University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2015
Program: B.Sc. Engineering (Civil)

3-2

Course Title: Principle of Management | **Course Code: IMG 301**
Time: 2 Hours | **Full Marks: 50**

Section A

(Answer any five Questions) 5x6

1. Describe the Informal Organization.
2. Explain the Disadvantages of Narrow span of management.
3. How effectively you can use Grapevine?
4. Describe any traditional Need theory.
5. Explain the Free-rein Leadership style.
6. Write down the Basic Control process.
7. Describe the e-commerce options.

Section B

(Answer any two Questions) 2x10

8. As a manager, how you can do 'Job Enrichment'?
9. Describe a contemporary Need theory of motivation.
10. Explain the various types of Communication flow inside the organization.

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2015
Program: B.Sc. Engineering (Civil)

Course Code: CE 313 | **Time: 180 Minutes**
Course Title: Structural Engineering II | **Full Marks: 20x10 = 200**

Answer any 10 of the following 14 Questions. (Each question carries equal marks). *The figures are not drawn to scale.*

[1] What are the assumptions for the vertical load analysis of Frames? Draw the approximate **Shear Force and Bending Moment Diagram** of EF, FG, and KL shown in Figure 1? Given, $w_1 = 1.25$ k/′, $w_2 = 2.5$ k/′, $w_3 = 3$ k/′, $w_4 = 8$ k/′, $w_5 = 2$ k/′.

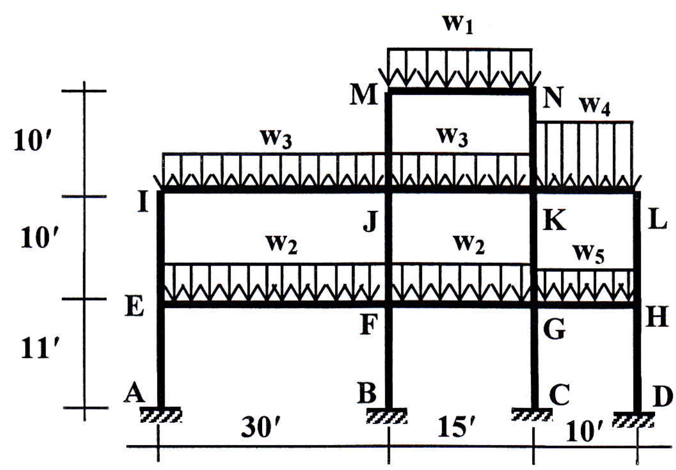


Figure 1

[2] Determine the approximate Axial Force, Shear Force and Moment of the following columns **AE, BF, CG and DH** of the frame shown in Figure 2 by using the **Cantilever Method**.

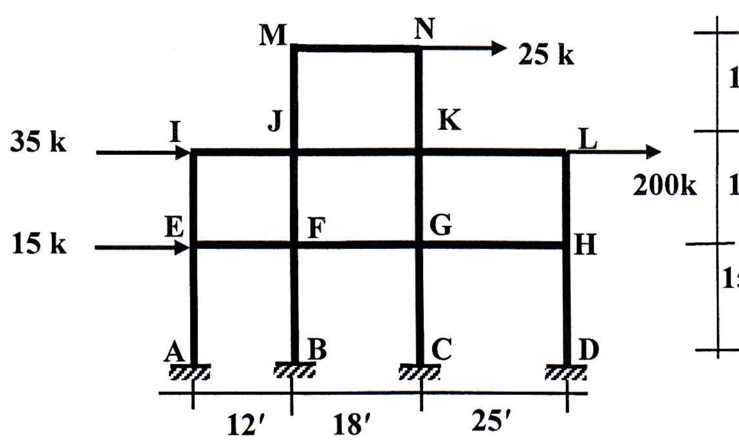


Figure 2

[3] Calculate the forces in members **BC, AJ and DH** of the statically indeterminate truss shown in Figure 3. Consider that the Diagonal members can take tension only.

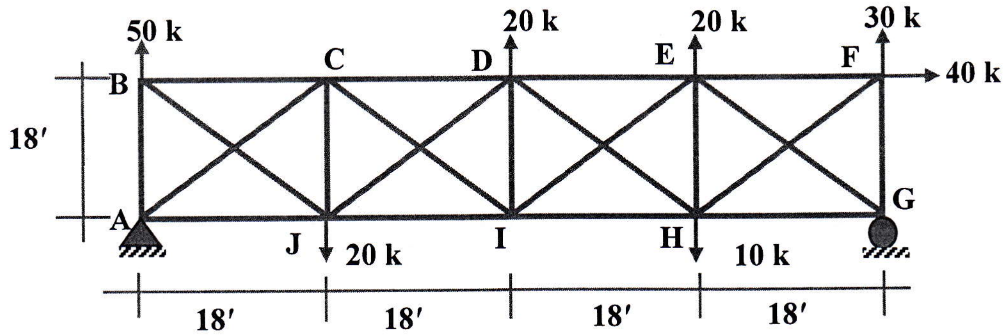


Figure 3

[4] Determine the **Horizontal (rightward) and Vertical (downward) deflection of joint D** of the truss shown in Figure 4 by using the Virtual Work Method. Consider, $E = 29 \times 10^3$ ksi, truss members area $A = 2.5$ in^2 except member AE which has an area of 4 in^2.

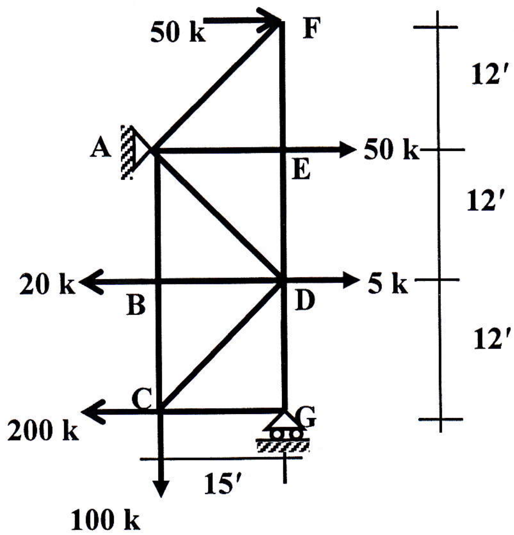


Figure 4

[5] Calculate the **rotation (counter clockwise) and vertical (upward) deflection at point B** of the beam shown in Figure 5 by using the Virtual Work Method. Consider, $E = 29 \times 10^3$ ksi, $I_1 = 5000$ in^4, $I_2 = 2500$ in^4, $I_3 = 1250$ in^4.

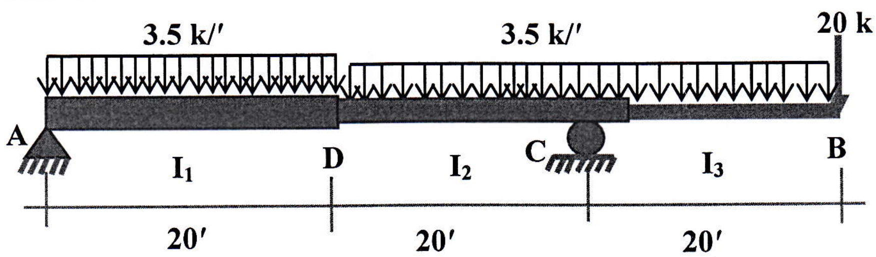


Figure 5

[6] Determine the **rotation (counter clockwise) and vertical (downward) deflection at point B** of the frame ABC shown in Figure 6 by using the Virtual Work Method. The cross-section of the members are same and assume $E = 25x10^3$ ksi, $I = 800in^4$.

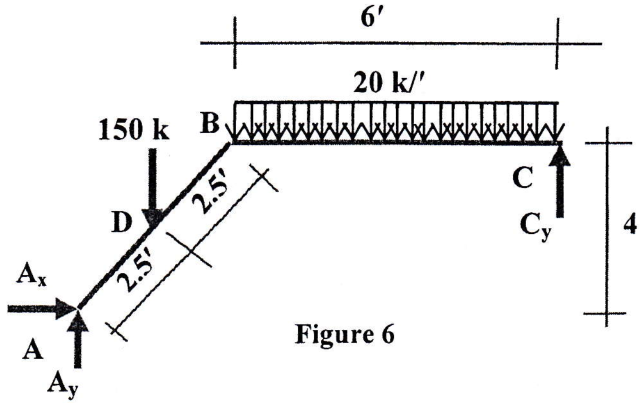


Figure 6

[7] Use the Method of Virtual Work determine the minimum cross-sectional area for the members of the truss shown in Figure 7, so that the **vertical deflection at joint B does not exceed 0.5 inches.** Assume, $E=1.8x10^3$ksi, EA is constant.

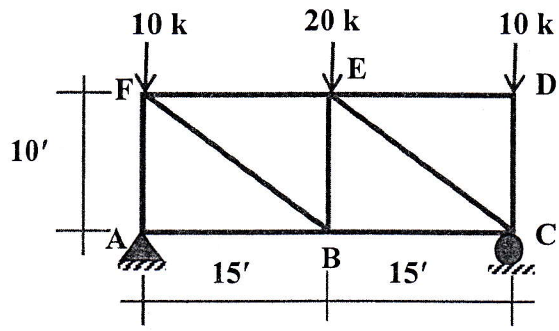


Figure 7

[8] Draw the Bending Moment Diagram of the beam shown in Figure 8 by employing the **Flexibility Method.** Consider, $E = 45x10^3$ ksi, $I = 1800in^4$.

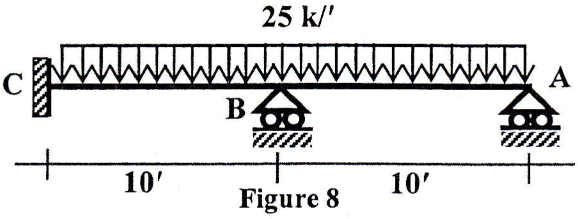


Figure 8

[9] Determine the Support Reactions and draw the Shear and Bending Moment Diagrams of the structure shown in Figure 9 by using the **Method of Consistent Deformations**. Consider, $E = 40x10^3$ ksi, $I_1 = 4000$ in^4, $I_2 = 3000$ in^4, $I_3 = 2500$ in^4, $L_1 = 30'$, $L_2 = 20'$, $H = 25'$.

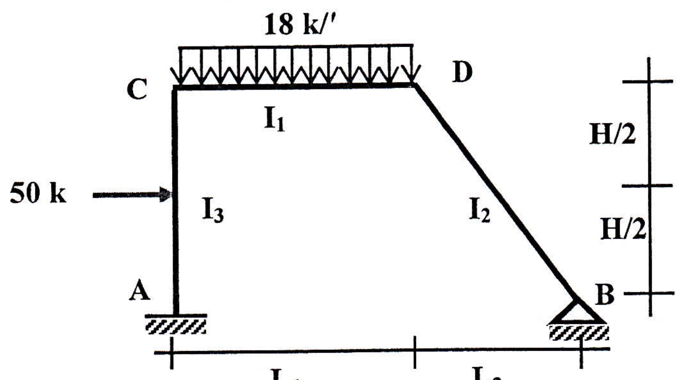


Figure 9

[10] Use the **Moment Area Theorem** and consider EI is constant for the beam shown in Figure 10.

(i) For the beam shown in Figure 10 (a) derive the expression, Rotational Stiffness and Moment Carryover Factor. Given, rotation at X is θ.

(ii) For the beam shown in Figure 10 (b) derive the expression, the Shear Stiffness and Bending Moment at B. Given, vertical deflection at A is Δ.

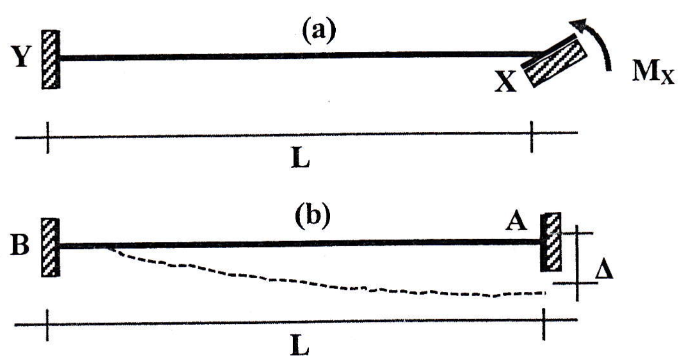


Figure 10

[11] Determine the member end moments and draw the Bending Moment diagram for the frame of Figure 11 for the loading shown in the figure and the support settlements of 1 inch at A by using the **Moment Distribution Method**. Consider, E = 48x103 ksi, I = 1600 in4, $L_1 = 5'$, $L_2 = 3'$, $H = 4'$.

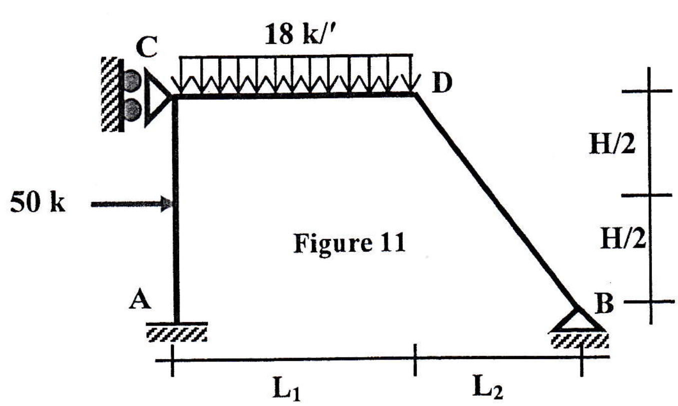


Figure 11

[12] Determine the member end moments and draw the Bending Moment diagram for the frame of Figure 12 for the loading shown in the figure and the support settlements of 1 inch at A and 1.5 inch at D by using the **Moment Distribution Method.** Consider, $E = 40 \times 10^3$ ksi, $I = 4800$ in^4, $L_1 = 30'$, $L_2 = 30'$, $L_3 = 10'$, $H = 20'$.

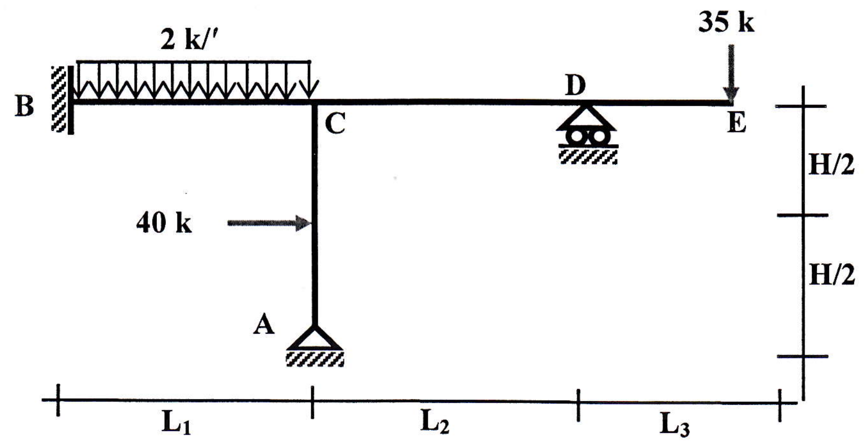
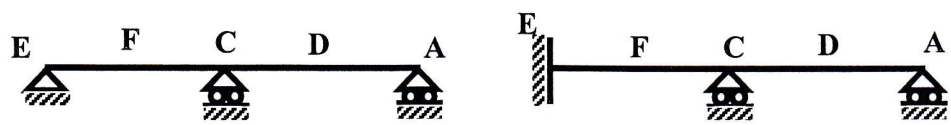


Figure 12

[13] Answer the following questions

(i) What is Influence Line (IL)? Draw the qualitative **IL for M_A, V_D and R_C** for the beams shown in Figure 13 (a-b).



(a) **(b)**

Figure 13

(ii) Draw the qualitative influence lines of **maximum positive moment at E,** $M_E^{max(+)}$ and **maximum negative shear** at F, $V_F^{max(-)}$ for the frame shown in Figure 14. Also place the Live Load 25 kN/m and Concentrated Moving Load 50 kN.

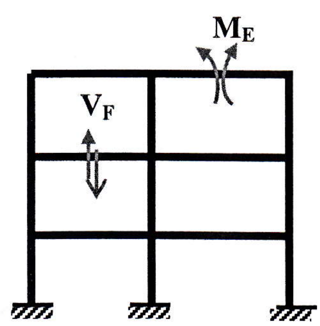


Figure 14

[14] Calculate the **member forces and the support reactions** of the truss ABCD shown in Figure 15 by using the Flexibility Method. Assume that the E = 28×10^3 ksi, area is same for all members A = 4 in^2.

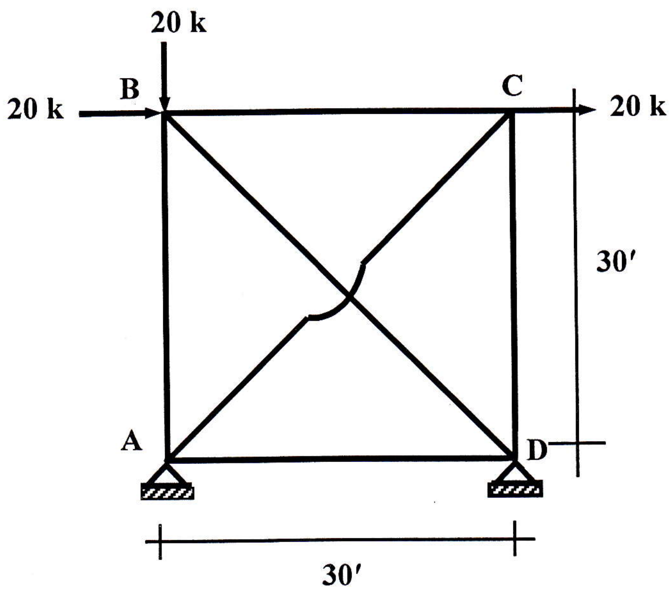


Figure 15

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2015

Course Code: CE 317 (A)
Course Title: Design of Reinforced Concrete II

Time: 3 (Three) Hours
Full Marks: 100

PART A

[There are 10 (ten) questions. Answer any **7 (seven)**]
(All symbols have their usual meanings. Assume reasonable value for any missing data)

1. A two-way beam supported slab system with columns 22″×22″square inch is shown in Fig:1. The slab contains floor finish of 35 psf, random wall = 50 psf and live load = 75 psf. Determine the following for slab-D.
   a. Moment Coefficients: $C_{a(D)+}$, $C_{a(L)+}$, C_{a-}, $C_{b(D)+}$, $C_{b(L)+}$ and C_{b-}
   b. Moments: M_{a+}, M_{a-}, M_{b+}, M_{b-}
   c. Required reinforcements: A_{sa+}, A_{sa-}, A_{sb+}, A_{sb-}
   d. Draw reinforcement details in a neat diagram.

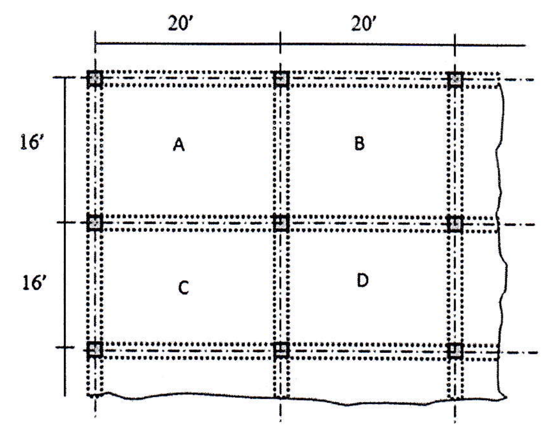
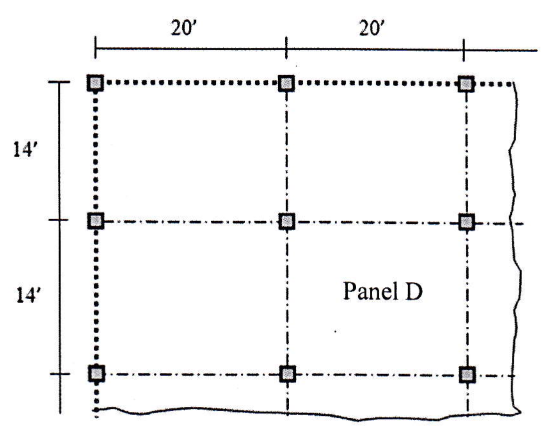


Fig: 1

2. Design an interior panel (D) of a flat slab (***Fig: 2***) of size 20′×14′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'= 3 ksi, f_y = 50 ksi.



3. A 12×20 inch column is reinforced with four #9 bars as shown in the ***Fig: 3***.
Given that f_c' = 4 ksi, f_y = 60 ksi. Determine:
a. the load P_b, moment M_b and corresponding eccentricity e_b for balanced failure;
b. the load and moment for a point in the tension failure region of the interaction diagram.
c. the load and moment for a point in the compression failure region of the interaction diagram.

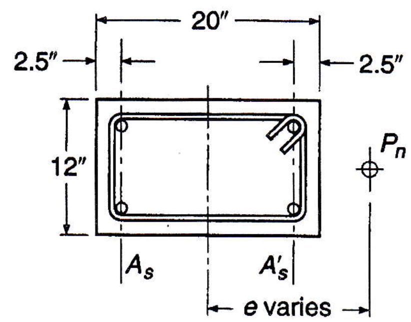


Fig: 3

4. Figure 4 shows the plan of a 6-storied RC structure, with 5″ thick slabs and 12″ × 18″ beams and 5″ thick partition walls along all column lines. Floor loads also include working FF = 30 psf, RW = 50 psf, LL = 40 psf.
(i) Design the central column C1, if it is subjected to axial force only [i.e., no moments].
(ii) Use the section of (i) to check if it is adequate for C2 (subjected to axial force and working Mx = 20 k-ft) [Given: f_c' = 3 ksi, f_y = 60 ksi].

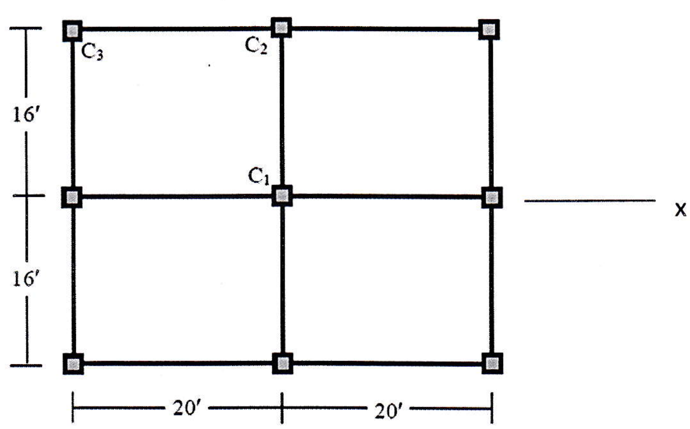


Fig: 4

5. Using 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=350 k, LL= 270 k, f_c' for footing = 3 ksi, f_c' for column = 4.5 ksi, f_y=60 ksi, Depth of foundation= 5ft, column size= 18"x18", q_{all}= 6 ksf, γ_c=150 lb/ft^3, γ_s=120 lb/ft^3.

6. The loads (including self-weight) and arrangement of columns of size 12"x12" of the combined footing are shown in ***Fig: 5***. Use WSD to

   i. Draw the bending moment diagram of the footing.

   ii. If the thickness of the footing is 25", check the adequacy of the thickness for punching shear, beam shear and bending.

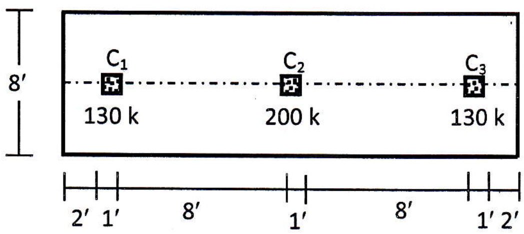


Fig: 5

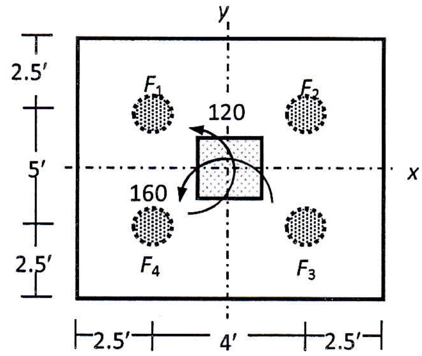


Fig: 6

7. Refer to the ***Fig: 6***, A 24"×24" column carrying working loads of DL = 300 k, and LL = 180 k is underlain by soil with allowable bearing capacity = 2 ksf. The column also carries biaxial moments (due to LL) of M_x= 120 k-ft and M_y = 160 k-ft. Design the pile foundation by WSD method. [Given: f_c'=3 ksi, f_y =50 ksi, α_2=0.8].

8. Check the thickness and calculate the necessary reinforcements (Using USD method) for a 7'X12' rectangular footing having thickness of 28"and supporting a 16"x16" column with working loads of P_{DL}=170 k and P_{LL}=130 k [Given, f_c'=3 ksi, f_y=50 ksi, f_s=20 ksi, k=0.378, j=0.874, R_u=0.739 ksi].

9. A section of a gravity retaining wall as shown in ***Fig: 7***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, γ_s= 120 pcf, φ= 30°, f_{base}= 0.5, Allowable bearing pressure= 3 tsf.]

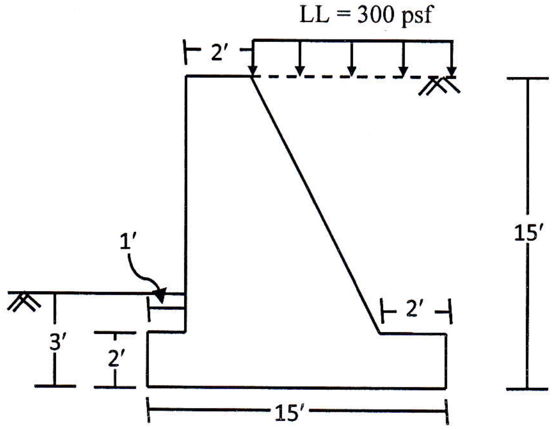


Fig: 7

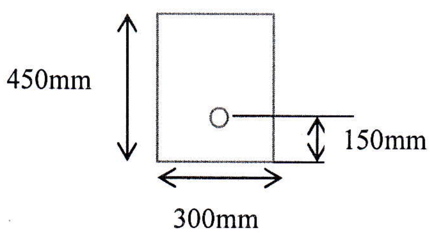


Fig: 8

10. A simply supported prestressed-concrete beam with a midspan section of 300 mm×450 mm (***Fig: 8***) has a simple span of 8 m and is loaded by a uniform load of 35 kN/m including its own weight. The prestressing tendon is located as shown in the ***Fig: 8*** and it produces an effective prestress of 2250 KN. Using the first concept of prestress concrete find out the fiber stresses at the midspan section.

PART B

[There are 5 (five) questions. Answer any **3 (Three)**]

11. (a) (a) Briefly outline the design provisions for two types of shear reinforcement in flat slabs.
(b) Mention and justify the maximum and minimum steel ratios specified by ACI for RC columns

12. (a) What is pre-stressed concrete? Compare prestressed concrete with reinforced concrete.
(b) Write down the different name of losses that may occur in prestressed concrete.

13. (a) What is retaining wall? Name different types of retaining walls and explain their relative advantages.
(b) Mention the ACI recommendations for the size, spacing and arrangement of lateral ties and spirals.

14. (a) Outline the procedure for the structural design of piles and pile caps
(b) Distinguish between allowable soil pressure and net soil pressure in the design of footings by USD.

15. (a) Define the band-width in placing reinforcements for rectangular footings and explain why it is used.
(b) Distinguish between active earth pressure and passive earth pressure.

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2015
Program: B.Sc. Engineering (Civil)

Course Title: Design of Concrete Structures II — Course Code: CE 317 **(B)**
Time: 3hrs — Full Marks: 10X10=100

There are two parts of this question. (**Part A** and **Part B**)

PART A

[There are 9 (nine) questions. Answer any **7 (seven)**]
(All symbols have their usual meanings. Assume reasonable value for any missing data)

1. A building is to be designed as a flat plate structure (supported on edge beams). A plan of the building is shown in ***Fig: 1***. The columns are 20"X20" in size. Use WSD method to calculate the column strip and middle strip moments of Panel A and Panel B.
   [Given, α_1=3.66 and β_t= 1.45,FF = 30 psf, RW = 45psf, LL = 70psf, f_c' = 4 ksi, and f_y = 60 ksi].

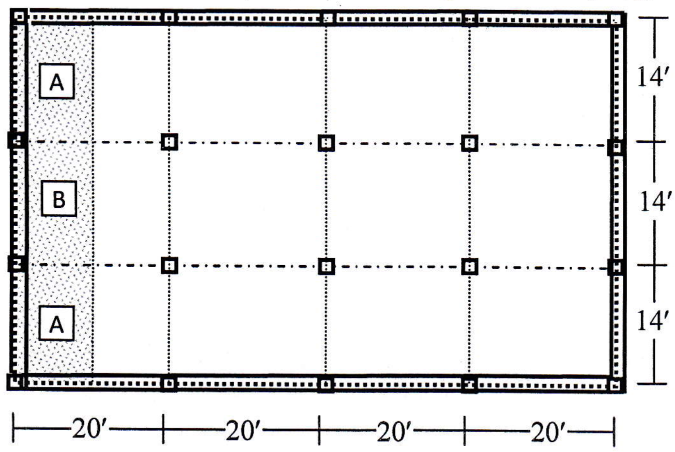


Fig: 1

2. For the tied column section shown below in ***Fig: 2*** [with f_c'= 3ksi, f_y = 60 ksi] , use the WSD to
   i. Draw the interaction diagram about x-axis.
   ii. Calculate the allowable moment of the section if it is subjected to axial force
      a. P = 150 k and b. P = 600 k
   iii. Verify if the section is allowed to take P = 850 k, at an eccentricity e= 4.5″.

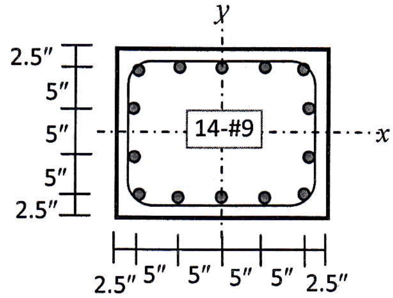


Fig: 2

3. A plan and section of a four storied building on beams and columns are shown in ***Fig: 3***.
   All the beams in all floors are 12"X 20".
   Column sections are proposed to be 24"X 24"
   5" wall along the peripherical beam
   Lime concrete on roof = 25 psf
   Floor finish on each floor = 30 psf
   Random wall load on each floor = 30 psf
   Live load on each floor =60 psf
   Live load on roof = 30 psf
   Material properties: $f_c' = 4$ ksi, $f_y = 60$ ksi and $f_s = 24$ ksi.
   Using U.S.D, design the edge column C_1.

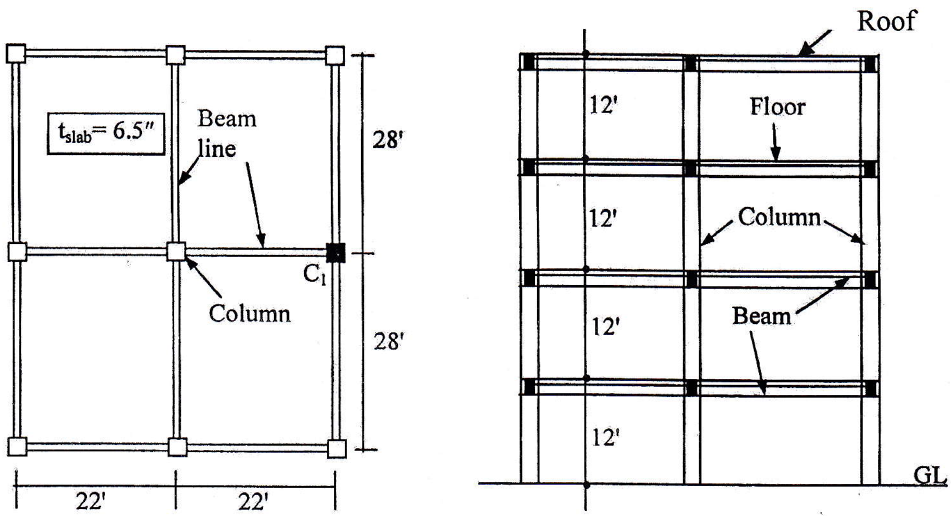
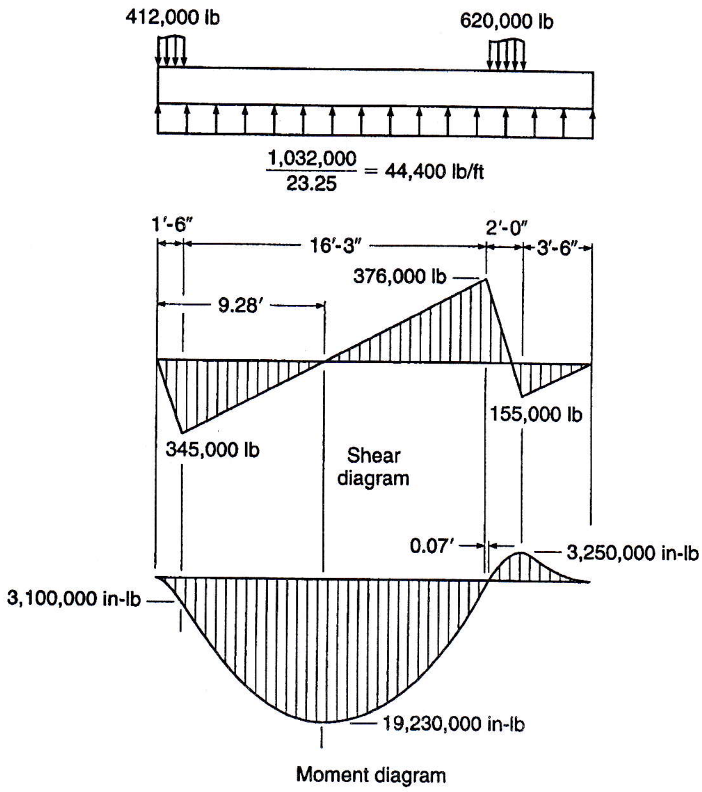


Fig: 3

4. Using USD Design a short square column for the following conditions:
   P_u= 600 k, M_u = 80 kf-ft, f_c'= 4 ksi, f_y = 60 ksi. Place bars uniformly around all four faces of the column.

5. A column 18 inch square, with f_c' = 4 ksi, reinforced with eight #8 bars of f_y = 60 ksi, supports a dead load of 230 kips and live load of 180 kips. The allowable soil pressure qa is 5 kips/ft2. Design a square footing with base 5 ft below grade, use f_c' = 4 ksi, f_y = 60 ksi.

6. An exterior 24 x 18 inch column with DL = 170 kips, LL=130 kips, and an interior 24 x 24 inch column with DL=250 kips, L = 200 kips are to be supported on a combined rectangular footing whose outer end cannot protrude beyond the outer face of the exterior column. The distance center to center of column is 18 ft and the allowable bearing pressure of the soil is 6 ksf. The bottom of the footing is 6 ft below grade and a surcharge of 100 psf is specified on the surface. Determine the thickness of the footing using the shear force and bending moment as shown ***Fig: 4***, for f_c' = 3 ksi, f_y = 60 ksi.



7. A 25x25 inch column (***Fig: 5***) carrying working loads DL = 300 k, and LL = 200 k is underlain by soil with allowable bearing capacity = 2 ksf. The column also carries biaxial moments (due to LL) of M_x= 100 k-ft and M_y= 200 k-ft. The footing area beneath the column must not exceed (10'x 10') because of proximity to adjacent columns. Use the USD to analyze and design the footing [Given: f_c'= 3 ksi, f_y= 50 ksi].

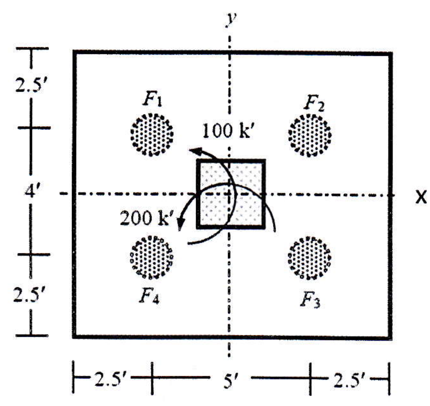


Fig: 5

8. A gravity wall shown in (***Fig: 6***) is to retain a bank 11.5 ft high whose horizontal surface is subject to live load surcharge of 500 psf. The soil is stiff clay and the allowable bearing capacity is 8.5 ksf. Determine whether the retaining wall is safe against overturning.

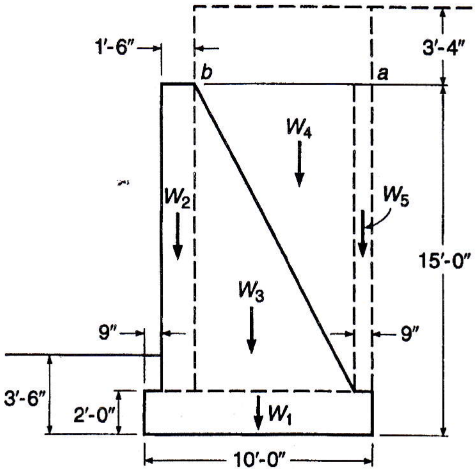


Fig: 6

9. A simply supported symmetrical I beam shown in ***Fig: 7*** will be used on a 40 ft span. It has to carry live load of 0.75 kips/ft. The beam will be pretensioned with multiple seven-wire strands with the centroid at a constant eccentricity of 7.91 in. The prestressing force immediately after transfer will be 158 kips, after losses the force will be 134 kips. The specified $f_c{}'$ = 5000 psi, and at the time of prstressing $f_{ci}{}'$ = 3750. It has the following properties:

Moment of Inertia: 12,000 in^4
Concrete area: 176 in^2
Radius of gyration: r^2= 68.2 in^2
Section modulus: 1000 in^3
Self-weight: 0.183 kip/ft

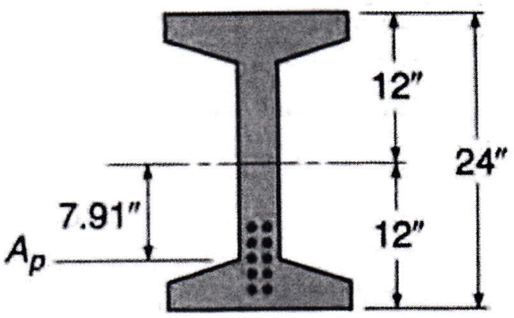


Fig: 7

PART B

[There are 5 (five) questions. Answer any **3 (Three)**]

10. (a) Briefly outline the design provisions for two types of shear reinforcement in flat slabs.

(b) Mention and justify the maximum and minimum steel ratios specified by ACI for RC columns

(c) Explain why punching shear is considered in the design of column footings but not for wall footings.

(d) Distinguish between earth pressure at rest, active earth pressure and passive earth pressure.

(e) Mention the advantages and disadvantages of pre-stressed concrete compared to reinforced concrete.

List of Useful Formulae for CE 317

Column-Supported Slabs

*Total Static Moment at Factored Loads, $M_0 = w_n L_2 L_n^2/8$

* Total static moment for interior spans: $M_u^{(-)} = 0.65\ M_0$, $M_u^{(+)} = 0.35\ M_0$

* 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: Without edge beam (c)	No beam between interior supports: With edge beam (d)	Exterior Edge fully restrained (e)
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	0.36

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

% 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 = $75 + 30\ (\alpha_1\ L_2/L_1)\ (1-L_2/L_1)$

*$A_v = (V_n - V_c)/(f_y \text{ Sin } \alpha)$ *$S = A_v f_v\ d/(V-V_c)$

*$V_c = 4\sqrt{f'_c}\ b_o d$ * $V_c = (2 + 4/\beta_c)\ \sqrt{f'_c}\ b_o d$ * $V_c = (2 + \alpha_s d/b_o)\ \sqrt{f'_c}\ b_o d$ [Use half of the values for WSD]

Short Column

*$P_n = 0.85 f_c' A_c + f_y A_s = A_g\,[0.85 f_c' + \rho_s\,(f_y - 0.85 f_c')]$ *$P_u = \alpha\,\phi A_g\,[0.85 f_c' + \rho_s\,(f_y - 0.85 f_c')]$

*$P_{all} = \phi'(0.25 f_c' A_g + f_{sall} A_s) = \phi' A_g(0.25 f_c' + \rho_s f_{sall})$ *$\rho_s = 0.45(A_g/A_{core} - 1)\ (f_c'/f_y)$ *$S = 4A_{sp}/(\rho_s\ d_{core})$

*$P/(P_a) + M/(M_f) = 1$ *$P_a = 0.34 f'_c(1+\rho_g m)A_g$ *$M_f = 0.45 f'_c S_{ut}$

*For symmetrical tied columns, $M_o = 0.40\ A_s f_y (d - d')$ and $e_b = (0.17 + 0.67\rho_g m)d$

* For spiral columns, $M_o = 0.12\ A_{sTotal} f_y (D_s)$ and $e_b = (0.14 + 0.43\rho_g m)d$

* $P/(P_a) + M_x/(M_{fx}) + M_y/(M_{fy}) \le 1$ *$1/P_{xy} = 1/P_x + 1/P_y - 1/P_0$

Footing and Foundation:

*$q_{nu} = (1.4\ DL + 1.7\ LL)/A_{(provided)}$ *$V_{fu} = q_{nu} \times$ tributary area *$v_{fu} = V_{fu}/bd$ *$v_{fu(all)} = 2\phi\sqrt{f'_c}$

* V_{pu} = factored load $- q_{nu} \times$ tributary area *$v_{pu} = V_{fu}/b_o d$ *$v_{pu(all)} = 4\phi\sqrt{f'_c}$

* $A_s = (f_c/f_y)\ [1 - \sqrt{\{1 - 2M_u/(\phi f_c\ bd^2)\}}]\ bd$ * $v_{f(all)} = 1.1\sqrt{f'_c}$ * $v_{p\,(all)} = 2\phi\sqrt{f'_c}$

*$Ru = \phi\rho_{max} f_y[1 - 0.59\rho_{max} \cdot (f_y/f'_c)]$ $R = 0.5 f_c kj$ *$\rho_{max} = 0.75 \times 0.85 \times \beta_1 \times (f'_c/f_y) \times [87/(87+f_y)$

* $F(x, y) = P/N + M_x\, y/(\sum x_i^2) + M_y\, x/(\sum y_i^2)$ * $F = \phi\ (a_p f_{call} + a_s f_{sall})$ * $L_p = F/\{\alpha_2 \tau_s(\pi d_p)\}$

*$a_s = (P/\phi - a_p f_{call})/f_{sall}$ * $S_t = (100/0.2)(a_t/a_p)\pi d_c$

Retaining Wall:

*$Y = h^2 + 3hh'/3(h+2h')$ *$P_a = 0.5[\{\ k_a\gamma_s h' + k_a\gamma_s(h'+h)\}] \times h$

*a) If Rv is in the middle third

$q_1 = (4l-6a)Rv/l^2$ $q_2 = (6a-2l)Rv/l^2$

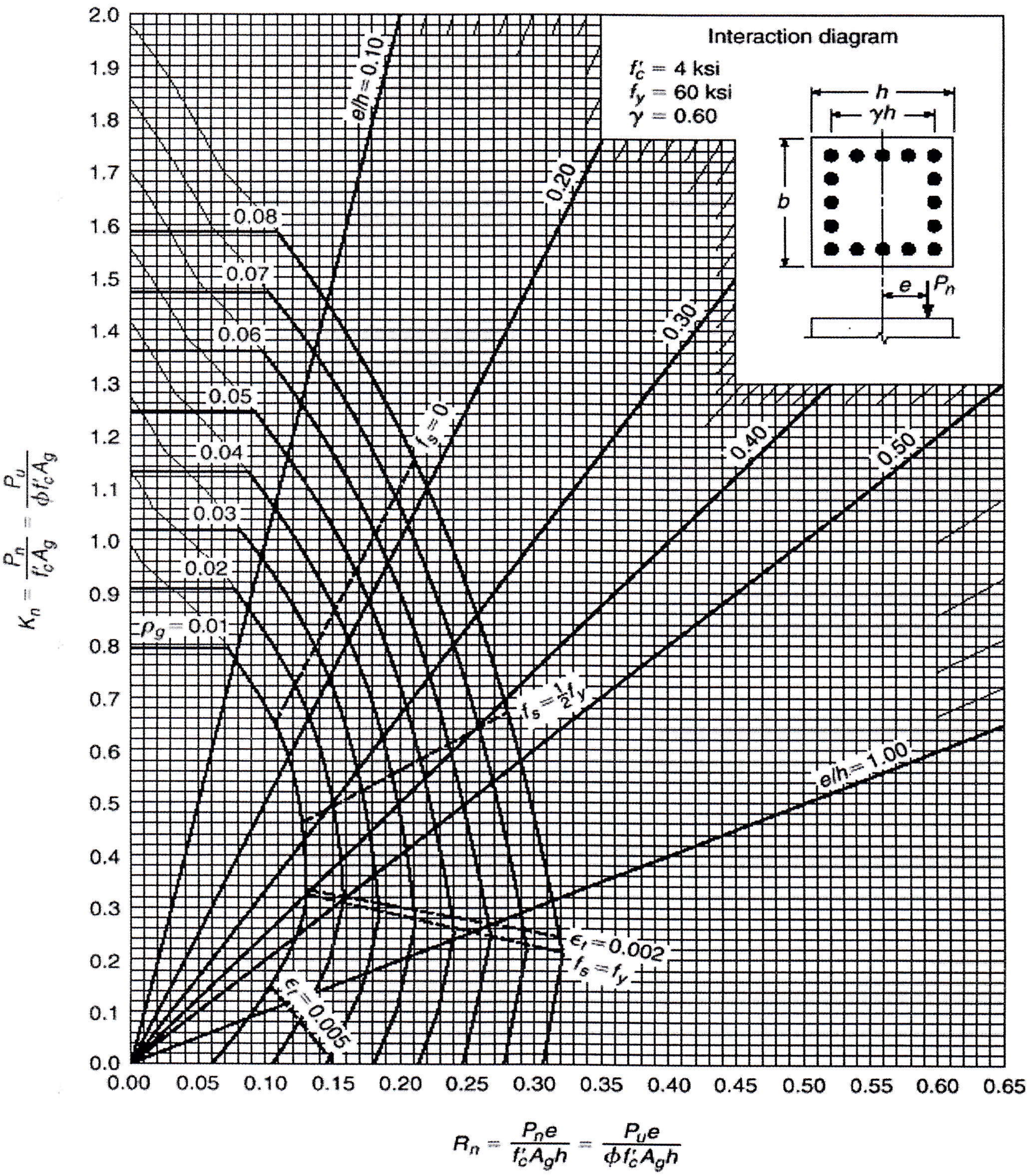
*b) If Rv is at the edge of middle third $q_1 = 2Rv/l$

*c) If Rv is at the edge, outside of middle third $q_1 = 2Rv/3a$.

Prestressed Concrete:

*$f = -(F/A_g) \pm (Fey/I)$

*$f = -(F/A) \pm (Fey/I) \pm (My/I)$



GRAPH A.5

Column strength interaction diagram for rectangular section with bars on four faces and · = 0.60 (for instructional use only).

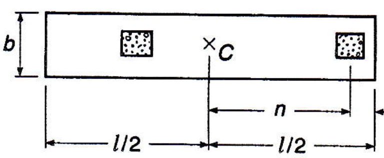
CE 317 Formulae 2

Footings

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

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

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



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

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

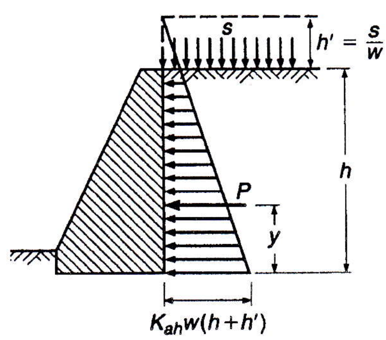
$$q_u = \frac{1.2D + 1.6L}{A}$$

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

Retaining wall

$$p_h = K_0 w h$$

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



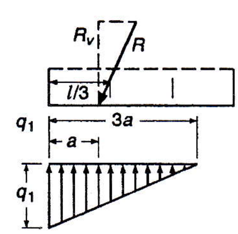
$$y = \frac{h^2 + 3hh'}{3(h + 2h')}$$

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

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

Condition	Class U	Class T	Class 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

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

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2015
Program: B.Sc. Engineering (Civil)

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

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*Use **separate** scripts for each section.*
*Answer any **three** out of **four** questions from each section (25*6=150)*
Assume reasonable value of missing data (if any)

Section A

1. (a) Define sanitation. Describe the interrelationship between water, sanitation and health education with figure. [10]
   (b) Make a comparison in a tabulated form between separate system and combined system for wastewater collection. [15]

2. (a) Draw the graph of water quality changes during municipal uses of water in a time sequence including the concept of water reclamation and reuse. [5]
   (b) Design and sketch of a two compartment septic tank to serve a household of 15 persons who produce 110 lpcd of wastewater. The tank is to be desludged every 8 years. [20]

3. (a) Define plumbing system of a building. Write down the governing principles of plumbing system. [10]
   (b) Write short notes on i) Blackwater ii) Greywater iii) Stromwater [15]

4. (a) Mention some criteria for selecting a treatment system for wastewater. [5]
   (b) Discuss centralized, decentralized and satellite treatment system of wastewater with sketch. [20]

Section B

5. (a) Define sludge. Mention the methods that are commonly adopted for sludge disposal. [10]
   (b) Draw and discuss typical bacterial growth pattern in wastewater indicating different stages. Which stages are more important for wastewater treatment and why? [15]

6. (a) "Not only wastewater treatment but also water reuse is needed in recent days" – justify the statement. [5]
   (b) Write short notes on i) physical, chemical and biological characteristics of wastewater ii) preliminary treatment process of wastewater. [20]

7. (a) Discuss the basic elements of VIP latrines with neat sketch. [10]
   (b) Discuss the economic considerations of small bore sewerage system over

conventional sewerage system. [15]

8. (a) What basic processes are involved in the "Waste Stabilization Pond" method of wastewater treatment? [5]

(b) Design a waste stabilization pond system to treat wastewater from a low-income settlement with a population of 25,000. The average wastewater flow is about 100 lpcd and the BOD contribution is 50 gm/person/day. The mean temperatures at winter season and summer season are 18°C and 29°C, respectively. Assume fecal coliform concentration in raw wastewater to be $1*10^8$ /100 mL. It is desired that the final effluent be used for crop irrigation. [20]

Table-1: Design values of λ_v and BOD removal rate at various temperatures

Temperature (°C)	Volumetric loading rate (g BOD/m^3 day)	BOD removal (%)
20	300	60
21	300	62
22	300	64
23	300	66
24	300	68
>25	300	70

Table-2: Design values for surface BOD loading rates for facultative ponds at various temperatures

Temperature (°C)	Surface loading rate (kgBOD/ha.day)	Temperature (°C)	Surface loading rate (kgBOD/ha.day)
16	183	23	311
17	199	24	331
18	217	25	350
19	235	26	369
20	253	27	389
21	272	28	406
22	292	29	424

$$N_e = N_i /(1+K_t\theta_a)(1+K_t\theta_f)(1+K_t\theta_m)$$

$$\theta_m = \left\{\left[N_i / N_e(1+K_t\theta_a)(1+K_t\theta_f)\right]^{\frac{1}{n}} - 1\right\} / K_t$$

University of Asia pacific
Department of Civil Engineering
Final Examination Fall 2015
Program: B.Sc. Engineering (Civil)

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

There are **six** questions. Answer **five** of them

1. a) Name the types of signal controller. 6
   b) Classify traffic signs along with brief description. 12
   c) Two straight sections of a highway meet at an angle of 150^0. If the radius of simple circular curve is 700m, find 12
      i) Tangent distance
      ii) Length of long chord
      iii) Mid-ordinate and
      iv) Apex distance

2. a) What are the objectives of traffic volume study? 8
   b) What are the different types/ techniques of traffic calming? Explain any one of the types. 12
   c) Spot speeds of 8 vehicles traversing 4 km segment of a highway are given below. Calculate the Time Mean Speed and the Space Mean Speed of the vehicles. 10

Vehicle	Speed (km/hr.)
1	75
2	55
3	66
4	42
5	52
6	60
7	70
8	68

3. a) Compare on-street and off-street parking. 10
   b) The following spot speeds (km/hr) were observed for 40 vehicles traversing a segment of a highway. 20
      25, 48, 56, 71, 66, 58, 48, 47, 53, 68, 29, 36, 59, 43, 45, 63, 46 42, 76, 45, 38, 65, 58, 34, 36, 53, 45, 73, 55, 43, 37, 47, 44, 68, 52, 57, 62, 65, 35, 39.
      Calculate the design speed, average speed, safe speed, median speed and lower limit of speed. (Consider pace as **10-19, 20-29** and so on)

4. a) Write short notes on any **four**: 16
      i) Visual acuity
      ii) Origin Destination survey
      iii) Color vision
      v) Forced flow
      iv) Park and Ride system

   b) A horizontal curve with a radius of 700 ft is designed for a two-lane highway having 14 a design speed of 75 mph. If the section of highway is having a 4% downgrade and coefficient of friction is 0.348, determine the smallest possible distance of any object can be placed from the centerline of the inside lane of the curve. Assume PR time 2.5.

5. a) A negative 4% grade vertical curve is followed by a positive 6% grade at a section of a two-lane highway. What is the required length of vertical curve needed to satisfy design stopping sight distance? Assume the stopping sight distance to be 600 ft. 12

   b) An arterial road has a design speed of 80 m/hr. There is a 3% grade (upgrade). What safe stopping sight distance must be provided? Assume reaction time as 3 second and friction factor as .35. 12

   c) Define mobility and accessibility in terms of highway classification. 6

6. a) Briefly describe how Geographic factor and Political factor effect the development of transportation system in Bangladesh. 15

   b) Briefly explain the constraints of road and rail transportation sector in Bangladesh. 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 Fall 2015
Program: B. Sc. Engineering (Civil)

Course Code: CE 363 — Course Title: Engineering Hydrology
Full Marks: 150 — Time: 3 hours

There are TWO sections in the question paper namely "Part A" and "Part B". You have to answer from the both sections according to the instruction mentioned on each section.

Part A
There are FOUR questions answer any THREE (3 * 25 = 75)

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

i. Weather front
ii. Residence time
iii. Vapor pressure
iv. Pan co-efficient

1. (b) Describe the procedure to estimate precipitable water from a static atmospheric air column. (10)

1. (c) A catchment area has 6 rain gauge stations. In a year the annual rainfall recorded by the gauges are as follows: (5)

Station	A	B	C	D	E	F
Rainfall	78.3	85.7	105.1	110.9	95.0	72.8

For a 12% error in the estimation of the mean rainfall, calculate the optimum number of stations required to be established in the catchment.

2. (a) There were 6 rain gauge stations namely N, O, P, Q, R, and S where station P was inoperative for the month. At that month rainfall recorded in the other five stations were 6.2, 9.1, 5.9, 8.3, 5.7 cm respectively. If the average annual rainfalls for the stations are 91, 67, 75, 86, 69, 72 cm. Estimate rainfall at station P for that month. (5)

2. (b) Annual rainfall data are available below for four gauges (E, F, G, H). Gauge H was relocated permanently at the end of 1987. Therefore rainfall data for gauge H for the period 1985-1987 must be adjusted to the rainfall characteristics at the new location. Find adjusted rainfall data at H. (15)

Year	Annual Rainfall (in)			
	E	F	G	H
1985	22	26	23	28
1986	21	26	25	33
1987	27	31	28	38
1988	25	29	29	31
1989	19	22	23	24
1990	24	25	26	28
1991	17	19	20	22
1992	21	22	23	26

2. (c) What are the factors affecting Evapotranspiration? (5)

3. (a) Describe different methods of base flow separation. (10)

3. (b) For a drainage basin of 575 km^2, isohyetals drawn for a storm gave the following data: (8)

Isohyetal intervals (cm)	15-12	12-9	9-6	6-3	3-1
Inter Isohyetal area (km^2)	92	128	120	175	85

Estimate the average depth of precipitation over the catchment.

3. (c) Discuss how the role of the shape, slope and drainage density of a basin affects the shape of flood hydrograph. (7)

4. (a) Explain the following: (9)

i. Conditions that must be present for the production of precipitation.
ii. Initial loss to reduce the water volume available for runoff.
iii. Intensity-duration-frequency curve

4. (b) A storm with 15 cm precipitation produced a direct runoff of 7.8 cm. The time distribution of the storm is as follows. Estimate Φ index of the storm. (10)

time from start (hr)	1	2	3	4	5	6	7	8
Incremental rainfall (cm)	0.6	1.35	2.25	3.45	2.7	2.4	1.5	0.75

4. (c) Show different components of hydrograph in a neat sketch. (6)

Part B

There are FOUR questions answer any THREE (3 * 25 = 75)

5. (a) Write a short note on runoff characteristics of streams with neat sketches. (6)

5. (b) The ordinates of a 4-h unit hydrograph are as given below: (12)

Time	0	2	4	6	8	10	12	14	16	18
ordinates of 4-hr UH (cumec)	0	24	49	82	122	155	110	89	58	34

If two storms, each of 4-hr duration and having rainfall excess values of 3-cm and 4-cm respectively, then calculate Direct Runoff Hydrograph. The 4 cm ER rain follows the 3 cm ER rain.

5. (c) What are the climatic factors affecting flood hydrograph? What data are required for reservoir routing? (7)

6. (a) Describe the methods of developing unit hydrograph of different durations. (10)

6. (b) The following are the ordinates of the hydrograph of flow from a catchment area of 720 km^2 due to a 6-hr rainfall. Derive the ordinates of 6-hr unit hydrograph for the basin. Make suitable assumptions regarding base flow. (15)

Time	6	12	18	24	30	36	42	48	54	60	66	72	78
Discharge	40	64	215	360	405	350	470	205	145	100	70	50	42

7. (a) A basin has 480 sq. km of area, L= 40 km and L_{ca} = 16 km. Assuming C_t=1.2 and C_p = 0.65. Develop a 6-hr synthetic unit hydrograph for this basin using Snyder's method. (12)

7. (b) Describe the procedure of estimating 'k' and 'x' in Muskingum equation. (8)

7. (c) An area of 12 acres has a runoff co-efficient of 0.55. Find peak discharge using rational method for a 1.75 inch per hour rainfall intensity. (5)

8. (a) Describe the procedure of estimating flood discharge of any interval using Gumbel's method. (7)

8. (b) The following data were collected for a 24 m wide stream at a gauging station. The rating equation of the current meter is V= $0.33N_s + 0.05$ m/s. (8)
Compute the discharge.

Distance from left water edge (m)	0	2	4	6	9	12
Depth (m)	0	0.5	1.1	1.95	2.25	1.85
Revolution per second at 0.6 depth	0	0.43	0.70	1.10	1.17	1.00

Distance from left water edge (m)	15	18	20	22	23	24
Depth (m)	1.75	1.65	1.5	1.25	0.75	0
Revolution per second at 0.6 depth	0.97	0.90	0.77	0.70	0.47	0

8. (c) The inflow hydrograph readings for a channel reach are given for which the Muskingum coefficients of k=28 hr and x=0.35. Route the flood through the reach and determine the attenuation and time lag of outflow. Outflow at the beginning of the flood may be taken as the same as inflow. (10)

Time (hr)	0	6	12	18	24	30	36	42	48
Inflow (cumec)	15	16	31	96	121	102	85	70	57

Time (hr)	54	60	66	72	78
Inflow (cumec)	47	35	26	22	17