ksi,

Depth of foundation: 5ft, column size: 18"x18", q_a= 6 ksf, unit weight of concrete=150 pcf, unit weight of soil=l20pcf.

5(b) Explain why the slab coefficients (*Ca*) for short direction moments decrease with span ratio, while the slab coefficients (*Cb*) for long direction moments increase with span ratio.

6(a) An interior column (size 18"x18") of a building carries total service dead load of 300 kip and live load of 200 kip. Design a rectangular footing to support the column such as the length of the footing is twice its width. Show the reinforcements detailing with neat sketches. Allowable soil bearing pressure is 5 ksf. Given f'c=4ksi, fy=60ksi. Assume the base of footing is 5ft below grade.

6(b) Explain why the factors ϕ and α are used for column design. Also explain why a smaller value of ϕ is used for columns compared to beams.

7(a) A section of a gravity retaining wall as shown in ***Fig 4*** was made to support the soil behind the wall and the surcharge on the ground surface. Check the external stability of the section against sliding and overturning. Also check the soil pressure under the base.

[Given, unit weight of soil=120pcf, ϕ = 25°, f= 0.5, Allowable bearing pressure:6 ksf]

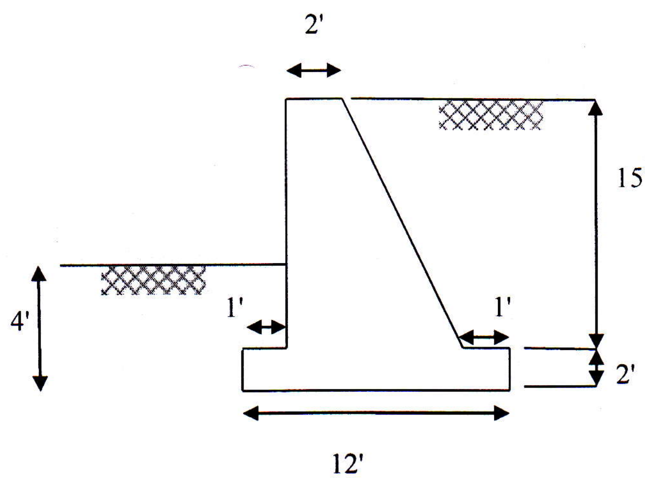


Fig: 4

7(b) Explain why flat slabs are divided into Column Strips and Middle Strips for design purpose.

8. An exterior 22" x 16" column with DL=150 kips, LL=125 kips, and an interior 22" x22" column with DL=200 kips, L = 170 kips are to be supported on a combined rectangular footing as shown in ***Fig 5*** whose outer end cannot protrude beyond the outer face of the exterior column. The center to center distance of columns is 18 ft and allowable bearing pressure of the soil is 6 ksf. The bottom of the footing is 6 ft below grade. Design the footing, for f'c=3ksi, fy=60ksi.

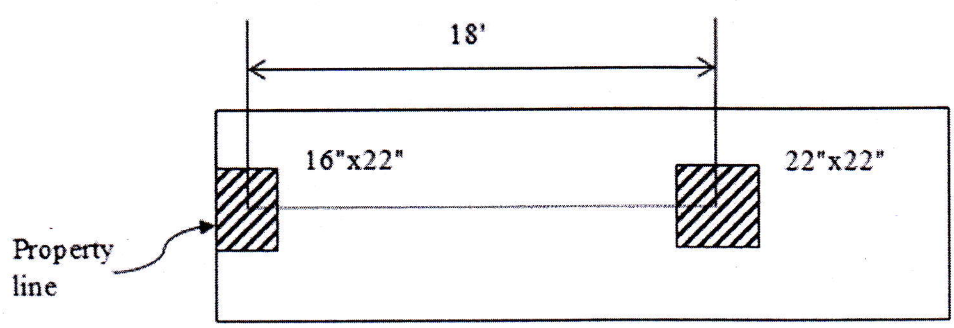


Fig: 5

9. A simply supported symmetrical prestressed I beam section having a span of 40 ft is shown in ***Fig 6***. It has the following section properties:

Moment of inertia , Ic= 12,000 in^4

Concrete area=176 in^2

Radius of gyration r=8.258 in

Section modulus=1000 in^3

Self weight=0.182 k/ft

It has to carry superimposed dead plus live load=0.75 k/ft in addition to its own weight. The beam will be pretensioned with multiple seven wire strands at a constant eccentricity of 7.91 in.

The prestress force P_i immediately after transfer will be 158 kips, after time-dependent losses, the force will reduce to P_e=134 kips.

The specified strength of concrete is 5000 psi, at the time of prestressing strength will be f'_{ci}=3750 psi.

Calculate the concrete flexural stresses at the midspan section of the beam at the time of transfer, and after all losses with full service load in place. Compare with ACI allowable stresses for a class U member.

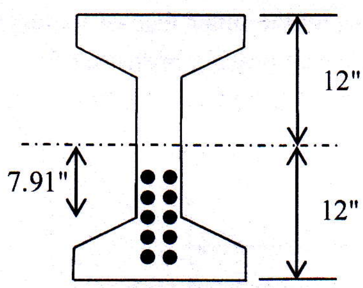


Fig: 6

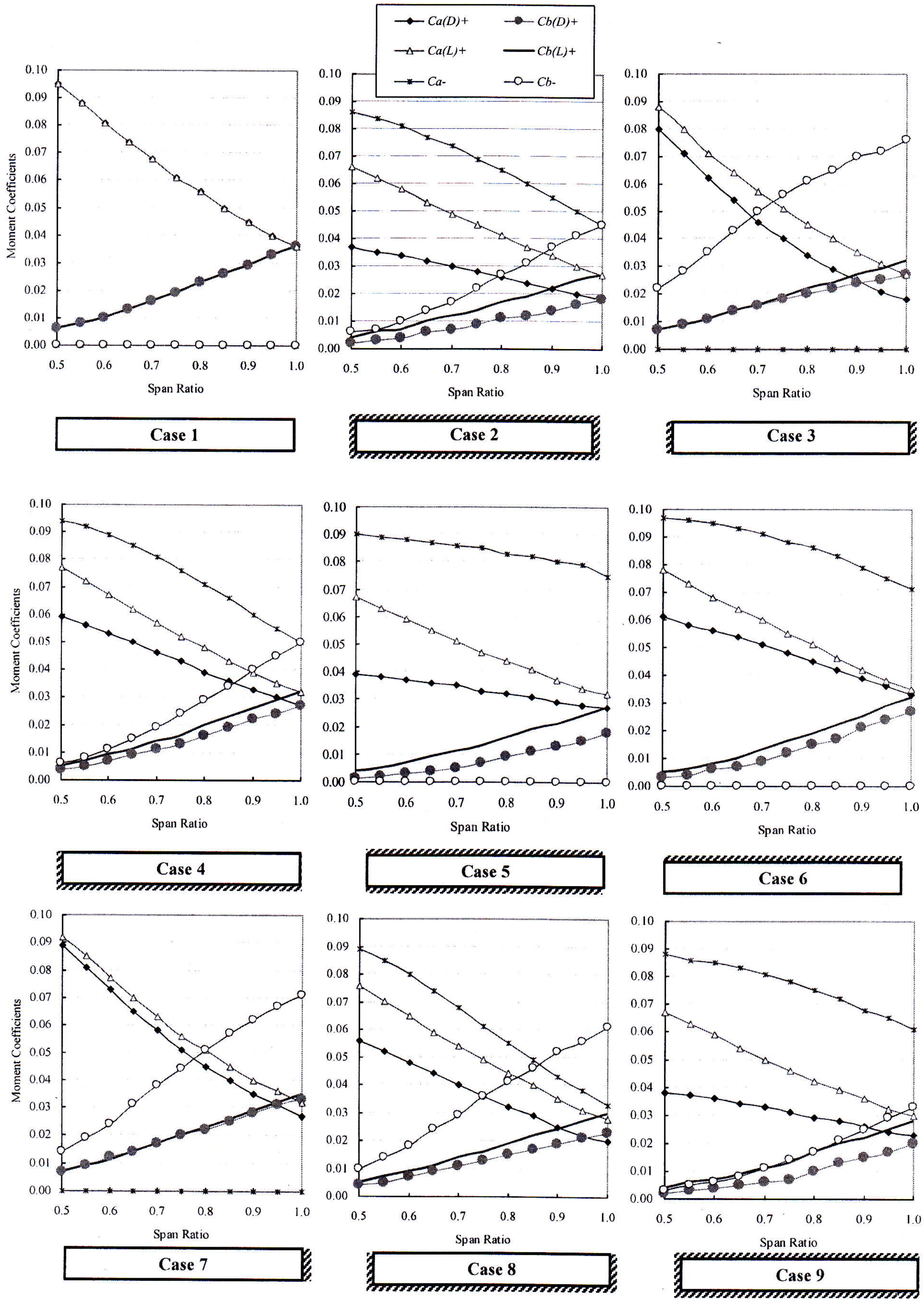


Fig. 1.5: Moment coefficients for different support conditions

CE 317 Formulae

<u>Co-efficient Method:</u>

$Ma = C_a\ w_u\ la^2$
$Mb = C_b\ w_u\ lb^2$
Thickness h =P/180 ≥ 3.5, P = panel perimeter
Shear strength of the slab, $\varphi V_c = 2\sqrt{f_c'}bd$

$$d = \sqrt{\frac{M_u}{\phi\rho f_y(1-0.59\rho\frac{f_y}{f_c'})}} \qquad \text{Here } \rho = \rho_{max} = 0.75\rho_b = 0.75 * 0.85*\beta_1\frac{f_c'}{f_y} * \frac{87000}{87000+f_y}$$

<u>Direct Design Method:</u>

Minimum thickness of Flat Slab

Exterior Panels without Edge Beams	Exterior Panels with Edge Beams	Interior Panels
$L_n/33$	$L_n/36$	$L_n/36$

For reinforcements with fy ≠ 40 ksi, the tabulated values are to be multiplied by (0.8 + fy/200).

$$M_o = w_n L_2 L_n^2/8;\ M_u^{(-)} = 0.65M_o;\ M_u^{(+)} = 0.35M_o$$

Distribution Factors applied to Static Moment M_0 for Positive and Negative Moments

Position of Moment	Ext Edge unrestrained (a)	Slab with beams between all supports (b)	No beam between interior supports		Exterior Edge fully restrained (e)
			Without edge beam (c)	With edge beam (d)	
Exterior $M^{(-)}$	0.00	0.16	0.26	0.30	0.65
Interior $M^{(-)}$	0.75	0.70	0.70	0.70	0.65
$M^{(+)}$	0.63	0.57	0.52	0.50	0.35

$\alpha = E_{cb}I_b/E_{cs}I_s \quad \beta_t = E_{cb}C/2E_{cs}I_s \quad C = \sum(1-0.63\ x/y)\ x^3y/3$

% of Exterior $M^{(-)}$ supported by Column Strip = $100 - 10\beta_t + 12\ \beta_t\ (\alpha_1\ L_2/L_1)\ (1-L_2/L_1)$

% of $M^{(+)}$ supported by Column Strip = $60 + 30\ (\alpha_1\ L_2/L_1)\ (1.5-L_2/L_1)$

% of Interior $M^{(-)}$ supported by Column Strip = $75 + 30\ (\alpha_1\ L_2/L_1)\ (1-L_2/L_1)$

For slabs without beams between supports ($\alpha_1 = 0$) and without edge beams ($\beta t = 0$), the portion of negative moments in column strip is simply 100% and 75% for exterior and interior supports, respectively, and portion of positive moment in column strip is simply 60%.

Punching shear capacity $V_c = 4\sqrt{f'_c}\ b_o d$

<u>Short Column:</u>
Axial Capacity $P_u = \alpha\ \phi\ A_g[0.85f_c' + \rho_s\ (f_y - 0.85f_c')]$

$$c = c_b = d\frac{\epsilon_u}{\epsilon_u + \epsilon_y} \qquad f_s = \epsilon_u E_s\frac{d-c}{c} \le f_y \qquad f_s' = \epsilon_u E_s\frac{c-d'}{c} \le f_y \qquad C = 0.85f_c'ab$$

$$P_n = 0.85f_c'ab + A_s'f_s' - A_sf_s$$

$$M_n = P_ne = 0.85f_c'ab\left(\frac{h}{2} - \frac{a}{2}\right) + A_s'f_s'\left(\frac{h}{2} - d'\right) + A_sf_s\left(d - \frac{h}{2}\right)$$

$$K_n = \frac{P_u}{\phi f_c'A_g} \qquad R_n = \frac{M_u}{\phi f_c'A_gh}$$

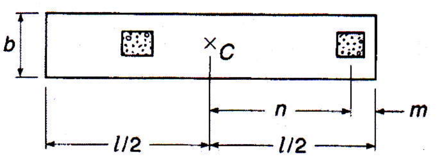
CE 317 Formulae 2

Footings

$$A_{req} = \frac{D + L}{q_a}$$

$$q_{\substack{max \\ min}} = \frac{P}{A} \pm \frac{Mc}{I}$$

Minimum Steel, $A_{s,min} = \frac{3\sqrt{f'_c}}{f_y} b_w d \geq \frac{200 b_w d}{f_y}$



$$l = 2(m+n)$$

$$b = \frac{R}{q_e l}$$

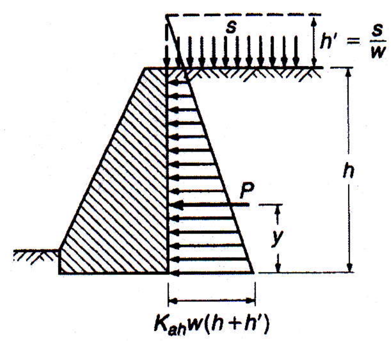
$$q_u = \frac{1.2D + 1.6L}{A}$$

As = $0.85 f'_c / f_y [1 - \sqrt{(1 - 2M_n/(0.85 f'_c b d^2))}] bd$

Retaining wall

$$p_h = K_0 wh$$

$$K_{ah} = \frac{1 - \sin\phi}{1 + \sin\phi} \qquad K_{ph} = \frac{1 + \sin\phi}{1 - \sin\phi}$$



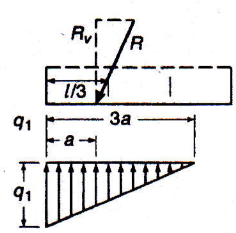
$$y = \frac{h^2 + 3hh'}{3(h+2h')}$$

$$P = \frac{1}{2} K_{ah} wh(h + 2h')$$

Unit weights w, effective angles of internal friction ϕ, and coefficients of friction with concrete f

Soil	Unit Weight w, pcf	ϕ, deg	f
1. Sand or gravel without fine particles, highly permeable	110–120	33–40	0.5–0.6
2. Sand or gravel with silt mixture, low permeability	120–130	25–35	0.4–0.5
3. Silty sand, sand and gravel with high clay content	110–120	23–30	0.3–0.4
4. Medium or stiff clay	100–120	25–35[a]	0.2–0.4
5. Soft clay, silt	90–110	20–25[a]	0.2–0.3

[a] For saturated conditions, ϕ for clays and silts may be close to zero.



(c) Resultant outside middle third

$$q_1 = \frac{2R_v}{3a}$$

Prestressed concrete

Permissible stresses in concrete in prestressed flexural members

	Class		
Condition	**U**	**T**	**C***
a. Extreme fiber stress in compression immediately after transfer (except as in b)	$0.60f'_{ci}$	$0.60f'_{ci}$	$0.60f'_{ci}$
b. Extreme fiber stress in compression at ends of simply supported members	$0.70f'_{ci}$	$0.70f'_{ci}$	$0.70f'_{ci}$
c. Extreme fiber stress in tension immediately after transfer (except as in d)	$3\sqrt{f'_{ci}}$	$3\sqrt{f'_{ci}}$	$3\sqrt{f'_{ci}}$
d. Extreme fiber stress in tension immediately after transfer at the end of simply supported members†	$6\sqrt{f'_{ci}}$	$6\sqrt{f'_{ci}}$	$6\sqrt{f'_{ci}}$
e. Extreme fiber stress in compression due to prestress plus sustained load	$0.45f'_c$	$0.45f'_c$	—
f. Extreme fiber stress in compression due to prestress plus total load	$0.60f'_c$	$0.60f'_c$	—
g. Extreme fiber stress in tension f_t in precompressed tensile zone under service load	$\leq 7.5\sqrt{f'_c}$	$>7.5\sqrt{f'_c}$ and $\leq 12\sqrt{f'_c}$	—

* There are no service stress requirements for Class C.

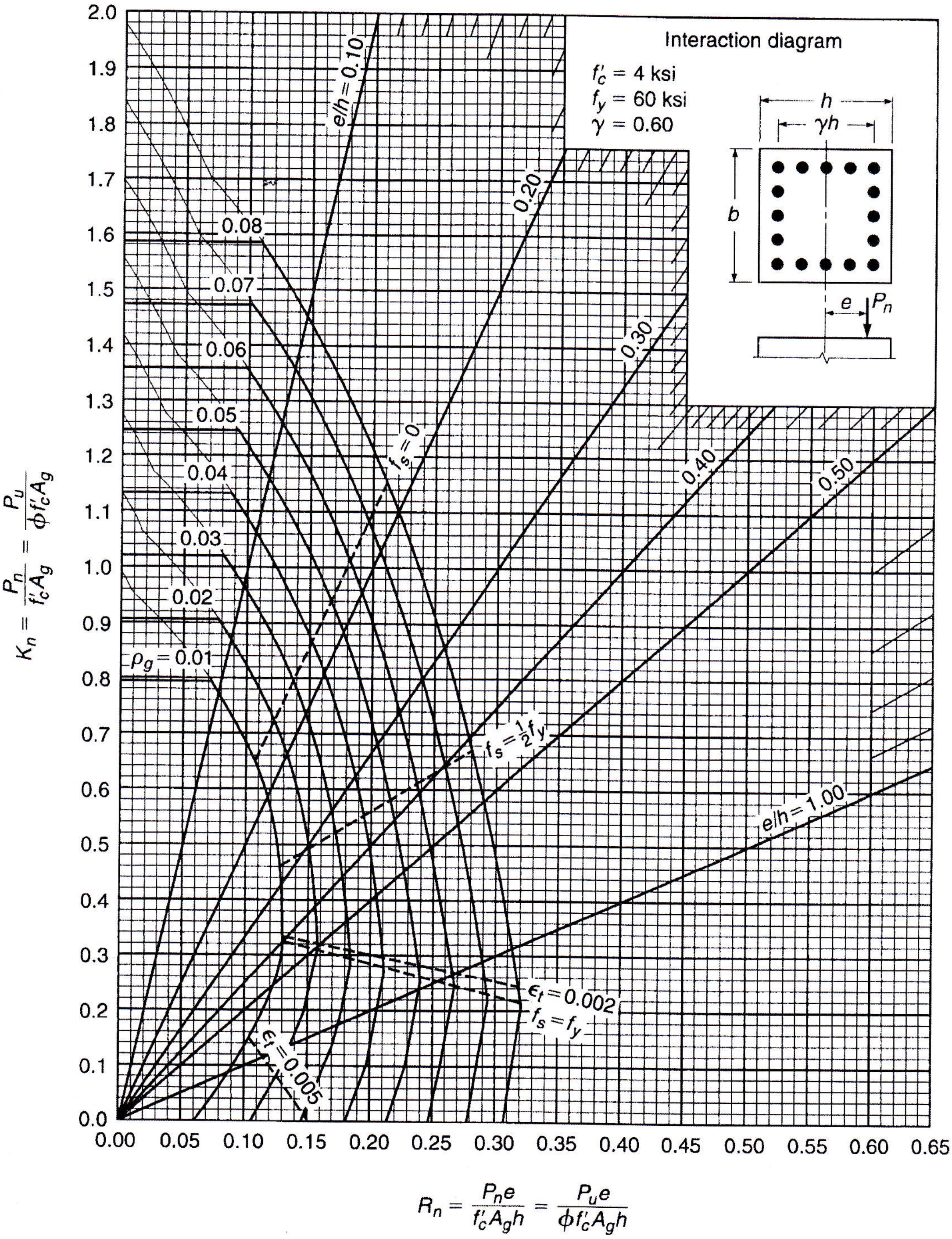
† When computed tensile stresses exceed these values, bonded auxiliary prestressed or nonprestressed reinforcement shall be provided in the tensile zone to resist the total tensile force in the concrete computed with the assumption of an uncracked section.

Top fibre stress

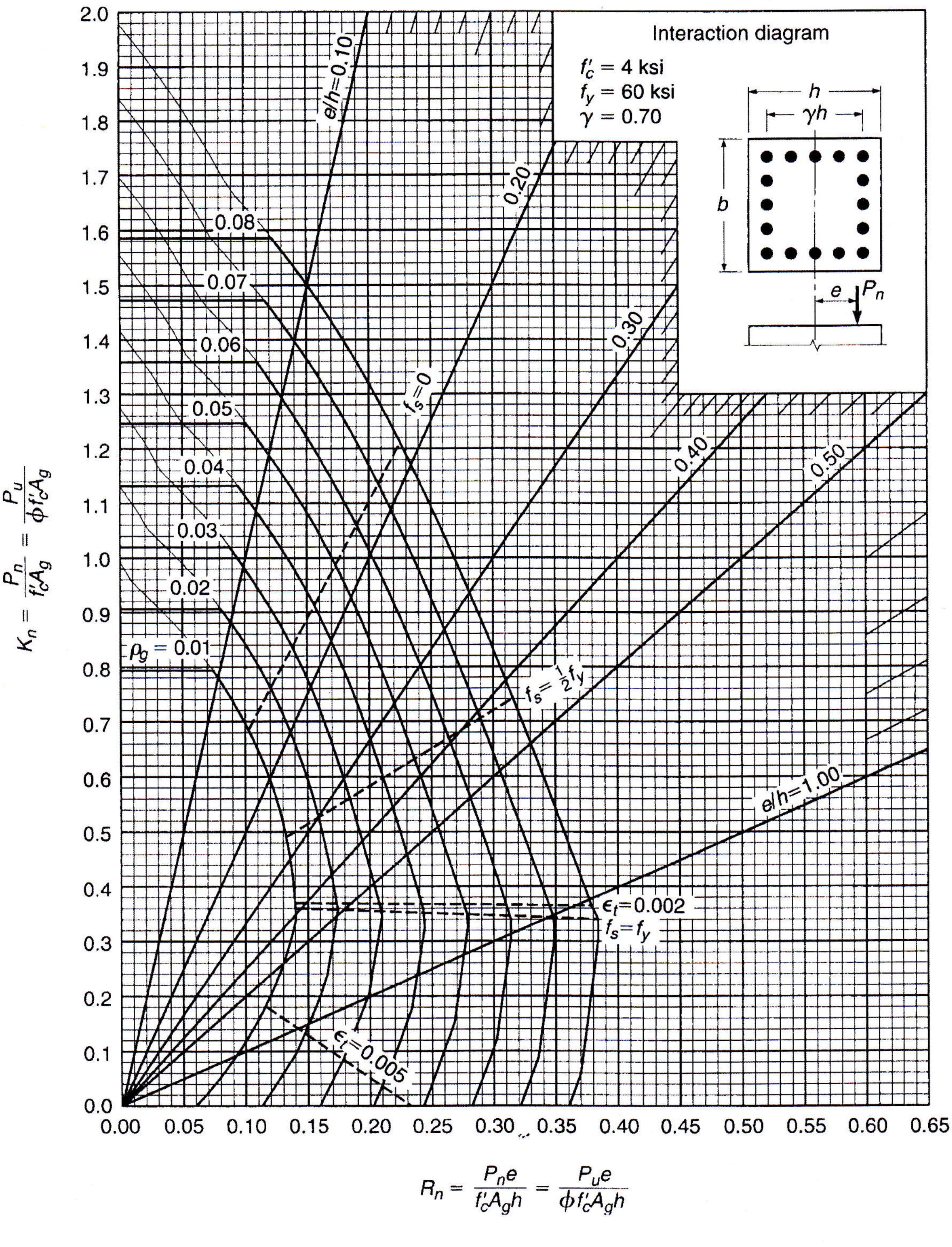
$$f_1 = -\frac{P_i}{A_c} + \frac{P_i e c_1}{I_c} = -\frac{P_i}{A_c}\left(1 - \frac{ec_1}{r^2}\right)$$

Bottom fibre stress

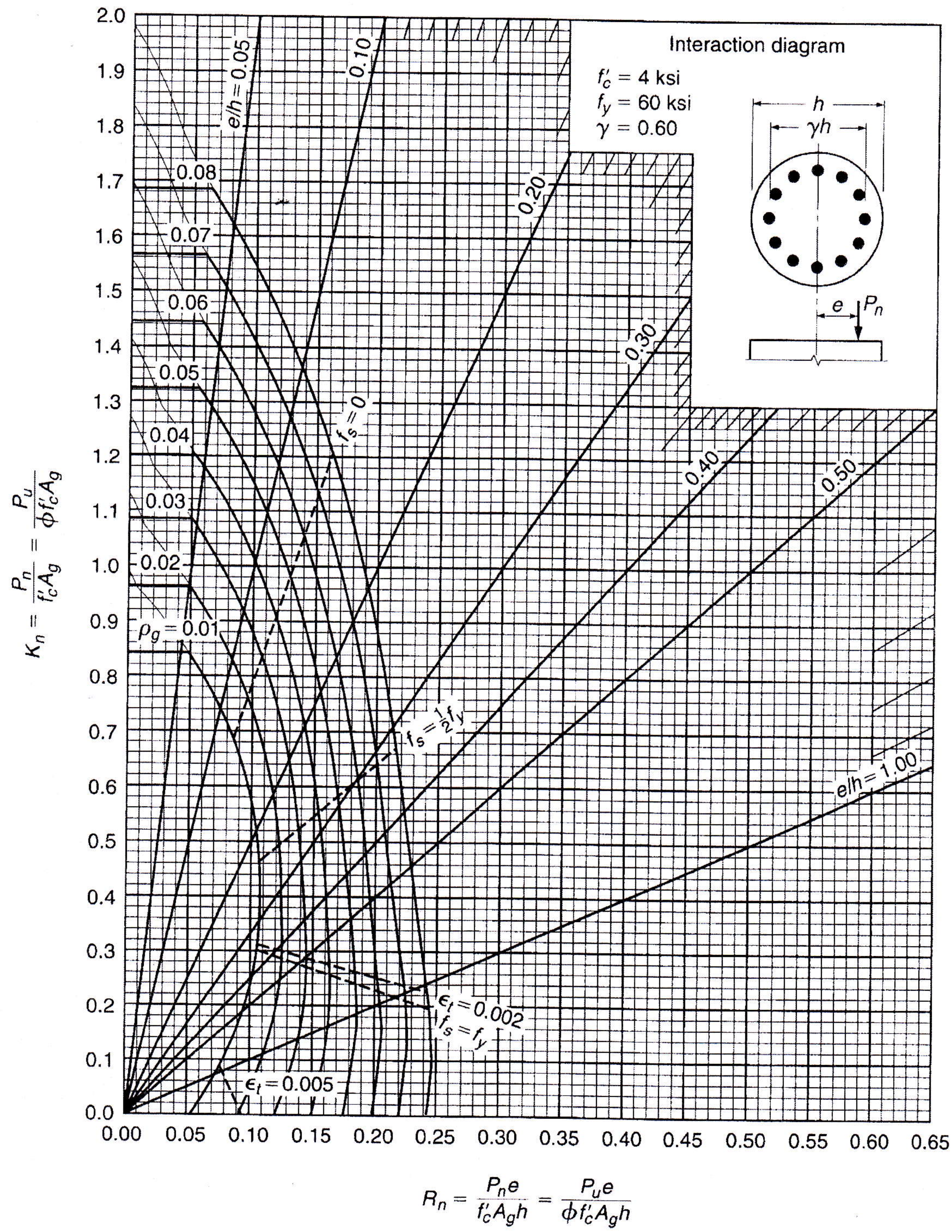
$$f_2 = -\frac{P_i}{A_c} - \frac{P_i e c_2}{I_c} = -\frac{P_i}{A_c}\left(1 + \frac{ec_2}{r^2}\right)$$



Interaction diagram
f'c = 4 ksi
fy = 60 ksi
γ = 0.60
h
γh
b
e
Pn
e/h = 0.10
0.20
0.30
0.40
0.50
e/h = 1.00
ρg = 0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
fs = 0
fs = 1/2 fy
εt = 0.002
fs = fy
εt = 0.005
Kn = Pn / (f'c Ag) = Pu / (φ f'c Ag)
Rn = Pn e / (f'c Ag h) = Pu e / (φ f'c Ag h)
0.0
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
1.5
1.6
1.7
1.8
1.9
2.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65



Interaction diagram
f'_c = 4 ksi
f_y = 60 ksi
γ = 0.70
h
γh
b
e
P_n
e/h=0.10
0.20
0.30
0.40
0.50
e/h=1.00
0.08
0.07
0.06
0.05
0.04
0.03
0.02
ρ_g = 0.01
$f_s=0$
$f_s=\frac{1}{2}f_y$
ϵ_t=0.002
$f_s=f_y$
ϵ_t=0.005
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$
0.0
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
1.5
1.6
1.7
1.8
1.9
2.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65



Interaction diagram
$f'_c = 4$ ksi
$f_y = 60$ ksi
$\gamma = 0.60$
h
γh
e
P_n
e/h = 0.05
0.10
0.20
0.30
0.40
0.50
e/h = 1.00
0.08
0.07
0.06
0.05
0.04
0.03
0.02
$\rho_g = 0.01$
$f_s = 0$
$f_s = \frac{1}{2} f_y$
$\epsilon_t = 0.002$
$f_s = f_y$
$\epsilon_t = 0.005$
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course Title: Engineering Hydrology — Course Code: CE 363

Time: 3 hour — Full marks: 150

Assume any reasonable value, if not given.

Part A

There are FOUR questions. Answer any THREE.

1(a). Write short notes on (any four): (10)

i. Potential evapotranspiration
ii. Permanent wilting point
iii. Field capacity
iv. Actual evapotranspiration
v. Climate of Bangladesh
vi. Intensity-Duration-Frequency relationship

1(b). Assuming that all the water in river is contributing surface runoff, estimate the average residence time of river water using the following data: (5)

Volume of water in the rivers of the world =	0.00212	M km^3
Average flow rate of water in global rivers =	44700	km^3 / yr
Average ground water flow rate =	2200	km^3 / yr
Total runoff =	47000	km^3 / yr

1(c). At a climate station, the following measurements are made: air pressure = 101.1 kPa, air temperature = 25 °C, and saturated vapour pressure = 2.064 kPa; calculate the corresponding vapour pressure, relative humidity, specific humidity, and air density at that place. (10)

2(a). The normal annual precipitation of five raingauge stations *P, Q, R, S* and *T* are respectively 125, 102, 76, 113 and 137 cm. During a particular storm the precipitation recorded by stations *P, Q, R* and *S* are 13.2, 9.2, 6.8 and 10.2 cm respectively. The instrument at station *T* was inoperative during that storm. Estimate the rainfall at station T during that storm. (5)

2(b). There are 9 rain gauges in Dhaka, as shown in the Figure 1. Annual rainfall recorded in *A, B, C, D, E, F, G, H* and *I* gauge are 58, 63, 62, 68, 68.5, 67, 72, 73 and 71.5 inch respectively. Estimate average annual rainfall in the area using Isoheytal where 1 small square = 10 km^2. (15)

2(c). Explain Water-Budget method of evaporation estimation. (5)

3(a). The precipitation over a 15 km^2 catchment produced a direct runoff of 5.8 cm. The time distribution of the storm is as follows. Calculate Φ index and the discharge at the outlet. (10)

Time from start (h)	1	2	3	4	5	6	7	8
Incremental rainfall in each hour (cm)	0.4	0.5	1.5	2.3	1.8	1.6	1	0.5

3(b). List required data for reservoir routing? List the assumptions to select Δt? (10)

3(c). Describe Dalton's law of evaporation? (5)

4(a). At a reservoir in the neighborhood of Dhaka, the following climatic data were observed. Calculate the mean annual evaporation from the reservoir using the Meyer's formula. (15)

Month	Temp (°C)	Relative Humidity (%)	Wind velocity at 2 m above GL (km/h)
Jan	12.5	85	4.0
Feb	15.8	82	5.0
Mar	20.7	71	5.0
Apr	27.0	48	5.0
May	31.0	41	7.8
Jun	33.5	52	10.0
Jul	30.6	78	8.0
Aug	29.0	86	5.5
Sep	28.2	82	5.0
Oct	28.8	75	4.0
Nov	18.9	77	3.6
Dec	13.7	73	4.0

4(b). Annual average rainfall data are available below for four stations *(A, B, C, D)*. Station *D* was relocated permanently at the end of 2003. Therefore, recorded rainfall data for station *D* for the period 2000 - 2003 must be adjusted to the rainfall characteristics at the new location. Determine adjusted rainfall data at *D*. (10)

Year	Annual Rainfall (in)			
	A	B	C	D
2000	22	26	23	28
2001	21	26	25	33
2002	27	31	28	38
2003	25	29	29	31
2004	19	22	23	24
2005	24	25	26	28
2006	17	19	20	22
2007	21	22	23	26

Part B

There are THREE questions. Answer any TWO.

5(a). Define unit hydrograph? List the assumptions involved in the unit hydrograph theory? (5)

5(b). Given the ordinates of a 3-hr unit hydrograph as below, determine the ordinates of a 1.5-hr unit hydrograph for the same catchment. (10)

Time (h)	0	3	6	9	12	15	18	21	24	27
UH ordinate (cumec)	0	60	120	90	50	30	20	10	5	0

5(c). Route the following flood hydrograph through a river reach for which Muskingum coefficient $K = 8$ h and $x = 0.25$. The initial outflow discharge from the reach is 8.0 m^3/s. (10)

Time (h)	0	4	8	12	16	20	24	28
Inflow (m^3/s)	8	16	30	30	25	20	15	10

6(a). Explain the role of drainage density and shape of basin on hydrograph. (10)

6(b). The ordinates of a 6-h unit hydrograph are as given below: (10)

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66
Observed flow (m^3/s)	0	20	60	150	120	90	66	52	32	20	10	0

If two storms, each of 1-cm rainfall excess and 6-h duration occur in succession, calculate the resulting hydrograph of flow. Assume base flow to be uniform at 10 m^3/s.

6(c). Write short notes: Mean velocity and Current meter. (5)

7(a). Flood-frequency computations for the river Padma at *Hardinge bridge*, by using Gumbel's method, yielded the following data: (15)

Return period, T (yrs)	Peak flood (cumec)
100	40,809
50	46,300

Estimate the flood discharge in the river with a probability of 0.2%?

7(b). The following data are obtained in a stream-gauging operation. A current meter with a calibration equation V= (0.51Ns+0.033) m/s was used to measure the velocity at 0.6 depth. Using the mid-section method, calculate the discharge in the stream. (10)

Distance from right bank (m)	Depth (m)	Number of revolutions	Observation Time (s)
0	0	0	0
2	0.5	80	180
4	1.1	83	120
6	1.95	131	120
9	2.25	139	120
12	1.85	121	120
15	1.75	114	120
18	1.65	109	120
20	1.50	92	120
22	1.25	85	120
23	0.75	70	150
24	0	0	0

Part C

This part is Compulsory.

8(a). Due to climatic change in Dhaka city the rainfall pattern is expected to be altered. Rahman et al. (2015) reported that, duration of rainfall would be 0.975 h in near future. If the catchment area of *Hatirjheel* and runoff coefficient remain same as of present 19 (10)

km^2 and 0.53 respectively. Then, calculate the peak discharge of *Hatirjheel* by considering a return period of 50 year.

8(b). Develop a Synthetic Unit Hydrograph for Hatirjheel Lake using Snyder's method. Assume, C_t = 1.257 and C_p = 0.576 in both region. (15)

Nasirabad Nandipara Khal	*Hatirjheel Lake*
L = 5.18 km	L = 4.32 km
L_{ca} = 2.00 km	L_{ca} = 1.50 km
A = 22.00 km^2	A = 19.00 km^2

List of Equations

1. $E_L = K_M(e_w - e_a)(1 + \frac{u_9}{16})$
2. $x_T = \bar{x} + K_T \sigma_{n-1}$
3. $K_T = \frac{y_T - \bar{y}_n}{S_n}$
4. $y_T = -[\ln.\ln(T/(T-1))]$
5. $i_{tc,p} = \frac{KT_x}{(t_c + a)^m}$
6. $Q_2 = C_0 I_2 + C_1 I_1 + C_2 Q_1$

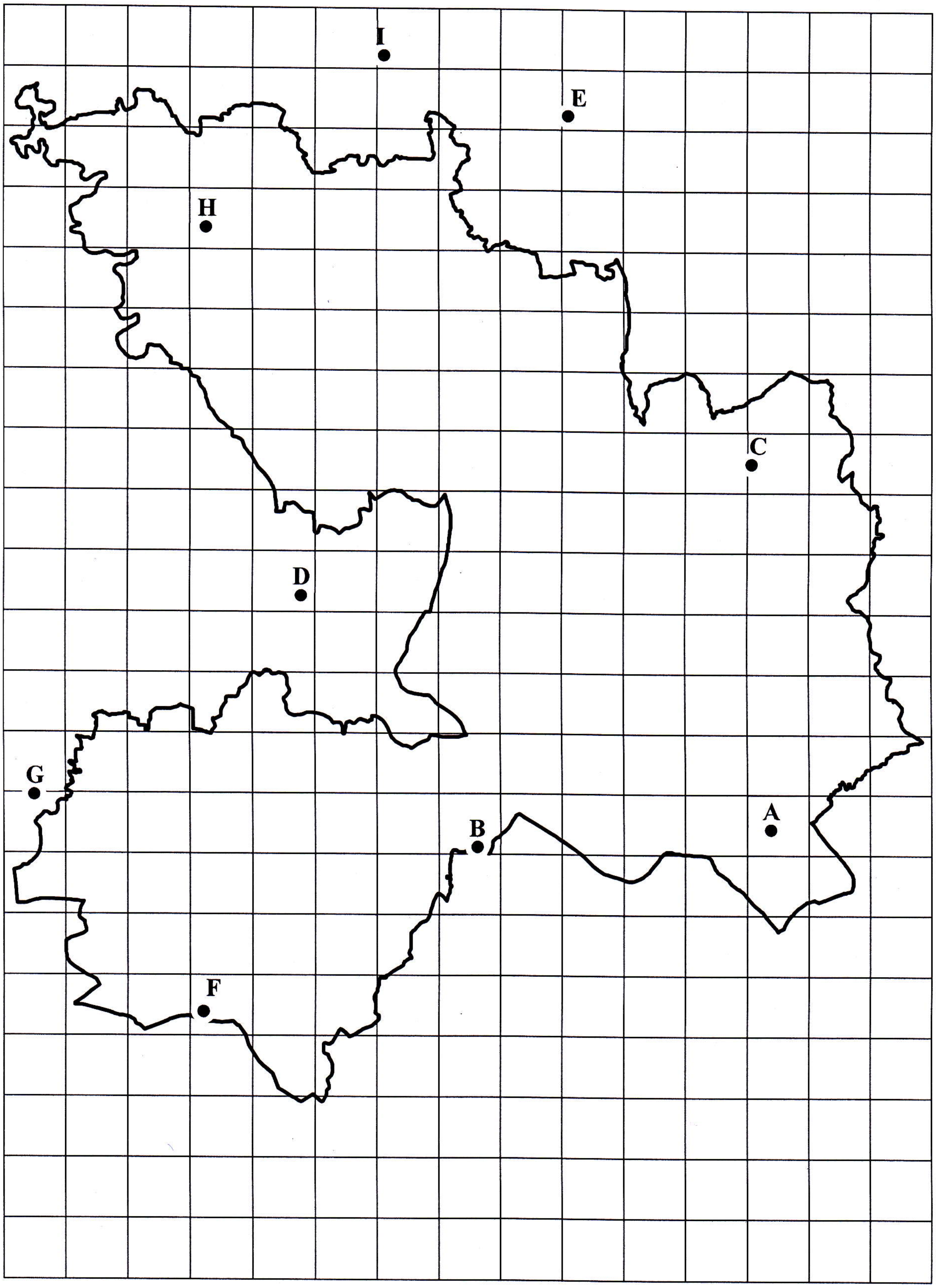
   Where,

   a) $C_0 = \frac{-Kx + 0.5\Delta t}{K - Kx + 0.5\Delta t}$

   b) $C_1 = \frac{Kx + 0.5\Delta t}{K - Kx + 0.5\Delta t}$

   c) $C_2 = \frac{K - Kx - 0.5\Delta t}{K - Kx + 0.5\Delta t}$

Figure 1: Question: 2(b). Enclose the Figure with your answer script:



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II | Course No: CE 333
Time: 3.0 hours | Full Marks: 150

Answer any ***Six*** *out of* ***Eight*** *questions from each section (25*6=150)*
Assume reasonable value of missing data (if any)

1. (a) "Hygiene Education is an important component of Water Supply and Sanitation (WSS) program"—mention the reasons to justify this statement. [5]
   (b) When an area is alleged under 100% sanitation coverage? Explain the National Sanitation Campaign (NSC) program of Bangladesh government to achieve 100% sanitation. [5+15]

2. (a) Write short notes on: i) Agricultural Wastewater ii) Greywater. [10]
   (b) Define plumbing system of a building. Write down the governing principles of plumbing system in a building. [5+10]

3. (a) Describe in detail: i) Preliminary treatment process iii) Advanced primary treatment process of wastewater. [15]
   (b) A 20 inch sewer with n=0.013 is laid on a grade of 0.015. What will be the discharge capacity when the depth of flow is 10 inch? [10]

4. (a) Discuss natural treatment process of wastewater. What are the advantages and disadvantages of waste stabilization pond system for wastewater treatment? Mention the processes that generally occur in a waste stabilization pond. [5+5+5]
   (b) To eliminate open defecation the local authority in a village offers pre-cast concrete rings of 1.0m dia and concrete slabs to cover the pits at a very subsidized rate. Design a simple pit latrine for an average family of 8 persons who uses water for cleansing. The ground water table is below 5.0m. The latrine has to be designed for at least 4 years. [10]

5. (a) Classify microorganisms based on source of energy and carbon. [5]
   (b) With a schematic diagram design a two compartment septic tank to serve two houses of 5 persons each. The production of wastewater is 120 lpcd. The tank is to be desludged every 5 years. [20]

6. (a) Define self-cleansing velocity. Why maximum permissible velocity is required while designing sewerage system? [4+6]
   (b) Define wastewater. What is the composition of wastewater? Enlist the objectives of wastewater treatment? [5+5+5]

7. (a) What are the factors that influence the ability and willingness of a community to invest in sanitation facilities? [5]

(b) Define sludge. Enlist the methods that are commonly adopted for sludge treatment and disposal. What are the common factors for selecting a particular method? Explain sludge drying bed for sludge dewatering. [3+5+5+7]

8. (a) With a schematic diagram show bacterial growth phases in a biological reactor. [5]

(b) Write short notes on: i) Centralized ii) Decentralized iii) Satellite treatment system of wastewater. [20]