University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B.Sc. Engineering (Civil)

Course Title: Geotechnical Engineering I — Course Code: CE 341
Time: 3 hours — Full Marks: 100

PART A
Answer the following questions. **50**
= (10 + 15 + 25)

1. Apply Unified Soil Classification System for classifying 'Soil A' for the following questions.

(i) The results of sieve analysis and Atterberg's limits of 'Soil A' are given below: 8

Percent finer than 0.075 mm = 8%
Percent finer than 0.425 mm = 28%
Percent finer than 0.6 mm = 30%
Percent finer than 1 mm = 60 %
Percent finer than 4.75 mm = 90%
Effective size = 0.063 mm
Liquid limit = 32% & Plastic limit = 24%

(ii) Reclassify the above soil if there is a change in the sieve analysis (given in the above question) as below: 2

Percent finer than 0.075 mm = 18%
Except this, the other information remains the same.

2. Apply Rankine's theory of lateral earth pressure for the following questions: 15

(i) **Compute** the magnitude of lateral force (per unit length of the wall) acting on the earth retaining structure, shown in the following figure. Given that the backfill soils push the retaining wall. Consider up to the dredge line. 10

(ii) Estimate the change in the lateral force (per unit length of the wall) due the following change in soil data. 5
Both the layers have cohesion of 10 kPa and the water table is at a depth of 15 m below the ground level.

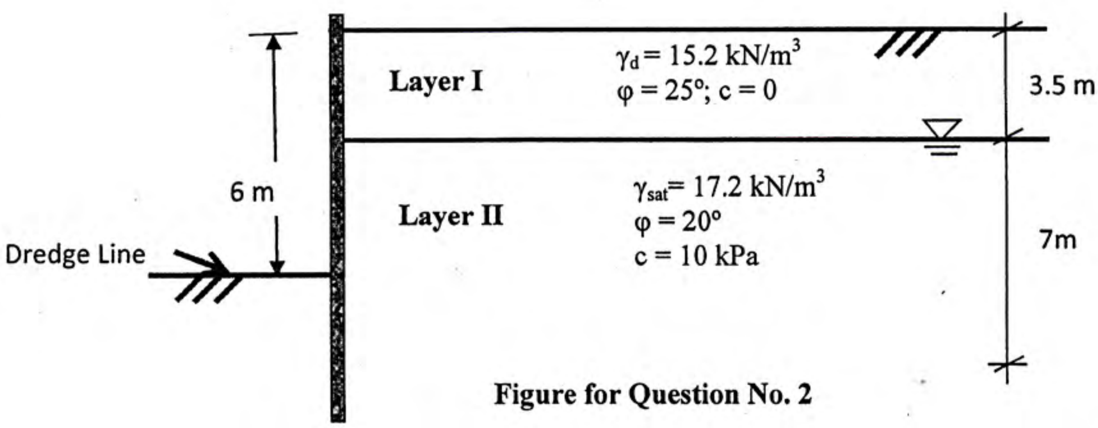


Figure for Question No. 2

3. Answer Question 3(a) or 3(b)

3(a) (i) A rectangular footing (1.5 m x 2 m), in the soil profile shown in the following figure, transmits a pressure of 215 kN/m^2 at the footing base. Determine the increase in vertical stress at the mid depth of 1 m thick clay layer below the centroid (O) of the footing using both the methods: 4 + 4

- 2:1 (2 vertical to 1 horizontal) method
- Influence factor

(ii) Calculate the over-consolidation ratio (OCR) for a soil element at the mid- depth of the clay layer (just below the centroid of the footing) considering the stress increase obtained from both the methods in (i). 2+2

Given that pre-consolidation pressure of the clay layer = 180 kPa.

(iii) Estimate the primary consolidation settlement of the clay layer for the maximum stress increase obtained in (i). 10

Addition information from the laboratory tests are given below:

Liquid limit = 32%

Given that: Cc = 0.009(LL – 10)

How long will it take to complete 40% of the estimated settlement of the clay layer in (iii)? 3

Given that

Coefficient of consolidation, $c_v = 0.2$ mm^2/s

$$T_v = \frac{\pi}{4}\cdot\left(\frac{U}{100}\right)^2$$

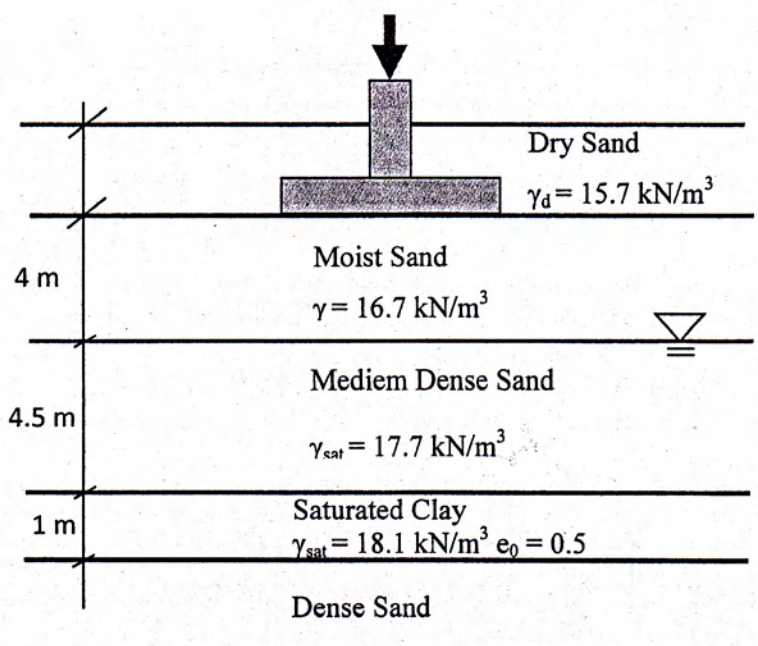


Figure for Question No. 3(a) and 3(b)

Table: Influence factor chart

n	m							
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
0.1	0.005	0.009	0.013	0.017	0.020	0.022	0.024	0.26
0.2	0.009	0.018	0.026	0.033	0.039	0.043	0.47	0.050
0.3	0.01323	0.02585	0.03735	0.04742	0.05593	0.06294	0.06858	0.07308
0.4	0.01678	0.03280	0.04742	0.06024	0.07111	0.08009	0.08734	0.09314
0.6	0.02223	0.04348	0.06294	0.08009	0.09473	0.10688	0.11679	0.12474

3(b) (i) A square footing (2 m x 2 m), in the soil profile shown in the following figure, transmits a pressure of 215 kN/m^2 at the footing base. Determine the increase in vertical stress at the mid depth of 1 m thick clay layer below the centroid (O) of the footing using 'equivalent point load method'. 5

Boussinesq's equation for point load is given below:

$$\sigma_z = \frac{3Q}{2\pi} \cdot \frac{z^3}{(r^2 + z^2)^{5/2}}$$

(ii) Calculate the overconsolidation ratio (OCR) for a soil element at the mid- depth of the clay layer just below the centroid of the footing under the case of (i). 2

Given that pre-consolidation pressure of the clay layer = 180 kPa.

(iii) Estimate the primary consolidation settlement of the clay layer for the stress increase obtained in (i). 12

Addition information recorded during one-dimensional consolidation test is as follows:
When the pressure on the sample was increased from 250 to 480 kN/m^2, the void ratios (after 100% consolidation under the pressure applied) were 0.745 and 0.52, respectively.

(iv) During one-dimensional consolidation test, a 2 cm thick clay specimen takes 45 mins to reach 45% degree of consolidation.

Calculate the coefficient of consolidation. 3

Also, determine the time required by the clay layer in field to reach 55% consolidation. 4

Given that

$$T_v = \frac{\pi}{4} \cdot \left(\frac{U}{100}\right)^2$$

PART B

Answer the following questions. **50 = (20 + 20 + 10)**

4. Answer Question 4(a) or 4(b)

4(a). The results of three direct shear tests are plotted, as given in the following.

Calculate the shear strains (in %) of the specimen under peak shear stress in all three tests. Given that the size of the shear box is 60 mm by 60 mm. 3

For the soil tested, plot the Mohr-Coulomb failure envelop for peak shear strength and ultimate shear strength. 8

Also determine the shear strength parameters both for peak and ultimate shear strengths of the soil. 6

Draw the typical shape of axial displacement versus shear displacement relation for the soil condition considered during these tests. 3

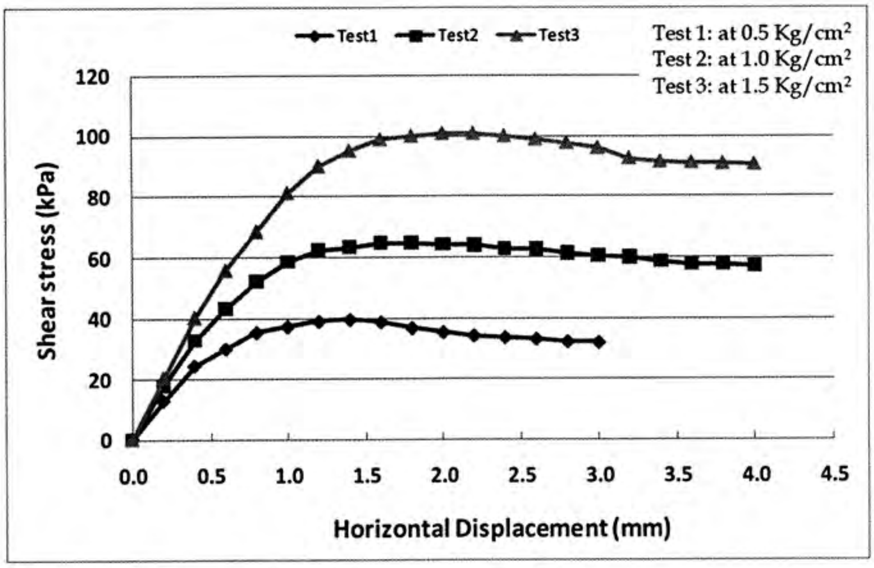


Figure for Question No. 4(a)

4(b). The results of three CU triaxial tests were plotted and the total stress failure envelope was drawn, as given in the following. The pore water pressures were recorded 5, 10 and 15 kPa during Test-1, Test-2 and Test-3, respectively.

Draw effective stress Mohr-circles and Mohr Coulomb failure envelope in a graph paper. 8

Determine shear strength parameters for both total and effective stresses of the soil. 4

Calculate the diameters of three effective stress circles. 4.5

If the middle Mohr-circle is obtained for a cohesionless soil, draw the Mohr-circle and the Mohr-Coulomb failure envelope in a graph paper. Calculate the shear strength parameters. Draw 3.5

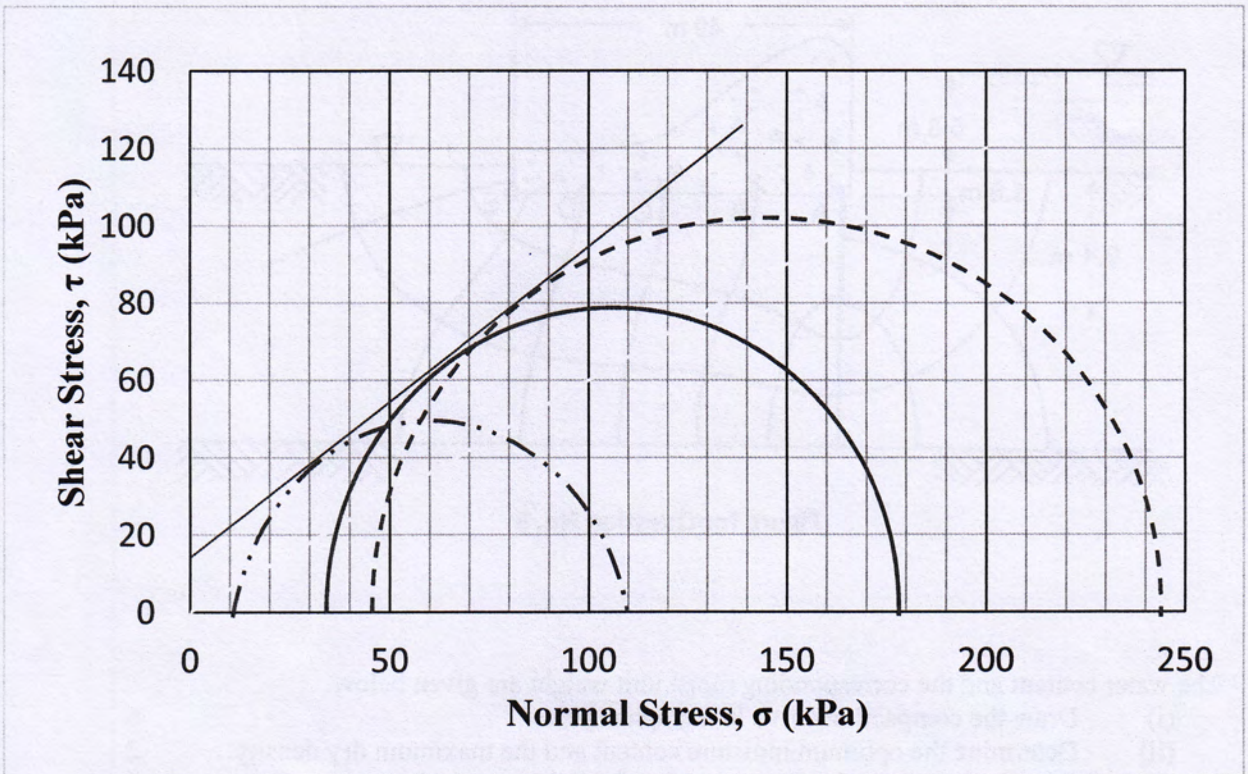


Figure for Question No. 4(b)

5. A flownet is drawn, as shown in the following figure, for calcularing seepage flow underneath the dam.

(i) Determine the flow rate of water under the dam. Assume $k = 3 * 10^{-3}$ cm/s. 5

(ii) Compute the uplift pressures (kPa) along the base of the dam at points A, B, C, D and E. Point A is just to the right of the sheet pile. Also calculate the uplift force. 4 + 8

(iii) Assuming points A through E are equally spaced along the base of the dam, compute the hydraulic gradient between points C and D. Assume the distance from A to E is 48 m. 3

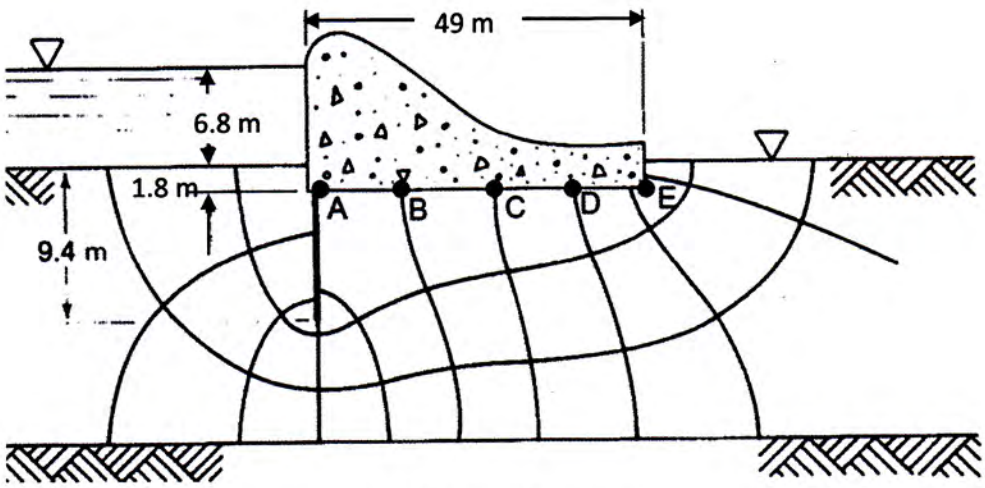


Figure for Question No. 5

6. The water content and the corresponding moist unit weight are given below.
   (i) Draw the compaction curve in a graph paper. 6
   (ii) Determine the optimum moisture content and the maximum dry density. 2
   (iii) Specify the range of moisture content for field compaction. 2

Table for Question No. 6

Moisture Content (%)	8.4	9.7	13.4	15
Moist Unit weight (kN/m^3)	18.1	19.6	19.5	17.3

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B. Sc. Engineering (Civil)

Course Title: Open Channel Flow — Course Code: CE 361

Time: 3 hours — Full marks: 150

There are **FOUR** questions in each section. Answer any **THREE** from each section. **(25*6= 150)**
(Assume reasonable data)

SECTION – A

1 (a) Discuss the importance of provision of lining in a channel and list the materials for lining. (5)

(b) Show that the best hydraulic trapezoidal section is one-half of a regular hexagon. (8)

(c) A trapezoidal channel lined with concrete (n = 0.013) and laid on a slope of 1 in 3600 carries a discharge of 90 m^3/s. Determine the section dimensions of the channel (i) taking b = 6m an side slope of 1:1, (ii) for the best hydraulic section when the side slope is 1:1. (12)

2 (a) Define specific energy with expression and draw the discharge-depth curve for a given specific energy. (6)

(b) Why is the best hydraulic section not necessarily the most economic section and need to be modified in practice? (5)

(c) Compute the flood discharge through a river reach 950 m long having a fall in water surface of 0.80 m (using slope-area method). Neglect the eddy loss. Use the following data: (14)

$A_1 = 12000\ m^2$, $P_1 = 2150$ m, $n_1 = 0.03$, $\alpha_1 = 1.15$

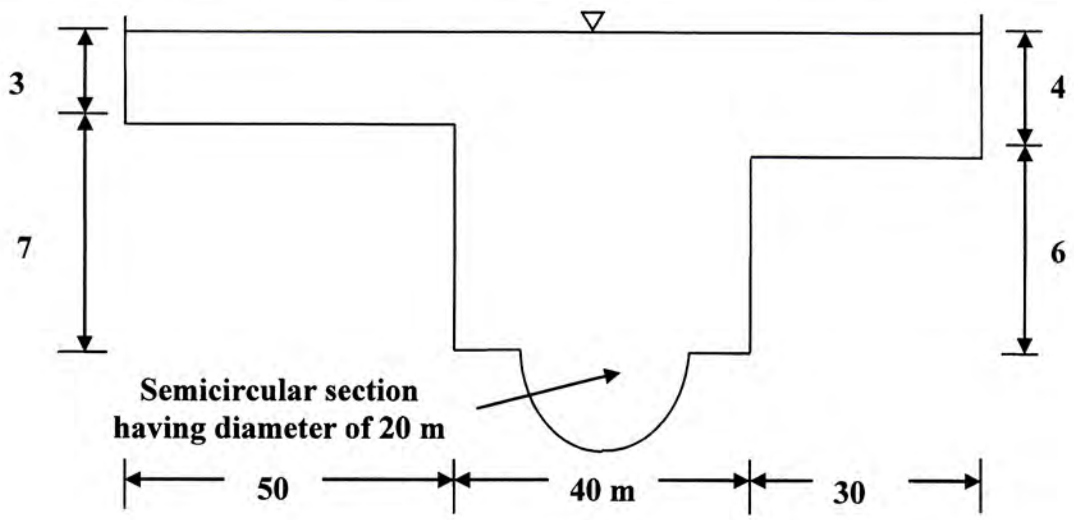
$A_2 = 10500\ m^2$, $P_2 = 2050$ m, $n_2 = 0.03$, $\alpha_2 = 1.18$

3 (a) Define with figure: i) Initial and sequent depth; ii) Oscillating jump and steady jump. (5)

(b) A rectangular channel with b = 5m, s= 2, n = 0.020 and S_o =0.0025 carries a discharge of 48.67 m^3/s. A dam constructed across the channel raises the water level to a depth of 5m immediately upstream of it. How far upstream or downstream from the dam will the depth be 4.9 m? Use the direct step method. (20)
[Hint: determine h_c and h_n first]

4 (a) Mention practical occurrence (examples) and state of flow for each of the following profiles: i) M1 Profile; ii) S1 profile; iii) S2 profile; iv) M3Profile; v) S3 profile. (10)

(b) A channel consists of a main section and two side sections as shown in the following figure. Compute the total discharge, the mean velocity of flow and the Manning's n for the entire section when n = 0.025 for the main channel, n = 0.045 for the side channels and S_o = 0.0002. Also compute the numerical values of α and β for the entire section assuming that $\alpha = \beta = 1.00$ for the main channels and the side sections. (15)



SECTION – B

5 (a) Define critical shear stress. List the information that are generally required to compute gradually varied flow profiles. (2+2)

(b) Discuss the applicability of the three governing equations with the example case of flow beneath a sluice gate. (6)

(c) An irrigation canal has to carry a discharge of 20 m^3/s through a coarse non-cohesive material having d_{50} = 2.5 cm, d_{75} = 3.0 cm and n = 0.025. The angle of repose of the perimeter material is 32°. The canal is to be trapezoidal in shape having s = 2 and laid on a slope of 1 in 1000. Determine section dimensions of the channel. Use Lane Method. (15)

6 (a) What is a wide channel? Show that for a wide channel, the Hydraulic Radius is approximately equal to the depth of flow. (4)

(b) Draw the types of jumps that occur in sloping channels. (6)

(c) An unlined irrigation canal (n= 0.025) is trapezoidal and has a bottom width of 6 m, side slopes of 1:1 and a depth of flow of 2 m. The longitudinal slope of the canal is 0.0005. Compute the discharge carried by the canal under uniform flow condition. It is proposed (15) to line the canal with concrete having n = 0.013. Compute the discharge that would be carried by the canal when (i) only the sides are lined, (ii) only the bottom is lined, an (iii) both the bottom and sides are lined.

7 (a) Show the pressure distribution in parallel, concave and convex flows in a figure and mention in each of the cases if the pressure is hydrostatic, less than hydrostatic or more than hydrostatic. (6)

(b) Specify the possible locations and usefulness of control sections. Show that "At the critical state of flow, the specific energy is the minimum for a given discharge". (4+4)

(b) A 5 m wide rectangular channel has three reaches arranged serially. The bottom slope of the reaches are 0.018, 0.016 and 0.007. The n values for the three reaches are 0.020, 0.015 and 0.025 respectively. For a discharge of 25 m^3/s, sketch the resulting flow profiles. (11)

8 (a) Sketch the possible flow profiles in the following serial arrangement of channels or conditions. The flow is from left to right: (9)

(i) Steep-steeper; (ii) Upstream and downstream of a sluice gate in a steep slope channel, (iii) Steep-mild; (iv) Upstream of an overflow weir in a mild slope channel.

(b) Write down three applications of hydraulic jump. (2)

(c) Water flows at a depth of 1 m in a horizontal trapezoidal channel having a base width of 5 m and side slope 1:1 and Q = 30 m^3/s. If a hydraulic jump occurs in this channel, compute the sequent depth and the energy lost in the jump. (14)

Given Formulae

	Trapezoidal channel	Circular Channel
$\overline{U} = \frac{\int_0^A u\,dA}{A}$ $\alpha = \frac{\int_0^A u^3\,dA}{\overline{U}^3 A}$ $\beta = \frac{\int_0^A u^2\,dA}{\overline{U}^2 A}$	$A = (b + sh)h$ $P = b + 2h\sqrt{1+s^2}$ $B = b + 2sh$	$h = \frac{d_O}{2}\left[1 - cos\frac{\omega}{2}\right]$ $\omega = 2cos^{-1}(1 - \frac{2h}{d_o})$ $A = (\omega - sin\omega)\frac{d_O^2}{8}$ $B = d_O \sin\frac{\omega}{2}$ $P = \frac{\omega d_O}{2}$ *Note that ω is in radian*

$$\alpha = \frac{\alpha_1 K_1^3/A_1^2 + \alpha_2 K_2^3/A_2^2 + \alpha_3 K_3^3/A_3^2}{K^3/A^2}$$

$$\beta = \frac{\beta_1 K_1^2/A_1 + \beta_2 K_2^2/A_2 + \beta_3 K_3^2/A_3}{K^2/A}$$

$$n = \left(\frac{P_1 n_1^{3/2} + P_2 n_2^{3/2} + P_3 n_3^{3/2}}{P}\right)^{2/3}$$

Lane Method: $\tau_b = 0.40\, d_{75}$

$$K = \frac{\tau_s}{\tau_b} = \sqrt{1 - \frac{sin^2\phi}{sin^2\Psi}}$$

Rectangular channel: $h_c = \sqrt[3]{\frac{\alpha Q^2}{gb^2}}$; $S_c = (\frac{nQ}{AR^{2/3}})^2$

$Fr = U/\sqrt{(gD)}$; $Q = K\sqrt{S_f}$; $K = AR^{2/3}/n$

$h_f = F + (\alpha_1 U_1^2/2g - \alpha_2 U_2^2/2g\_ - h_e$

$\Delta x = E_2 - E_1/(S_0 - S_f bar)$

For Hydraulic Jump:

$$\frac{h_2}{h_1} = \frac{1}{2}\left(\sqrt{1 + 8F_{r1}^2} - 1\right)$$

$$h_L = \frac{(h_2 - h_1)^3}{4h_1 h_2}$$

$$\frac{E_2}{E_1} = \frac{(1 + 8F_{r1}^2)^{3/2} - 4F_{r1}^2 + 1}{8F_{r1}^2(2 + F_{r1}^2)}$$

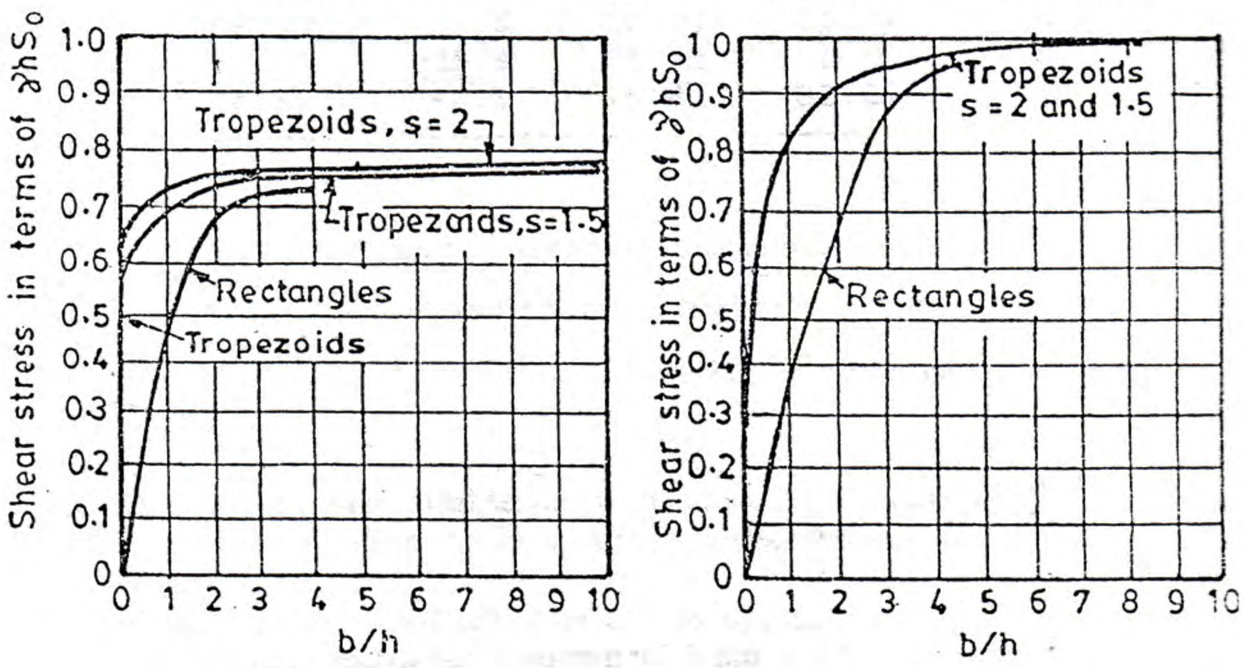
$$\frac{h_j}{E_1} = \frac{\sqrt{1 + 8F_{r1}^2} - 3}{2 + F_{r1}^2}$$

$$L_j = 9.75 h_1 (F_{r1} - 1)^{1.01}$$

$$F_2 = \frac{Q^2}{gA_2} + \overline{z}_2 A_2$$

For trapezoidal channel $\overline{z} = \frac{h}{6}(\frac{3b+2sh}{b+sh})$

Maximum Shear Stress on (a) sides and (b) bottom of channel



(a) (b)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures I — Course Code: CE 315(B)
Time: 3 hours — Full Marks: 70 (= 7 × 10)

Answer **Part I and Part II** on separate answer scripts
[Assume reasonable values for missing data]

Part I

[Answer any **three** (03) out of following **four** (04) questions]

1. A rectangular beam made using concrete with $f'_c = 4000$ psi and steel with $f_y = 60$ ksi has width b=12", total depth h = 20" and effective depth d = 17.5". Concrete modulus of rupture, $f_r = 400$ psi. The elastic modulus of steel and concrete are, respectively, 29 x 10^6 psi and 2.9 x 10^6 psi. The tensile steel area, A_s = 3 #8 bars in one layer.

a) Calculate the cracking moment of the above section and comment on whether the beam has cracked or not for a 30 k-ft imposed moment. (3)

b) Calculate the stresses in concrete and steel when the above section is subjected to a moment of 30 k-ft. (3)

c) Calculate the nominal moment capacity of the above section. (4)

2. (a) Design a rectangular simply supported beam for a 22-ft span if a dead load of 1 k/ft (including the beam weight) and a live load of 2 k/ft are to be supported. Use f'_c = 4000 psi and f_y = 60,000 psi. Use USD method. (7)

(b) Write three sources of uncertainty in the analysis, design and construction of reinforced concrete structures. (3)

3. (a) Calculate the nominal and design moment capacity of the beam shown in **Figure 1**.Given, f'_c = 5 ksi, f_y = 60 ksi, f_s = 24 ksi, E_s = 29000 ksi, E_c = 3222.22 ksi. Use USD method. (8)

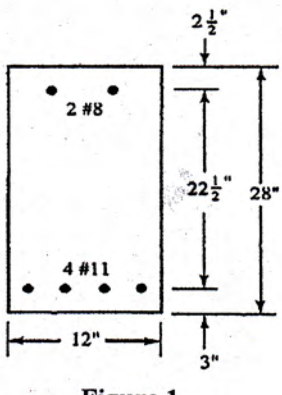


Figure 1

(b) What is the purpose of strength reduction factor (φ)? Why is φ lesser for shear than bending? (2)

4. A beam section is limited to a width of b=10" and total depth h=20" and has to resist (10) a factored moment of 240 k-ft. Calculate the required reinforcement. Given, f'_c = 3.5 ksi, f_y = 60 ksi. Use USD method.

Part II

[Answer any **four** (04) out of following **six** (06) questions]

5. (a) The uniformly distributed load on the beam W_{DL}= 1.6 k/ft (including self-weight) and W_{LL}= 3.6 k/ft. The beam has an $f_c' = 4$ ksi, $f_y = 60$ ksi, b=14 in., d=25.5 in. concrete cover =2.5 in., and strength of the shear reinforcement is f_{sy} = 40 ksi. Determine the shear reinforcement for beam shown in **Figure 2** according to ACI-USD method. Draw the stirrup layout of the beam. (7)

Given, Shear in end member at first interior support $=1.15\frac{w_u l_n}{2}$

Shear at other supports $= \frac{w_u l_n}{2}$

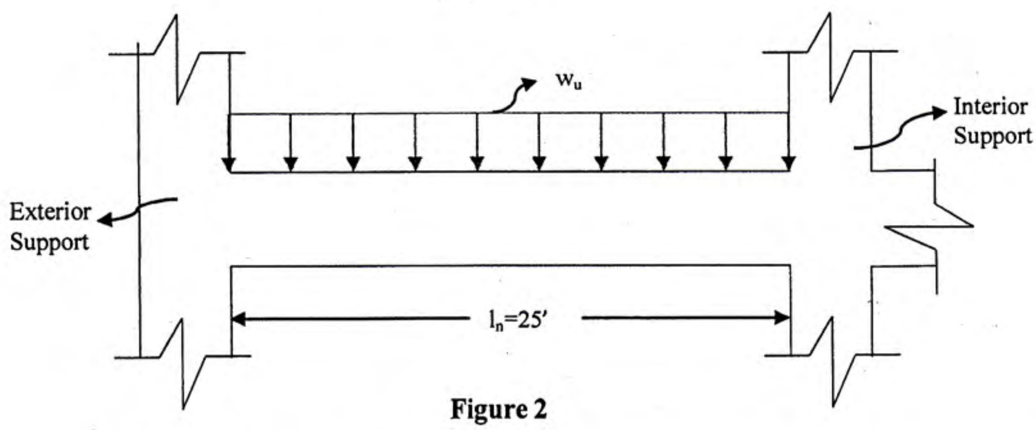


Figure 2

(b) Show with neat sketches the following cracks in RC beams and slab. (3)

(i) Shear cracks

(ii) Flexural crack due to bending

(ii) Bond cracks

6. (a) What is the advantage of designing beams as T-beams compared to rectangular beams? (2)

(b) A floor system consists of a 3 in. slab supported by continuous T-beams with 25 ft clear span, 48″ on centers as shown in **Figure 3**. Concrete dimensions, governed by web shear and clearance requirements, are b_w = 16 in. and d = 24 in. What tensile reinforcement is required at mid span to resist a factored moment M_u = 720 kip-ft, if f_c' = 3 ksi and f_y = 60 ksi? Use USD method. (8)

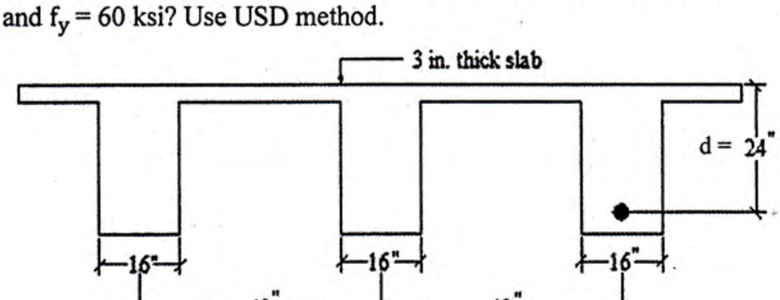


Figure 3

7. (a) A reinforced concrete slab system shown in **Figure 4** is built integrally with its support and consists of two equal spans. The service live load on the slab is 120 psf. Design the slab by USD method and draw neat sketches of slab section showing all the reinforcement details. Given, $f_c' = 3$ ksi and $f_y = 60$ ksi. ACI moment coefficients are given as follows: (7)

Exterior Negative: 1/24
Mid-Section Positive: 1/14
Interior Negative: 1/9

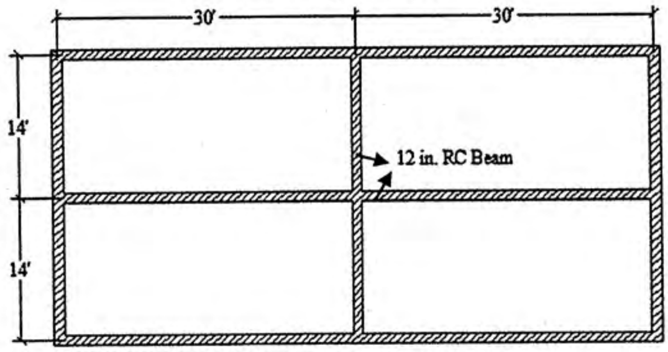


Figure 4: Plan View

(b) Why temperature and shrinkage reinforcements are required in one-way slab? What are the ACI/BNBC recommended ratio for such steel? (3)

8. (a) A simply supported beam shown in **Figure 5** of 18.75 ft clear span is to carry service dead load of 1.0 k/ft (including self-weight) and service live load of 1.18 K/ft. Reinforcement of the beam consists of three No. 10 bars (following USD method) at 12.5 in. effective depth. Center bar is to be discontinued where no longer required. Calculate the point where center bar can be discontinued according to ACI code provision. Given, $f_c' = 3$ ksi and $f_y = 60$ ksi. (5)

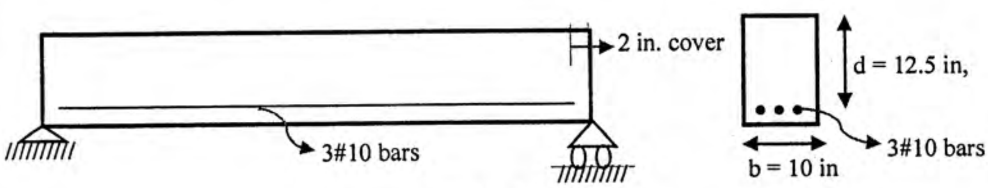


Figure 5

(b) List the factors that affect the development length of rebars. (2.5)

(c) Explain why the development length of compression bars is smaller than that of tension bars. (2.5)

9. (a) Explain why flexural reinforcement bars are not cut at the theoretical cut off point. (2)

(b) A cantilever beam section (b = 14 in., h = 21 in., d = 18 in.) is made of normal density concrete which is reinforced with 3 #9 bars and #3 stirrups @ 4 in. c/c. Reinforcement required from structural analysis is 2.5 in^2. Check to see if adequate length of reber is available for development length in the beam as shown in **Figure 6**. Given, $f_c' = 4$ ksi and $f_y = 60$ ksi. (8)

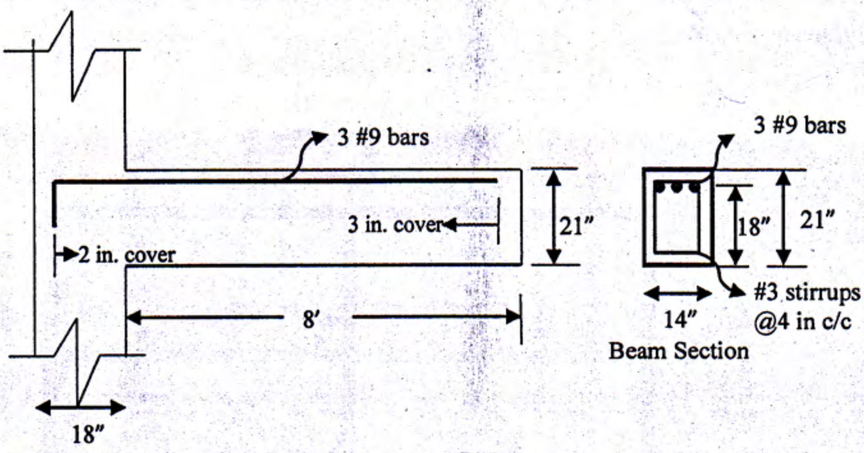


Figure 6

10. (a) Draw a neat sketch showing flexural stress distribution over T- beams. (3)

(b) Determine the design moment capacity of the T-beam shown in **Figure 7**. Given, f'_c = 3 ksi and f_y = 60 ksi. (7)

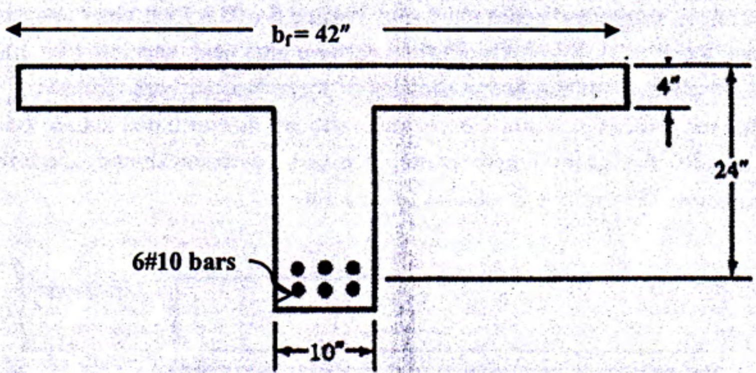


Figure 7

List of Useful Formulae for CE 315

Fundamentals

- Tensile strength of concrete $f_r' = 7.5\sqrt{f_c'}$ $E_s = 29 \times 10^6$ psi Modular ratio, $n = E_s/E_c$
- Within elastic limit, Flexural stress $f_c = M\ \bar{y}/\ I$
- Steel Ratio $\rho_s = A_s/bd$ Minimum Steel Ratio $\rho_{min} = 3\sqrt{f_c'}\ /f_y$, often taken as $= 200/f_y$

$Ec = 57000\sqrt{f'c}$(psi)

WSD

- 'Cracked' elastic section Analysis: $k = -n\rho_s + \sqrt{[2n\rho_s + (n\rho_s)^2]}$ $j = 1 - k/3$

  Design: $k = n/(n + r)$ [where $r = f_{s(all)}/f_{c(all)}$] $j = 1 - k/3$
- Singly Reinforced Beam: $M_s = A_s f_s jd$ and $M_c = (f_c kj/2)\ bd^2 = R\ bd^2$
- Balanced Stress Steel Ratio $\rho_{sb} = k/2r$, when $M_s = M_c$
- Doubly Reinforced Beam: $M_1 - Rbd^2$, $A_{s1} = M_1/(f_s jd)$

  $M_2 = M - M_1$, $A_{s2} = M_2/[f_s(d-d')]$ and $A_s' = M_2/[f_s'(d-d')]$, where $f_s' = 2f_s(k - d'/d)/(1-k)$

USD

- $\beta_1 = 0.85 - \left(\frac{f_c' - 4000}{1000}\right)(0.05) \geq 0.65$

$$\rho_{max} = 0.85\beta_1 \frac{f_c'}{f_y} \frac{\epsilon_u}{\epsilon_u + 0.005}$$

- Design conditions: $M_u < \phi\ M_n$, $V_u < \phi\ V_n$, $P_u < \phi\ P_n$ [$\phi = 0.483 + 83.3\varepsilon_t$]

- Singly Reinforced Analysis: $a = A_s f_y/(0.85 f_c'\ b)$ $M_n = A_s f_y (d - a/2) = \rho_s f_y (1 - 0.59\ \rho_s f_y / f_c')\ bd^2$

  $c = a/\beta_1$
- Doubly Reinforced Analysis:

  $a = A_{s1} f_y / (0.85 f_c'\ b)$ [where $A_{s1} = A_s - A_{s2}$, and can be taken as $= A_s - A_s'$ to begin with]

  $A_{s2} = A_s'\ f_s'\ /\ f_y$, where $f_s' = E_s \times \varepsilon_t$

  from which A_{s1} can be revised as $= A_s - A_{s2}$ and a can also be revised accordingly

  $M_n = A_{s1} f_y (d - a/2) + A_{s2} f_y (d - d')$
- Design: Singly Reinforced if $M_n = \rho f_y (1 - 0.59\ \rho f_y / f_c')\ bd^2$

  Area Calculation: $R_n = M_u/(\phi bd^2)$, $\rho = 0.85f_c'/f_y \times [1-\sqrt{(1-2R_n/(0.85f_c'))}]$, $As = \rho bd$

  Doubly Reinforced $M_1 = M_{max}$ $A_{s1} = \rho_{max}\ bd$,

  $M_2 = M_u - M_1$ $A_{s2} = M_2\ /\ f_y\ (d - d')$

  Determination of c: $A_s f_y = 0.85 f_c' \beta_1 cb + E_s \epsilon_u A_{s'}(c-d')/c$; Check ϕMn: $\phi Mn = A_{s1} f_y (d-a/2) + A_{s'} f_s (d-d') > M_u$
- T-beam b_{eff} is the minimum of $L/4$, $(16t + b_w)$, and (c/c distance between adjacent beams)

  L-beam b_{eff} is the minimum of $(L/12 + b_w)$, $(6t + b_w)$, and (b_w + half the clear distance between adjacent beams)

- USD Analysis: $A_{sf} = 0.85 f_c'\ (b_{eff} - b_w)t\ /\ f_y$ $M_{n1} = A_{sf} f_y (d - h_f/2)$

  $A_{sw} = A_s - A_{sf}$ $a = A_{sw} f_y / (0.85 f_c'\ b_w)$ $M_{n2} = A_{sw} f_y (d - a/2)$ } $M_n = M_{n1} + M_{n2}$

  Design: $A_{sf} = 0.85 f_c'\ (b_{eff} - b_w)t\ /\ f_y$, $M_{uf} = A_{sf} f_y (d - t/2)$; while A_{sw} can be obtained from $M_{uw} = M_u - M_{uf}$

Parameters of Development Length of Tension Bars

Symbol	Parameter	Variable	Value
α	Reinforcement Location Factor	• Horizontal Reinforcement over ≥ 12" concrete • Other Reinforcement	1.3 1.0
β	Coating Factor	• Epoxy-coated bars with cover $<3d_b$ or clear spacing $<6d_b$ • All other epoxy-coated bars or wires • Uncoated bars • Maximum value of $\alpha\beta$	1.5 1.2 1.0 1.7
γ	Reinforcement Size Factor	• ≥ #7 bars • ≤ #6 bars and deformed wires	1.0 0.8 (?)
λ	Lightweight Aggregate Concrete Factor	• When lightweight aggregate concrete is used • When normal-weight concrete is used	1.3 1.0
c	Spacing or Cover Dimension (in)	• Bar center to nearest concrete cover • One-half the c/c spacing of bars	Smaller than both
K_{tr}	Transverse Reinforcement Index	S = Maximum spacing of transverse reinforcement A_{tr} = Area of all transverse reinforcement within S f_{tr} = Yield strength of transverse reinforcement, ksi n = No. of bars being developed along the plane of splitting	$A_{tr} f_{tr}/(1.5Sn)$

$$l_d/d_b = (3/40)\,(f_y/\sqrt{f_c'})\,(\alpha\beta\gamma\lambda)/\{(c + K_{tr})/d_b\}$$

where the term $(c + K_{tr})/d_b$ is ≤ 2.5.

Simplified Equations for Basic Development Length (Tension)

Condition	$(c + K_{tr})/d_b$	l_d
Avoid pullout failure (Experimentally derived limit)	2.5	$0.03\,(f_y/\sqrt{f_c'})d_b$
• Clear cover and Clear spacing ≥ d_b + Code required stirrups • Clear cover and Clear spacing ≥ $2d_b$	1.5	$0.05\,(f_y/\sqrt{f_c'})d_b$ (≥ #7 Bars) $0.04\,(f_y/\sqrt{f_c'})d_b$ (≤ #6 Bars and deformed wires) (?)

Bar Diameter and area

d (No.)	2	3	4	5	6	7	8	9	10
A_s (in^2)	0.05	0.11	0.20	0.31	0.44	0.60	0.79	1.00	1.27

d (mm)	8	10	12	16	19	22	25	28	31
A_s (in^2)	0.08	0.12	0.18	0.31	0.44	0.59	0.76	0.95	1.17

Shear Design

• $S = A_v f_v d/(V_{cu} - V_{ct}) = A_v f_v/\{(v_{cu} - v_c) b\}$ for vertical stirrups, and

$S = A_v f_v d\,(\sin\alpha + \cos\alpha)/(V_{cu} - V_c) = A_v f_v(\sin\alpha + \cos\alpha)/\{(v_{cu} - v_c) b\}$ for inclined stirrups

Summary of ACI Shear Design Provisions (Vertical Stirrups)

		USD	Additional Provisions
Design Shear Force		$V_n = V_u/\phi$ [$\phi = 0.75$]	Calculated at d from Support face
Min^m Section Depth		$V_s/8\sqrt{f_c'}b_w$	$f_y \le 60$ ksi
Allowable Concrete Shear, V_C		$2\sqrt{f_c'}\,bd$	$\sqrt{f_c'} \le 100$ psi $Vd/M \le 1.0$
No Stirrup		$V_u \le \phi V_c/2$	
Max^m Spacing		d/2, 24" $S = A_v f_y/50b_w$	To be halved if $V_s \ge 4\sqrt{f_c'}b_w d$ OR $V_w \ge 2\sqrt{f_c'}b_w d$ in WSD

Temperature and shrinkage reinforcement

Slabs with f_y = 40 or 50 ksi	0.0020
Slabs with f_y ≥ 60 ksi	$0.0018 \times (60/f_y) \ge 0.0014$

Minimum Thickness of One way Slab

Simply Supported	One end continuous	Both ends continuous	Cantilever
$L/20$	$L/24$	$L/28$	$L/10$

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering I — Course Code: CE 331
Time: 3 hours — Full Marks: 100

There are six (6) questions. Answer any five (5).

1. (a) With a neat diagram explain the sources of water. **[5]**
   (b) Explain the factors affecting per capita consumption. **[5]**
   (c) (i) A water supply company delivered an annual quantity of 10,000,000 m^3, assuming an average leakage of 20%. On the maximum consumption day, the registered delivery was as follows: **[7]**

Hour	1	2	3	4	5	6	7	8	9	10	11	12
m^3	989	945	902	727	844	1164	1571	1600	1775	1964	2066	2110
Hour	13	14	15	16	17	18	19	20	21	22	23	24
m^3	1660	1309	1091	945	1062	1455	1745	2139	2110	2037	1746	1018

Determine:
a. diurnal peak factors for the area,
b. the maximum seasonal variation factor.

   (ii) Calculate the total stream flow in gpm for a town having a population of 20,000. Assume that each stream will spray 200 gpm on the fire simultaneously. **[3]**

2. (a) Explain the hydrological cycle of water sources. **[5]**
   (b) Describe the working principle of Tara hand pump tubewell. **[5]**
   (c) (i) Design a suitable set of pumping unit to deliver 550000 gph from an intake well of a river bank to the treatment plant. Total length of rising main from the intake well to the treatment plant is 900 ft and the static hand is 65 ft. Design also the cast iron main. **[7]**

   Assume: Velocity of water = 10 fps
   Friction factor = 0.0075
   Efficiency = 70%

   (ii) Explain the working procedure of rotary pump. **[3]**

3. (a) Explain the criteria for the installation of aerators. **[5]**
   (b) With a neat diagram describe the operational mechanism of slow sand filter. **[5]**
   (c) *Calculate:* (i) Volume of basin; (ii) Power of rapid mixer; (iii) Volume of flocculation basin, using the following dataset. **[10]**

   1. Flow rates:
   (a) Maximum flow rate=113,500m^3/d
   (b) Average flow rate=57,900m^3/d

   2. Raw water quality:
   (a) Turbidity: 3-17 NTU
   (b) Seasonal Fe and Mn concentration: 0.2-0.7 mg/L and 0.05-0.4 mg/L
   (c) pH= 7.9-8.2
   (d) Total alkalinity: 80-110mg/L as $CaCO_3$
   (e) Total hardness: 100-120mg/L as $CaCO_3$

(f) Width of sedimentation basin 18.4 m

3. Chemicals:
(a) Coagulant: ferric sulfate, optimum dosage 25mg/L, maximum feed rate 60 mg/L. Application point is rapid mix basin.
(b) pH adjustment: $Ca(OH)_2$ is required to adjust pH 8 to 9 units. 15mg/L of $Ca(OH)_2$ is sufficient to provide optimum pH.
(c) $KMnO_4$: Needed for Fe, Mn precipitation.

4. Rapid Mix basin design parameters:
(a) Number of units= 4 basin
(b) Detention time = 20-30s
(c) G = 950/s

5. Flocculation basin design parameters:
(a) Number of basins=4
(b) Number of stages=3
(c) Detention time =30min total, 10min in each stage
(d) G=60/s

4. (a) What do you mean by break point chlorination? **[5]**
(b) Draw a flow diagram showing treatment for the raw water (W_1) having characteristics shown in the following table and also explain the steps of the flow diagram. Bangladesh standards for these parameters are also given in the following table. **[15]**

Parameter	Unit	W_1	
		Value	Bangladesh Standard
pH	---	6.3	--
Turbidity	NTU	28	25
Color	TCU	10	30
CO_2	ppm	75	15
Alkalinity, A	mg/L as $CaCO_3$	90	---
Hardness, H		120	
Fe	mg/L	0.7	1
As		0.08	0.05
BOD_5		18	10

5. (a) Classify and explain different water distribution methods. **[5]**
(b) Explain gate valves and butterfly valves employed in distribution networks. **[5]**
(c) Calculate the flow in each of the pipe in the following looped pipe network by Hardy-Cross method. Use the following equation and graph if required. **[10]**

$$\Delta = -\frac{\Sigma H}{x\Sigma \frac{H}{Q_a}}$$

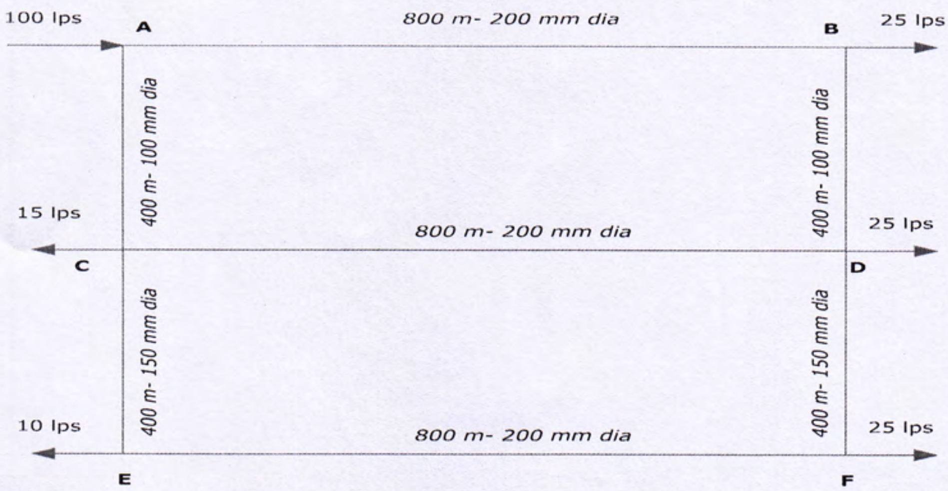


Figure: Looped network.

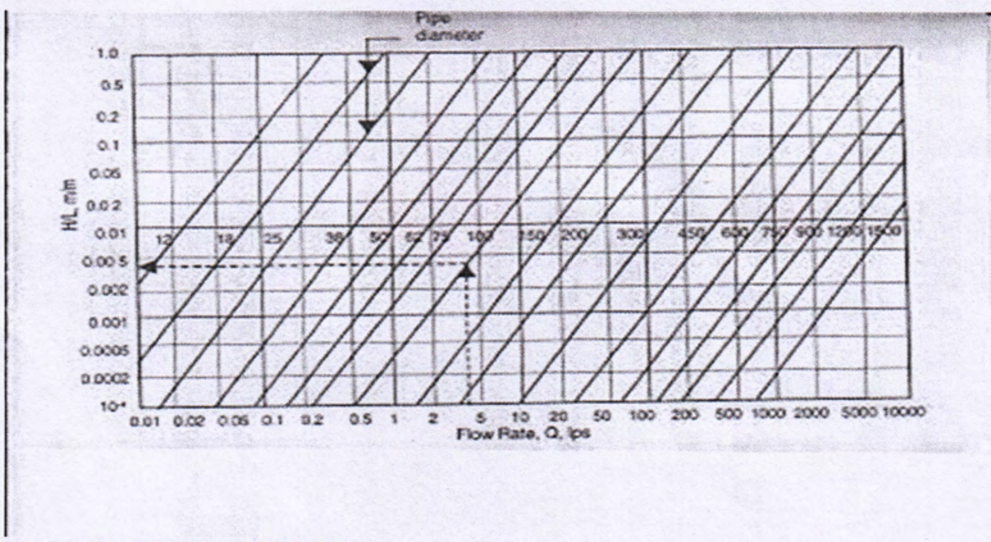


Figure: Determination of H/L.

6. (a) Illustrate the characteristics of private/public water supply management options. **[5]**
   (b) Write short notes on: (i) dug well and (ii) rain water harvesting. **[15]**

9. A simply supported beam shown in **Figure 7** of 20 ft clear span is to carry service dead load of 1.0 k/ft (including self-weight) and service live load of 1.5 K/ft. Reinforcement of the beam consists of 3 #11 bars (following USD method) at 12 in. effective depth. Center bar is to be discontinued where no longer required. Calculate the point where center bar can be discontinued according to ACI code provision. Given, $f'_c = 3$ ksi and $f_y = 60$ ksi. (10)

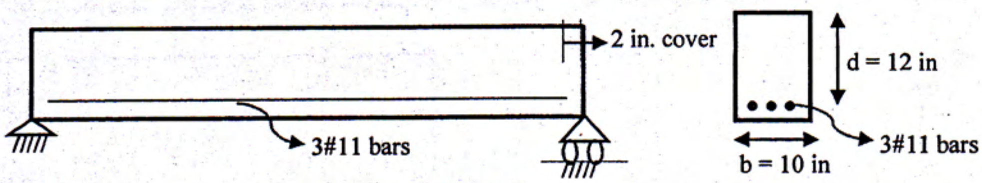
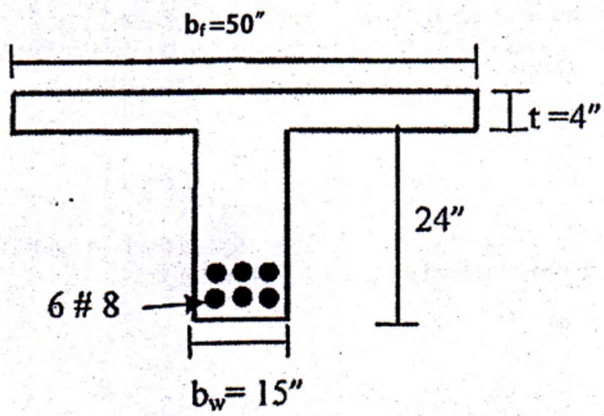


Figure 7

10. a)What are the factors affecting development length? (03)

b) Determine the design positive moment capacity of the following T-beam. Given that, $f'_c = 4$ ksi, fy= 60 ksi. (07)



6. A reinforced concrete one way slab is built integrally with its supports and consists of two equal spans. The slab panels are continuous in one direction and each panel has a clear span of 16ft is shown in Fig.5. The service live load is 100 psf and 4000 psi concrete is specified for using with steel with a yield stress equal to 60000 psi. Design the slab and show the reinforcement detailing. Use USD method. (10)

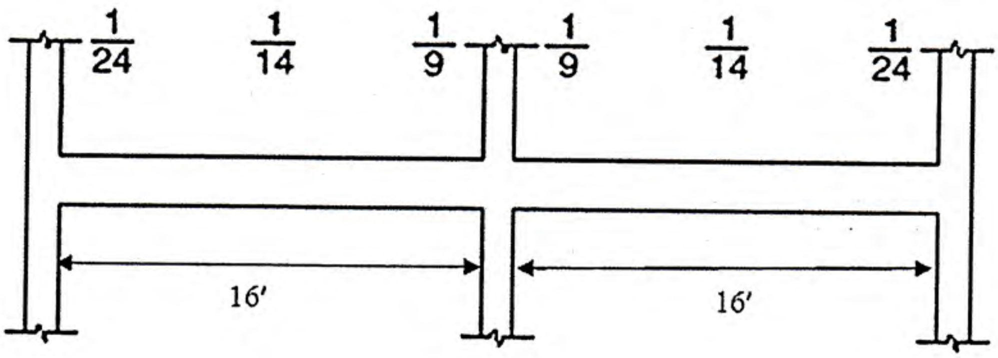


Figure 5

7. (a) Explain why temperature and shrinkage reinforcements are required in slabs. (03)

(b) A rectangular beam is to be designed to carry shear force V_u of 45 kips. Given, $f'_c = 4$ ksi, fy= 60 ksi and assuming effective beam depth is twice the size of beam width, determine the minimum cross-section of the beam according to ACI code provision. (07)

i. Considering no web reinforcement

ii. With minimum web reinforcement

8. Using vertical U stirrup with $f'_c = 4$ ksi, fy= 60 ksi, design the web reinforcement of the beam AB in the following figure 6 according to ACI-USD method. (10)

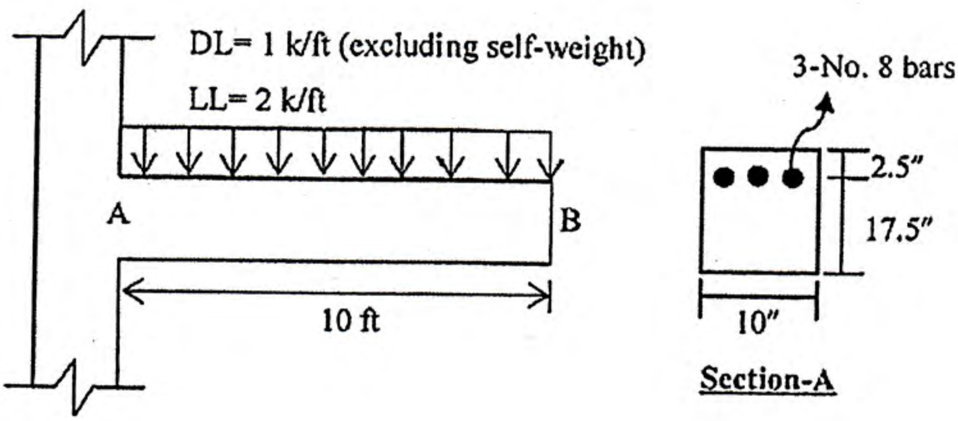


Figure 6

(b) Differentiate between WSD and USD method. (2)

4. (a) Explain the concept of over reinforced and under reinforced beams. Which one is preferable and why? (2.5)

(b) What is the balanced stress steel ratio? Derive the expression for balanced steel ratio (ρ_b). (2.5)

(c) Use the WSD method to design the simply supported RC beam AB shown in the **Figure 3** below as a singly reinforced beam excluding its self-weight. [Given: $f_c' = 4$ ksi, $f_s = 24$ ksi.] (5)

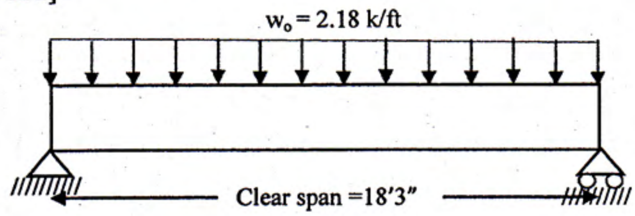


Figure 3

Part II

[Answer any **four** (04) out of following **six** (06) questions]
[Assume reasonable values for missing data]

5. Design a T beam for the floor system shown in Figure 4. Given, factored moment 650 k-ft, : $f_c' = 3000$ psi, $f_y = 60000$ psi, n=9 and span of the beam= 24 ft. Use USD method. (10)

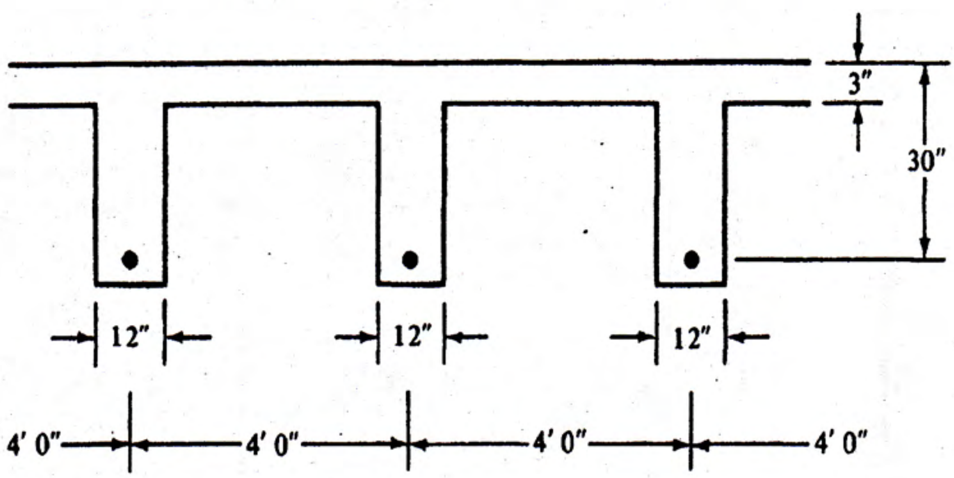


Figure: 4

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures I | Course Code: CE 315(Section A)
Time: 3 hours | Full Marks: 70 (= 7 × 10)

Answer **Part I and Part II** on separate answer scripts

[Assume reasonable values for missing data]

Part I

[Answer any **three** (03) out of following **four** (04) questions]

1. (a) Discuss the behavior of reinforced concrete regular beam in flexure under increasing load by drawing neat sketches for strain and stress distribution of uncracked, cracked and ultimate conditions. (3)

(b) Calculate (i) Cracking moment and (ii) stresses in concrete and steel caused by a bending moment M=100 kip-ft for the following singly reinforced RC beam section shown in **Figure 1**. Given, $f'_c = 4$ ksi, $f_y = 60$ ksi, $f_s = 24$ ksi, $f_c = 0.45f'_c$. (7)

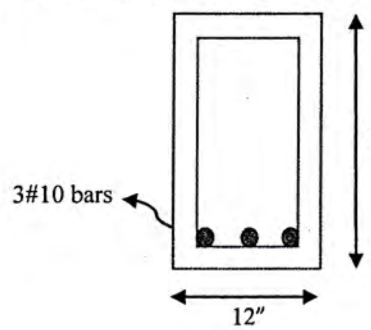


Figure 1

2. A rectangular concrete beam of width b = 24 in. is limited by architectural considerations to a maximum total depth of h = 16 in. It must carry a total factored load of M_u = 450 kip-ft. Use USD method to design the flexural reinforcement for this member using compression steel if necessary. Allow 3 inches cover of the bars from the compression or tension face of the beam. Given, material strengths are f'_c = 4000 psi, f_y = 72500 psi. (10)

3. (a) Compute the design moment capacity (φM_n) of the beam section shown in **Figure 2** and calculate the maximum live load 'W_{LL}' which will safely resist such moment in the beam. Use appropriate load factor and include self-weight of the beam in your calculation. Given, f'_c = 5000 psi, f_y = 60000 psi. (8)

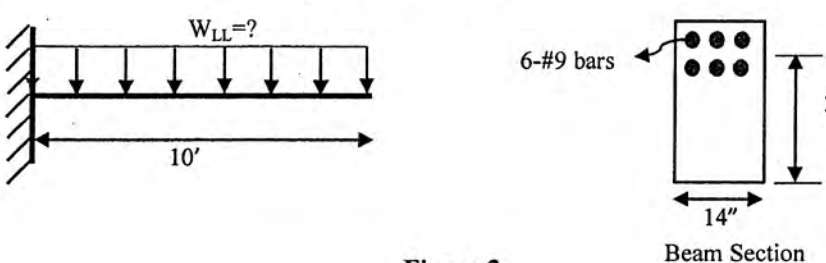


Figure 2

ANNEXURE

Earthquake

$$V = (ZIC/R)\,W$$
$$C = 1.25\,S/T^{2/3}$$
$$T = C_t (h_n)^{3/4}$$
$$F_x = (V - F_t)\,[w_x h_x / \Sigma w_i h_i]$$

Table: Site Coefficient for seismic Lateral forces

Soil Type	S
S_1	1
S_2	1.2
S_3	1.5
S_4	2

Table: Response Modification Coefficient for Structural Systems

Basic Structural System	Description of Lateral Force Resisting System	R
Moment Resisting Frame System	SMRF (steel)	12
	SMRF (concrete)	12
	IMRF	8
	OMRF (steel)	6
	OMRF (concrete)	5

C_t = 0.083 for steel moment resisting frames
= 0.073 for reinforced concrete moment resisting frames,
= 0.049 for all other structural systems

Z = 0.075, 0.15 and 0.25 for Seismic Zones 1, 2 and 3 respectively

Seismic Dead Load

Seismic dead load W is the total dead load of a building or a structure including permanent partitions. A minimum of 25 percent of the floor live load should be considered.

Wind

$$q_z = C_C C_I C_z V_b^2$$
$$p_z = C_G C_p q_z$$

Table: Structure Importance Coefficient

Category	C_I or I
Essential facilities	1.25
Hazardous facilities	1.25
Special occupancy	1.00
Standard occupancy	1.00
Low-risk structure	0.80

Table: Combined height and Exposure Coefficient

Height z (ft)	C_z		
	Exp A	Exp B	Exp C
0~15	0.368	0.801	1.196
50	0.624	1.125	1.517
100	0.849	1.371	1.743
150	1.017	1.539	1.890
200	1.155	1.671	2.002
300	1.383	1.876	2.171
400	1.572	2.037	2.299
500	1.736	2.171	2.404
650	1.973	2.357	2.547
1000	2.362	2.595	2.724

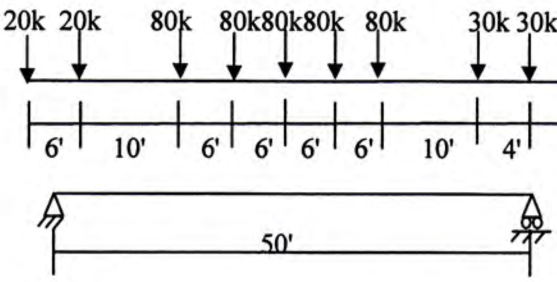
Table: Overall Pressure Co-efficient (C_P) for rectangular buildings with flat roof

h/B	L/B					
	0.1	0.5	0.65	1.0	2.0	≥ 3.0
≤ 0.5	1.40	1.45	1.55	1.40	1.15	1.10
1.0	1.55	1.85	2.00	1.70	1.30	1.15
2.0	1.80	2.25	2.55	2.00	1.40	1.20
≥ 4.0	1.95	2.50	2.80	2.20	1.60	1.25

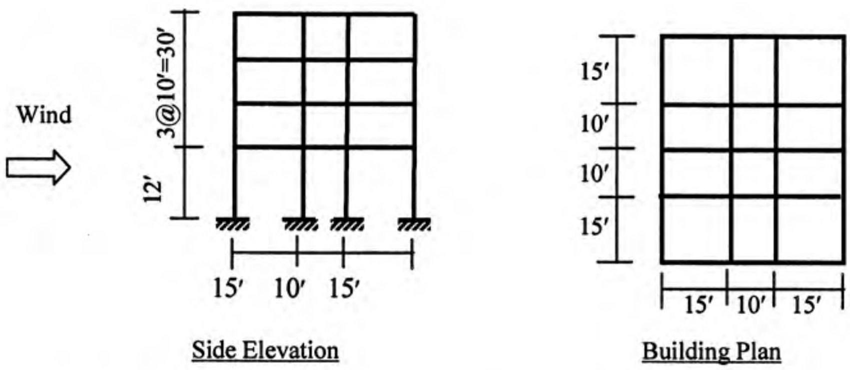
Table: Gust Response Factors

Height z (ft)	C_G (for non-slender structures)		
	Exp A	Exp B	Exp C
0~15	1.654	1.321	1.154
50	1.418	1.215	1.097
100	1.309	1.162	1.067
150	1.252	1.133	1.051
200	1.215	1.114	1.039
300	1.166	1.087	1.024
400	1.134	1.070	1.013
500	1.111	1.057	1.005
650	1.082	1.040	1.000
1000	1.045	1.018	1.000

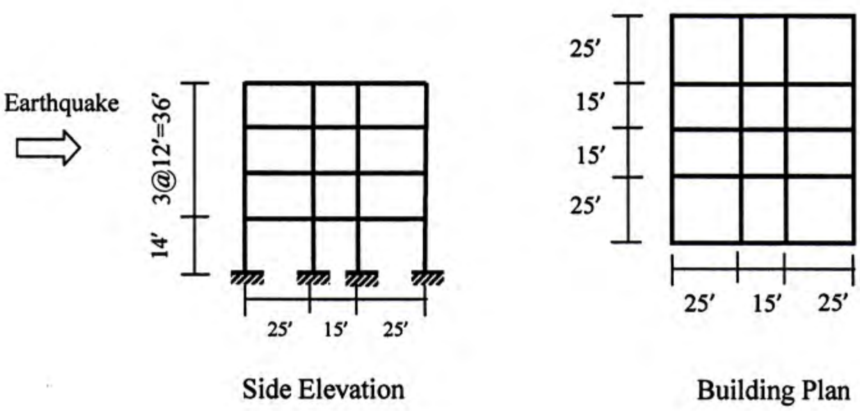
11. Calculate the maximum value of reaction at left support of the simply supported beam for the wheel load arrangement shown below. [10]



12. Calculate the wind load at each story of a four-storied hospital building (shown below) located at a flat terrain in Dhaka(Basic Wind Speed 130mph). Assume the structure to be subjected to Exposure B. [10]



13. Calculate the seismic concentrated load at each story of a four-storied concrete made Garments Factory (shown below) located in Dhaka (Z=0.15). Assume the structure to be an Ordinary Moment Resisting Frame (OMRF) built on soil condition S_2, carrying a Dead Load of 200 lb/ft^2 and Live load of 60 lb/ft^2. [10]

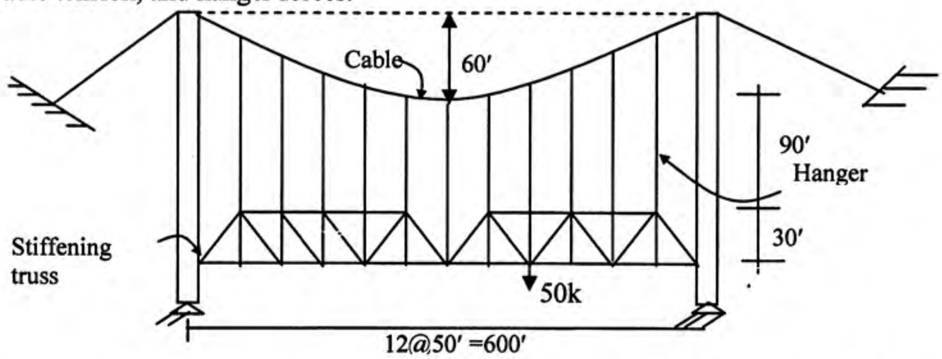


Part B

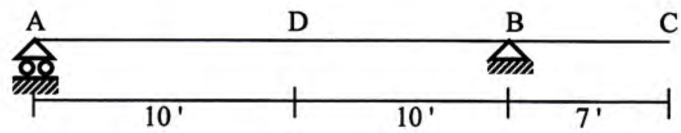
*There are **eight (08)** questions in this part. Answer any **six (06)**.*
Assume any missing data reasonably.

6. State and derive the General Cable Theorem. [10]

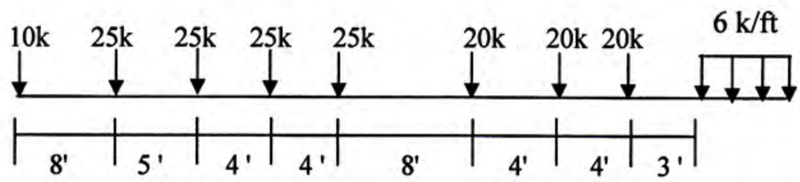
7. Refer to the statically determinate suspension bridge shown below. Determine the maximum cable tension, and hanger forces. [10]



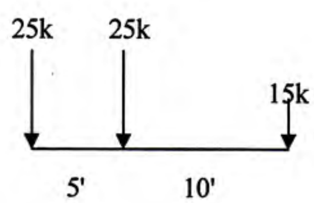
8. Calculate the maximum shear force at A, B and bending moment at D, B for the beam shown below, for a Dead Load of 3 k/ ', and moving Live Load of 2.0 k/ '. [10]

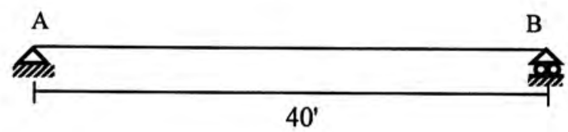


9. Calculate the maximum bending moment at the one-third point of a simply supported beam of span 70 ft due to the wheel loads shown in the figure below.

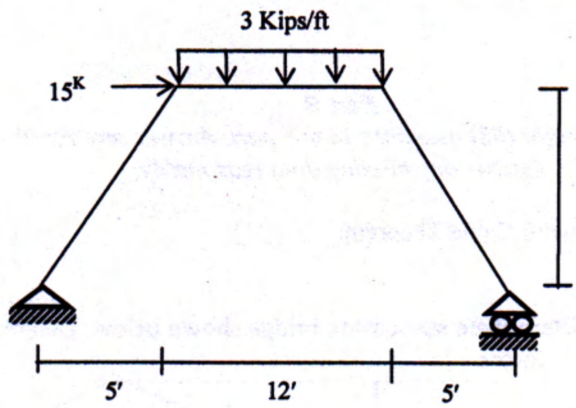


10. Determine the value of Absolute maximum moment of the 40' beam AB for the wheel load shown below. [10]

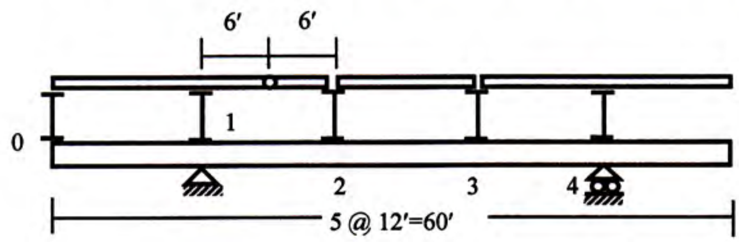




5. **Draw the shear force and bending moment diagrams for the frame shown in figure below.** **[10]**



2. Draw influence lines for floor beam reaction at 1, floor beam reaction at 2, shear in panel 2-3, moment at panel point 2 of the girder with floor beam system shown in figure below. [10]

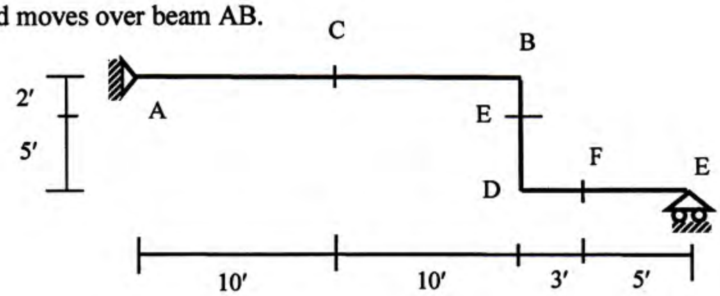


3. For the frame shown below draw influence lines for [10]

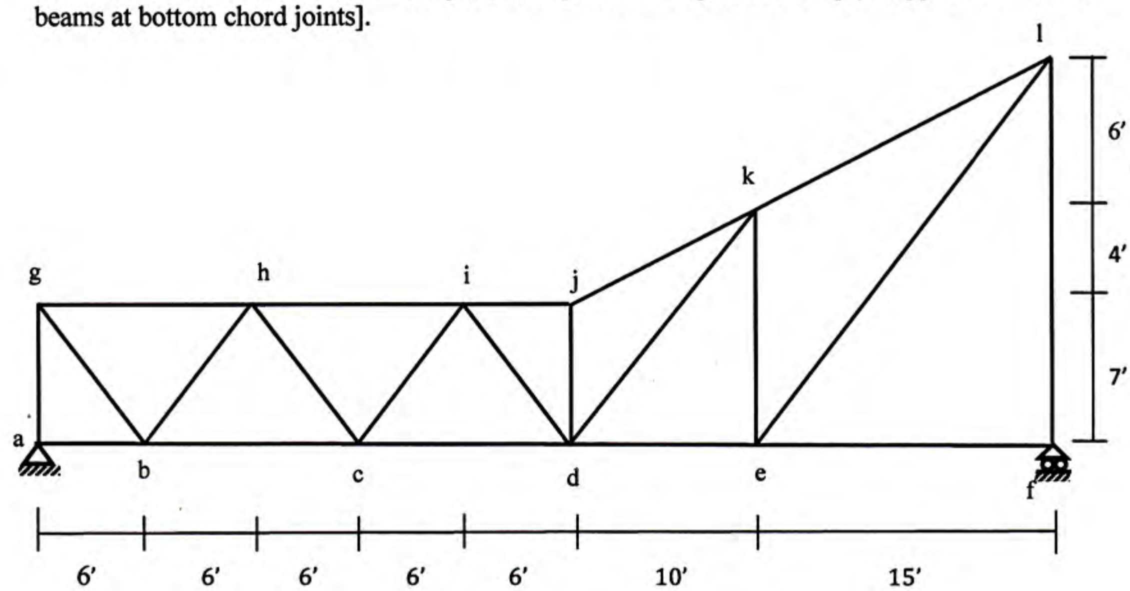
(a) Bending Moment at C and E

(b) Shear Force at C and F

Unit load moves over beam AB.



4. Determine degree of static indeterminacy of the truss shown below and also draw the influence lines for the forces in the members jk, de, ci [Note: Stringers are simply supported on floor beams at bottom chord joints]. [10]



University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B. Sc. Engineering (Civil)

Course Title: Structural Engineering I | Course Code: CE 311 (Section B)
Time: 3.00 Hours | Full Marks: 100 (=10×10)

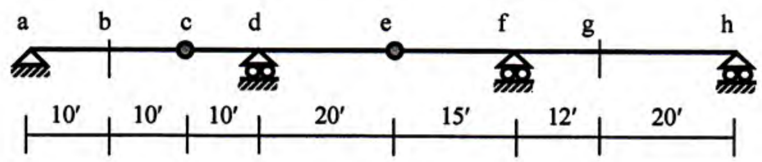
Part A

*There are **five (05)**questions in this part. Answer any **four (04)**.*
Assume any missing data reasonably.

1.(a) Draw influence lines for [10]

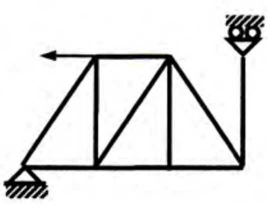
(a) Bending moment at b
(b) Bending moment at d
(c) Shear force at the right of d
(d) Shear force at g
(e) Shear force at the left of f
(f) Vertical reaction at d
(g) Vertical reaction at h

for the beam shown below. c and e are internal hinges.



(b) Determine the degree of static indeterminacy (DOSI) and static stability of the following structures.

(i)



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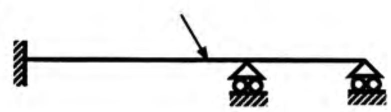
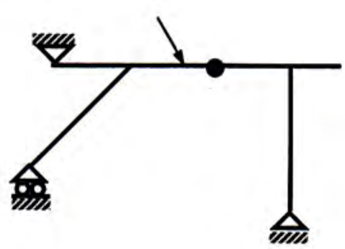


(iii)



Q.2. The management of Martinez Engineering Company has asked for your assistance in deciding whether to continue manufacturing or to buy hallow bricks from an outside supplier for building construction. An analysis of the accounting records and the production data revealed the following information for the year ending December 31, 2016:

a) The Machinery Department produced 36,000 units of bricks.
b) Each brick unit requires 10 minutes to produce. Three people in the Machinery Department work full time (2,000 hours per year) producing Brick. Each person is paid $11.00 per hour.
c) The cost of materials per brick unit is $2.00.
d) Manufacturing overhead costs directly applicable to the production of bricks are: indirect labor, $5,500; utilities, $1,300; depreciation, $1,600; property taxes and insurance, $1,000. All of the costs will be eliminated if brick is purchased.
e) The lowest price for bricks from an outside supplier is $3.90 per unit. Shipping charges will be $0.30 per unit, and a part-time receiving clerk at $8,500 per year will be required.
f) If brick is purchased, the excess space will be used to store Martinez's finished product. Currently, Martinez rents storage space at approximately $0.60 per unit stored per year. Approximately 6,000 units per year are stored in the rented space.

INSTRUCTIONS:

A. Prepare an incremental analysis for the make-or-buy decision. Should Martinez make or buy the bricks? Why?
B. Prepare an incremental analysis, assuming the released facilities can be used to produce $10,000 of net income in addition to the savings on the rental of storage space. What decision should now be made?

Q.3. Kathleen Jo is the advertising manager for Arup Real Estate Ltd. She is currently working on a major promotional campaign for newly built commercial spaces. Her ideas include the installation of a new lighting system and increased display space that will add $24,000 in fixed costs to the $210,000 currently spent. In addition, Kathleen is proposing that a 6.67% price decrease (from $30 to $28) will produce an increase in sales volume from 16,000 to 20,000 sqft. Variable costs will remain at $15 per sqft.

Management is impressed with Kathleen's ideas but concerned about the effects that these changes will have on the break-even point and the margin of safety.

INSTRUCTIONS:

A. Compute the current break-even point in units (sqft), and compare it to the break-even point in units if Kathleen's ideas are used.
B. Compute the margin of safety ratio for current operations and after Kathleen's changes are introduced. (Round to nearest full percent.)
C. Prepare a CVP income statement for current operations and after Kathleen's changes are introduced. Would you make the changes suggested? **(4+4+4.5)**

Q.4. The following data were taken from the records of Directpro Engineers Ltd. for the year ended December 31, 2015.

Raw Material, 1/1/15	$90,000	Factory Insurance	$40,000
Raw Material, 31/12/15	60,000	Factory -Depreciation	162,000

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall-2016
Program: B.Sc. Engg (3rd year 1st semester)

Course Title : Principles of Accounting	Course: ACN 301	Credit	: 2.0
Time : 2 hours		Full marks	: 50

[N.B.: There are six questions in this question paper. Answer any four from the followings]

Q.1. Selected financial data of Target and Wal-Mart for a recent year are presented here (in millions).

	Target Corporation	Wal-Mart Stores, Inc.
Income Statement Data for Year 2016		
Net sales	$61,471	$374,526
Cost of goods sold	41,895	286,515
Selling and administrative expenses	16,200	70,847
Interest expense	647	1,798
Other income (expense)	1,896	4,273
Income tax expense	1,776	6,908
Net income	**$ 2,849**	**$ 12,731**
Balance Sheet Data (End of Year 2016)		
Current assets	$18,906	$ 47,585
Noncurrent assets	25,654	115,929
Total assets	**$44,560**	**$163,514**
Current liabilities	$11,782	$ 58,454
Long-term debt	17,471	40,452
Total stockholders' equity	15,307	64,608
Total liabilities and stockholders' equity	**$44,560**	**$163,514**
Beginning-of-Year Balances		
Total assets	$37,349	$151,587
Total stockholders' equity	15,633	61,573
Current liabilities	11,117	52,148
Total liabilities	21,716	90,014
Other Data		
Average net receivables	$ 7,124	$ 3,247
Average inventory	6,517	34,433
Net cash provided by operating activities	4,125	20,354

INSTRUCTIONS:

For each company, compute the following ratios and make comment about the two company's performance from the comparison of those ratios:

- **A.** Current Ratio = Current Assets/Current Liabilities
- **B.** Asset turnover = Revenue/ Average Assets
- **C.** Return on assets = Net Income/ Average Assets
- **D.** Debt to total assets = Total Liabilities/ Total Assets
- **E.** Profit margin = Net income/ Revenue **(12.5)**

Finished Goods, 1/1/15	260,000	Raw material purchases	750,000
Finished Goods, 31/12/15	210,000	Administrative Expense	270,000
Work in process, 1/1/15	180,000	Sales	2,500,000
Work in process, 31/12/15	100,000	Utilities, Factory	36,000
Direct labor	150,000	Supplies, Factory	15,000
Indirect labor	300,000	Maintenance, Factory	87,000
Selling Expenses	140,000		

INSTRUCTION:

A. Prepare a cost of goods manufactured schedule of Directpro Engineers Ltd. for the year ended, December 31, 2015. (6.5)

B. Prepare an income statement for the year ended, December 31, 2015. (6.0)

Q.5. Theta Company is considering three capital expenditure projects. Relevant data for the projects are as follows:

Project	Investment	Annual Income	Life of the Project
22A	$250,000	$14,300	6 years
23A	270,000	21,000	9 years
24A	288,000	20,000	8 years

Annual income is constant over the life of the project. Each project is expected to have zero salvage value at the end of the project. Theta Company uses the straight-line method of depreciation.

INSTRUCTION:

If Theta Company's required rate of return is 12%, which projects are acceptable? **(12.5)**

Q.6. The bank statement for Laird Company shows a balance per bank of **$15,907.45** on April 30, 2016. On this date the balance of cash per books is **$11,589.45.**

Items to be reconciled:

Deposits in transit: April 30 deposit (received by bank on May 1). $2,201.40

Outstanding checks: 5,904

Errors: Laird wrote check no. 443 for $1,226 and the bank correctly paid that amount. However, Laird recorded the check as $1,262

Bank memoranda not recorded in book:

a. NSF check from J. R. Baron for $425.60

b. Charge for printing company checks $30

c. Collection of note receivable for $1,000 plus interest earned $50, less bank collection fee $15.

INSTRUCTIONS:

Prepare a bank reconciliation statement for the month of April 2016. (12.5)

TABLE 2 Present Value of $1

$$PV = \frac{\$1}{(1+i)^n}$$

n/i	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	20.0%
1	0.99010	0.98522	0.98039	0.97561	0.97087	0.96618	0.96154	0.95694	0.95238	0.94787	0.94340	0.93458	0.92593	0.91743	0.90909	0.90090	0.89286	0.83333
2	0.98030	0.97066	0.96117	0.95181	0.94260	0.93351	0.92456	0.91573	0.90703	0.89845	0.89000	0.87344	0.85734	0.84168	0.82645	0.81162	0.79719	0.69444
3	0.97059	0.95632	0.94232	0.92860	0.91514	0.90194	0.88900	0.87630	0.86384	0.85161	0.83962	0.81630	0.79383	0.77218	0.75131	0.73119	0.71178	0.57870
4	0.96098	0.94218	0.92385	0.90595	0.88849	0.87144	0.85480	0.83856	0.82270	0.80722	0.79209	0.76290	0.73503	0.70843	0.68301	0.65873	0.63552	0.48225
5	0.95147	0.92826	0.90573	0.88385	0.86261	0.84197	0.82193	0.80245	0.78353	0.76513	0.74726	0.71299	0.68058	0.64993	0.62092	0.59345	0.56743	0.40188
6	0.94205	0.91454	0.88797	0.86230	0.83748	0.81350	0.79031	0.76790	0.74622	0.72525	0.70496	0.66634	0.63017	0.59627	0.56447	0.53464	0.50663	0.33490
7	0.93272	0.90103	0.87056	0.84127	0.81309	0.78599	0.75992	0.73483	0.71068	0.68744	0.66506	0.62275	0.58349	0.54703	0.51316	0.48166	0.45235	0.27908
8	0.92348	0.88771	0.85349	0.82075	0.78941	0.75941	0.73069	0.70319	0.67684	0.65160	0.62741	0.58201	0.54027	0.50187	0.46651	0.43393	0.40388	0.23257
9	0.91434	0.87459	0.83676	0.80073	0.76642	0.73373	0.70259	0.67290	0.64461	0.61763	0.59190	0.54393	0.50025	0.46043	0.42410	0.39092	0.36061	0.19381
10	0.90529	0.86167	0.82035	0.78120	0.74409	0.70892	0.67556	0.64393	0.61391	0.58543	0.55839	0.50835	0.46319	0.42241	0.38554	0.35218	0.32197	0.16151
11	0.89632	0.84893	0.80426	0.76214	0.72242	0.68495	0.64958	0.61620	0.58468	0.55491	0.52679	0.47509	0.42888	0.38753	0.35049	0.31728	0.28748	0.13459
12	0.88745	0.83639	0.78849	0.74356	0.70138	0.66178	0.62460	0.58966	0.55684	0.52598	0.49697	0.44401	0.39711	0.35553	0.31863	0.28584	0.25668	0.11216
13	0.87866	0.82403	0.77303	0.72542	0.68095	0.63940	0.60057	0.56427	0.53032	0.49856	0.46884	0.41496	0.36770	0.32618	0.28966	0.25751	0.22917	0.09346
14	0.86996	0.81185	0.75788	0.70773	0.66112	0.61778	0.57748	0.53997	0.50507	0.47257	0.44230	0.38782	0.34046	0.29925	0.26333	0.23199	0.20462	0.07789
15	0.86135	0.79985	0.74301	0.69047	0.64186	0.59689	0.55526	0.51672	0.48102	0.44793	0.41727	0.36245	0.31524	0.27454	0.23939	0.20900	0.18270	0.06491
16	0.85282	0.78803	0.72845	0.67362	0.62317	0.57671	0.53391	0.49447	0.45811	0.42458	0.39365	0.33873	0.29189	0.25187	0.21763	0.18829	0.16312	0.05409
17	0.84438	0.77639	0.71416	0.65720	0.60502	0.55720	0.51337	0.47318	0.43630	0.40245	0.37136	0.31657	0.27027	0.23107	0.19784	0.16963	0.14564	0.04507
18	0.83602	0.76491	0.70016	0.64117	0.58739	0.53836	0.49363	0.45280	0.41552	0.38147	0.35034	0.29586	0.25025	0.21199	0.17986	0.15282	0.13004	0.03756
19	0.82774	0.75361	0.68643	0.62553	0.57029	0.52016	0.47464	0.43330	0.39573	0.36158	0.33051	0.27651	0.23171	0.19449	0.16351	0.13768	0.11611	0.03130
20	0.81954	0.74247	0.67297	0.61027	0.55368	0.50257	0.45639	0.41464	0.37689	0.34273	0.31180	0.25842	0.21455	0.17843	0.14864	0.12403	0.10367	0.02608
21	0.81143	0.73150	0.65978	0.59539	0.53755	0.48557	0.43883	0.39679	0.35894	0.32486	0.29416	0.24151	0.19866	0.16370	0.13513	0.11174	0.09256	0.02174
24	0.78757	0.69954	0.62172	0.55288	0.49193	0.43796	0.39012	0.34770	0.31007	0.27666	0.24698	0.19715	0.15770	0.12640	0.10153	0.08170	0.06588	0.01258
25	0.77977	0.68921	0.60953	0.53939	0.47761	0.42315	0.37512	0.33273	0.29530	0.26223	0.23300	0.18425	0.14602	0.11597	0.09230	0.07361	0.05882	0.01048
28	0.75684	0.65910	0.57437	0.50088	0.43708	0.38165	0.33348	0.29157	0.25509	0.22332	0.19563	0.15040	0.11591	0.08955	0.06934	0.05382	0.04187	0.00607
29	0.74934	0.64936	0.56311	0.48866	0.42435	0.36875	0.32065	0.27902	0.24295	0.21168	0.18456	0.14056	0.10733	0.08215	0.06304	0.04849	0.03738	0.00506
30	0.74192	0.63976	0.55207	0.47674	0.41199	0.35628	0.30832	0.26700	0.23138	0.20064	0.17411	0.13137	0.09938	0.07537	0.05731	0.04368	0.03338	0.00421
31	0.73458	0.63031	0.54125	0.46511	0.39999	0.34423	0.29646	0.25550	0.22036	0.19018	0.16425	0.12277	0.09202	0.06915	0.05210	0.03935	0.02980	0.00351
40	0.67165	0.55126	0.45289	0.37243	0.30656	0.25257	0.20829	0.17193	0.14205	0.11746	0.09722	0.06678	0.04603	0.03184	0.02209	0.01538	0.01075	0.00068

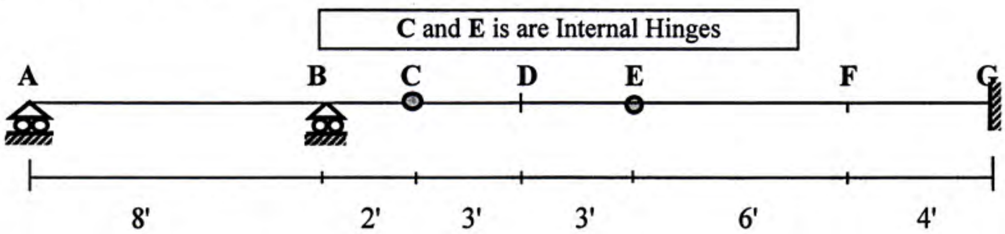
University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B. Sc. Engineering (Civil)

Course Title: Structural Engineering I — Course Code: CE 311 (Section A)
Time: 3.00 Hours — Full Marks: 100 (=10×10)

Part A

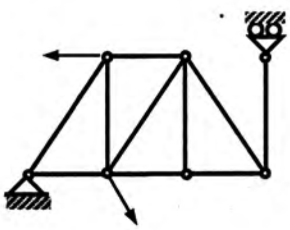
*There are **five (05)** questions in this part. Answer any **four (04)**.*
Assume any missing data reasonably.

1.(a) Draw the influence lines for- [10]
(i) Shear at sections taken an infinitesimal distance to the left and right of support B.
(ii) Moment at B and F.
(iii)Reaction at G and B



(b) Determine degree of static indeterminacy (DOSI) and static stability of the following structures.

(i)



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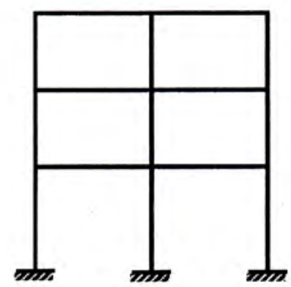
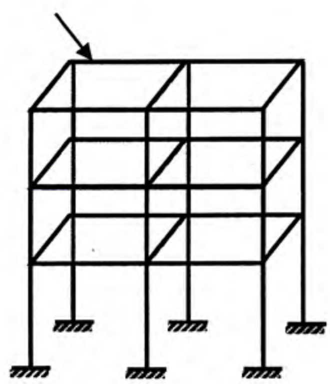


(iii)



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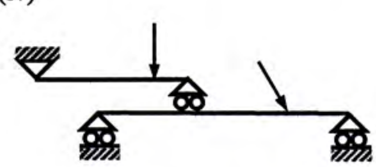
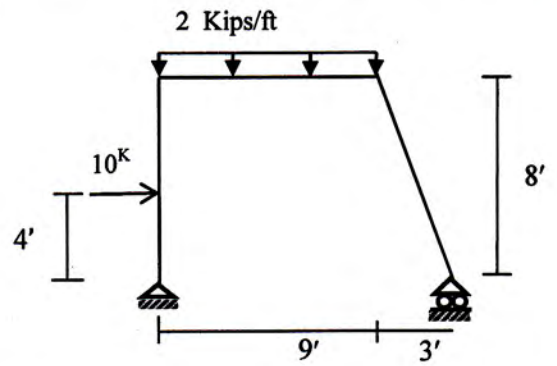
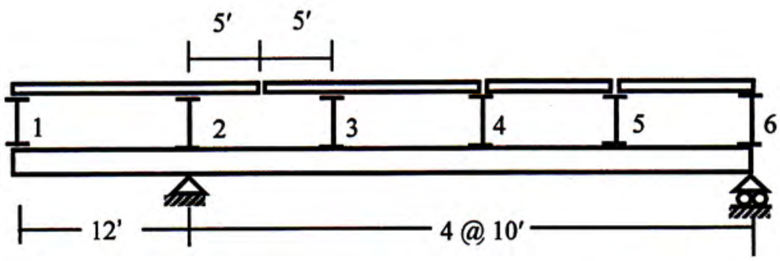


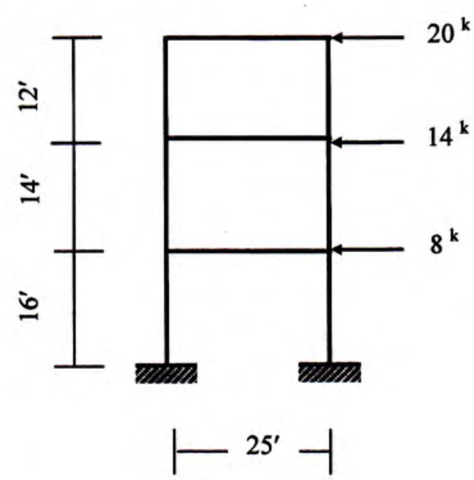
2. Draw the shear force and bending moment diagrams for the frame shown in figure below. [10]



3. Draw influence lines for shear in panel 2-3, moment at panel point 3 of the girder with floor beam system shown in figure below. [10]

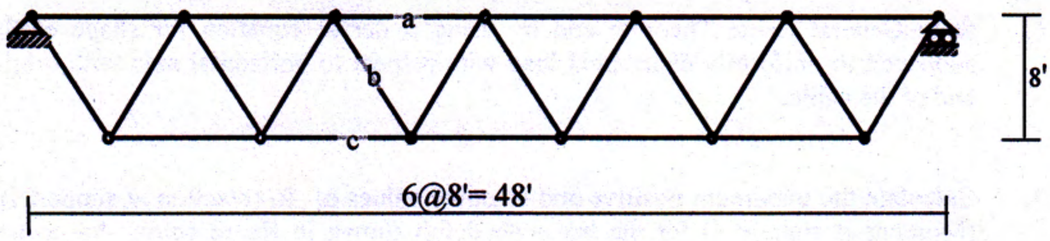


4. Draw shear force and bending moment diagrams of beams and columns of the three-storied frame subjected to lateral load as shown in the figure, assuming (i) equal share of storey shear forces between columns, (ii) internal hinge at column midspans [10]



5. **For the truss shown below, draw the influence line for forces in member a, b and c. [Load is moving along top cord.]**

[10]

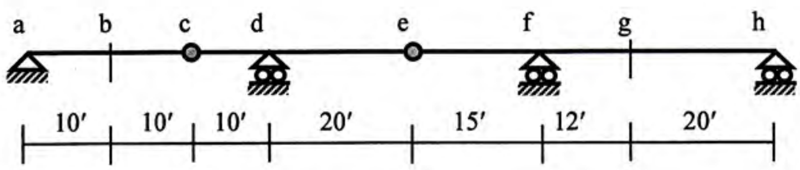


Part B

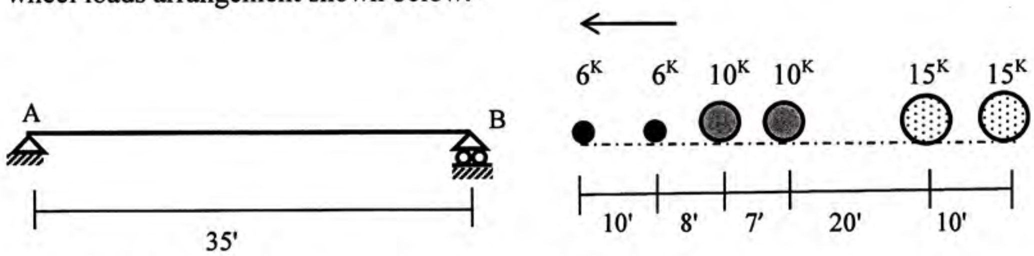
*There are **eight (08)** questions in this part. Answer any **six (06)**.*
Assume any missing data reasonably.

6. State General Cable Theorem and by using it derive equation for shape of the cable subjected to uniformly distributed load with respect to horizontal axis with origin at left end of the cable. [10]

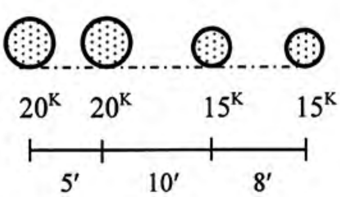
7. Calculate the maximum positive and negative values of R_f (reaction at support f) and M_f (Moment at support f) for the beam abcdefgh shown in figure below due to uniformly distributed dead load 2 k/ft, a moving uniformly distributed live load 1 k/ft and a moving concentrated load of 10 k. [10]



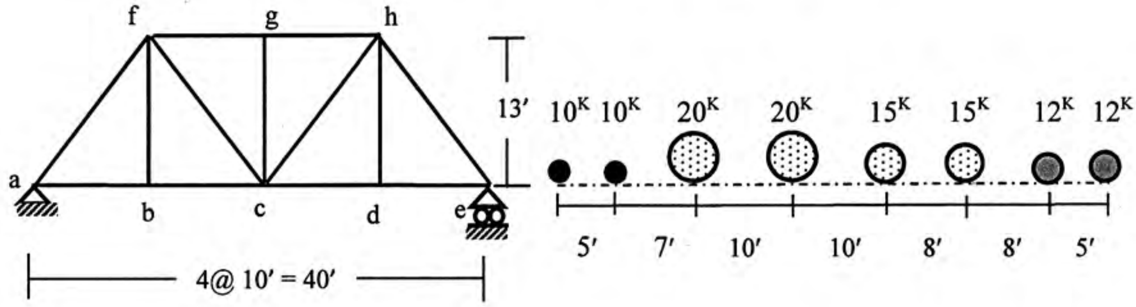
8. Calculate the maximum reaction at support A of a simply supported beam AB for the wheel loads arrangement shown below. [10]



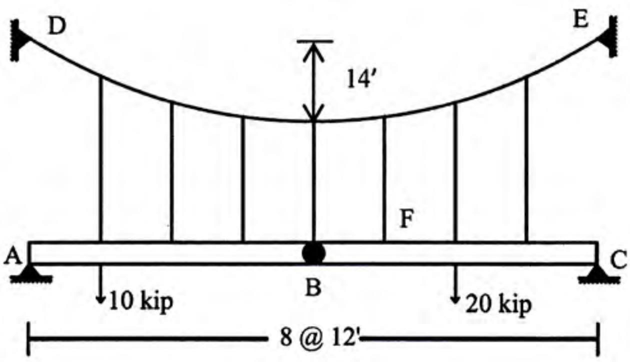
9. Compute the greatest maximum moment of a 50′ simply supported beam for the wheel arrangement shown in figure below.



10. Compute the maximum tension in the member bc of the parallel chord truss due to moving wheel loads shown in figure below. Loads move on the span from right to left. [10]

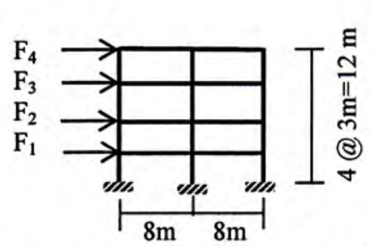


11. Determine the maximum cable tension, tension force in each hanger and bending moment at F of the stiffening girder of suspension bridge shown in figure below. B is an internal hinge. [10]

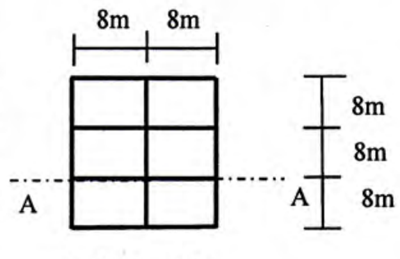


12. Four storied RCC hospital building frame A-A is shown below with the plan of the building. Assume the structure to be an Ordinary Moment Resisting Frame (OMRF), built on Soil condition S_3, carrying a Dead Load including partition of 8 kN/m^2 and floor live load of 2 kN/m^2. [10]

Determine Seismic zone coefficient and seismic base shear force if F_4 =70 KN due to earthquake.

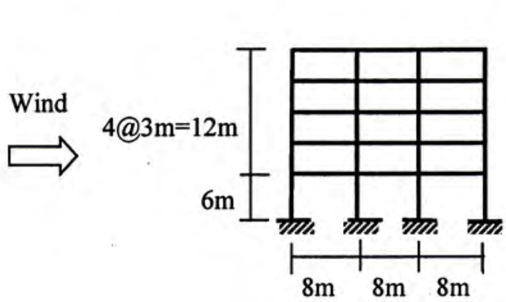


Side Elevation (Frame A-A)

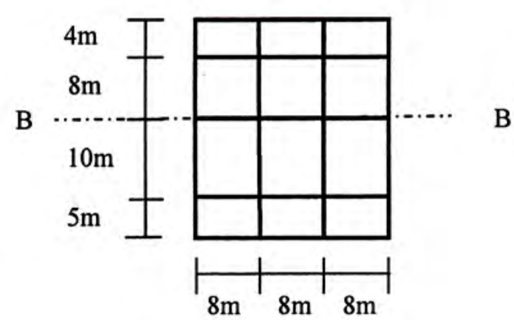


Building Plan

13. Calculate the wind load at frame B-B of a five-storied concrete made Industrial building (shown below) located at a flat terrain in Kishoreganj (Basic wind speed = 207 Kmph). Assume the structure to be subjected to Exposure B. [10]



Side Elevation



Plan

ANNEXURE

Earthquake

$$V = (ZIC/R)\,W$$
$$C = 1.25\,S/T^{2/3}$$
$$T = C_t (h_n)^{3/4}$$
$$F_x = (V - F_t)\,[w_x h_x / \Sigma w_i h_i]$$

Table: Site Coefficient for seismic Lateral forces

Soil Type	S
S_1	1
S_2	1.2
S_3	1.5
S_4	2

Table: Response Modification Coefficient for Structural Systems

Basic Structural System	Description of Lateral Force Resisting System	R
Moment Resisting Frame System	SMRF (steel)	12
	SMRF (concrete)	12
	IMRF	8
	OMRF (steel)	6
	OMRF (concrete)	5

C_t = 0.083 for steel moment resisting frames
= 0.073 for reinforced concrete moment resisting frames,
= 0.049 for all other structural systems

Z = 0.075, 0.15 and 0.25 for Seismic Zones 1, 2 and 3 respectively

Seismic Dead Load

Seismic dead load W is the total dead load of a building or a structure including permanent partitions. A minimum of 25 percent of the floor live load should be considered.

Wind

$$q_z = C_C\, C_I\, C_z\, V_b^2$$
$$p_z = C_G\, C_p\, q_z$$

Table: Structure Importance Coefficient

Category	C_I or I
Essential facilities	1.25
Hazardous facilities	1.25
Special occupancy	1.00
Standard occupancy	1.00
Low-risk structure	0.80

Table: Combined height and Exposure Coefficient

Height, z (m)	Combined Height and Exposure Coefficient, C_z		
	Exp A	Exp B	Exp C
0~4.5	0.368	0.801	1.196
6.0	0.415	0.866	1.263
9.0	0.497	0.972	1.370
12.0	0.565	1.055	1.451
15.0	0.624	1.125	1.517
18.0	0.677	1.185	1.573
21.0	0.725	1.238	1.623
24.0	0.769	1.286	1.667
27.0	0.810	1.330	1.706
30.0	0.849	1.371	1.743

Table: Overall Pressure Co-efficient (C_P) for rectangular buildings with flat roof

h/B	L/B					
	0.1	0.5	0.65	1.0	2.0	≥ 3.0
≤ 0.5	1.40	1.45	1.55	1.40	1.15	1.10
1.0	1.55	1.85	2.00	1.70	1.30	1.15
2.0	1.80	2.25	2.55	2.00	1.40	1.20
≥ 4.0	1.95	2.50	2.80	2.20	1.60	1.25

Table: Gust Response Factors

Height z (m)	C_G (for non-slender structures)		
	Exp A	Exp B	Exp C
0~4.5	1.654	1.321	1.154
6.0	1.592	1.294	1.140
9.0	1.511	1.258	1.121
12.0	1.457	1.233	1.107
15.0	1.418	1.215	1.097
18.0	1.388	1.201	1.089
21.0	1.363	1.189	1.082
24.0	1.342	1.178	1.077
27.0	1.324	1.170	1.072
30.0	1.309	1.162	1.067