University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2023
Program: B.Sc. in Civil Engineering

B-1

Course Title: Principles of Accounting		Course Code: ACN 301
Time: 2 hours	Credit Hour: 2	Full Marks: 50

Instruction: **Submit your question inside your answer script.**

There are **Four** questions in this paper. **Answer Q no. One (1), Two (2)** and any one from the remaining.

1. a) Why do we analyze financial statements? Justify with examples. **6**

   b) The comparative statements of Sun Company are presented below: **14**

Sun Company
Balance sheet
On December 31, 2020

	2020(Taka)	2019(Taka)
Assets:		
Current assets		
Cash	24,000	30,000
Short- term investments	28,000	15,000
Accounts receivables (net)	86,000	74,000
Inventory	100,000	70,000
Total Current Assets	238,000	189,000
Fixed Assets	423,000	393,000
Total Assets	**Tk 661,000**	**Tk. 582,000**
Liabilities and Stockholder's Equity:		
Current liabilities		
Accounts payable	126,000	122,000
Income tax payable	23,000	22,000
Total Current Liabilities	149,000	144,000
Long term liabilities		
Bond payable	119,000	80,000
Total Liabilities	268,000	224,000
Stockholders' equity		
Common stock (Tk 5 par)	160,000	148,000
Retained earnings	233,000	210,000
Total stockholders' equity	393,000	358,000
Total Liabilities & Stockholders' Equity	**Tk 661,000**	**Tk 582,000**

Other Information:

	2020 (Taka)	2019 (Taka)
Net Sales	1,000,000	720,000
Cost of Goods Sold	450,000	542,000
Net Income	50,400	310,400

Compute the following ratios of 2020:

i. Current ratio
ii. Receivables turnover
iii. Average collection period
iv. Profit margin
v. Asset turnover
vi. Return on assets
vii. Debt to total assets

2. a) Define fixed expense and variable expense with examples. **3**

b) Moon Products distributes a single product, a woven basket whose selling price is 60 Taka per unit and whose variable expense is 35 Taka per unit. The company's monthly fixed expense is 5,000 Taka. **8**

i. Calculate the company's break-even point in unit sales.
ii. Calculate the company's break-even point in Taka sales.
iii. If the company's fixed expenses increase by 3000 Taka, what would become the new break-even point in unit sales? In Taka sales?

c) XYZ Corporation has a single product whose selling price is 90 Taka per unit and whose variable expense is 55 Taka per unit. The company's monthly fixed expense is 10,000 Taka. **4**

i. Calculate the unit sales needed to attain a target profit of 20,000 Taka.
ii. Calculate the dollar sales needed to attain a target profit of 45,000 Taka.

3. a) What is cash basis and accrual basis of accounting? **5**

b) Prepare the adjusting entries of following transactions: **10**

	Debit (tk)	Credit (tk)
Prepaid insurance	3,600	
Supplies	2,800	
Equipment	25,000	
Accumulated depreciation- equipment		8,400
Notes payable		20,000
Unearned rent revenue		10,200
Rent revenue		60,000
Interest expense	1000	
Salaries and wages expense	14,000	

i. The equipment depreciates Taka 400 per month.
ii. One-third of the unearned rent revenue was earned during the quarter.
iii. Interest of Taka 500 is accrued on the notes payable.
iv. Supplies on hand total Taka 900.
v. Insurance expires at the rate of Taka 200 per month.

4. a) Define indirect expense and product cost. Give two examples of each. **5**

b) Moon Architecture firm has the following information on May 31,2022: **10**

Cash TK 5,000	Notes Payable TK 30,000
Accounts Receivable 4,900	Rent Expense 1,200
Equipment 70,000	Maintenance and Repairs Expense 400
Service Revenue 10,000	Gasoline Expense 2,500
Advertising Expense 600	Insurance Expense 400
Accounts Payable 35,000	Owner's capital 10,000

a. Prepare an income statement.
b. Prepare an owner's equity statement.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2023
Program: B. Sc. Engineering (Civil)

Course: Structural Engineering I | **Course Code: CE 311**
Time:1.5+1.5=3 Hours | **Full Marks: 50+50=100**

Answer all the Questions of both Part A & Part B
Assume any missing data reasonably (If required)

Use separate Answer Script for each part

Part– A

1. Analyze the simply supported girder shown in **Figure 1** for the following wheel load and Calculate the Maximum Bending Moment at 21ft from left support of the girder. [12]

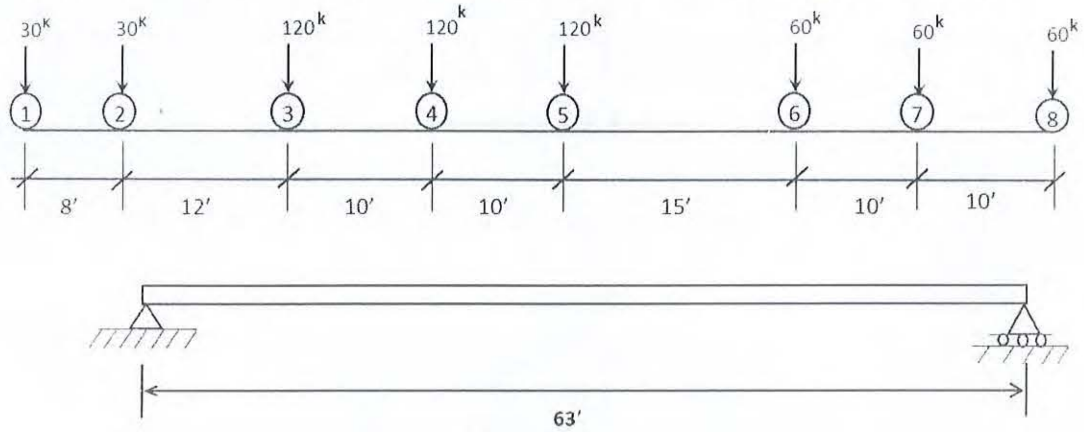


Figure 1

2. Analyze the simply supported girder shown in **Figure 2** for the following wheel load and Calculate the Maximum Shear at Quarter point from left support of the girder. [13]

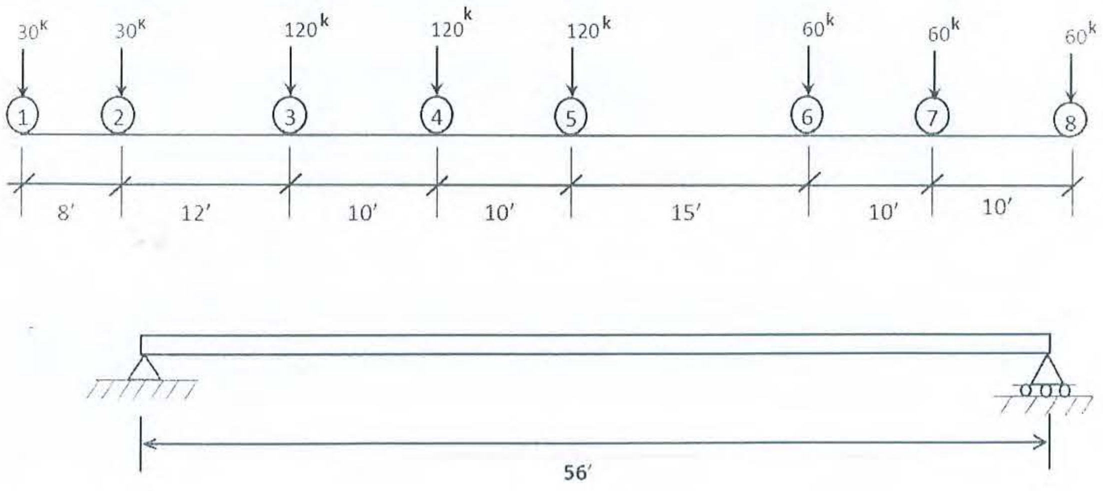


Figure 2

3. Analyze the floor beam with girder structure shown in **Figure 3** and Draw Influence Line Diagram for girder reaction at Z (right support), moment at point D and F of the girder and shear in panel D-E of the girder. [13]

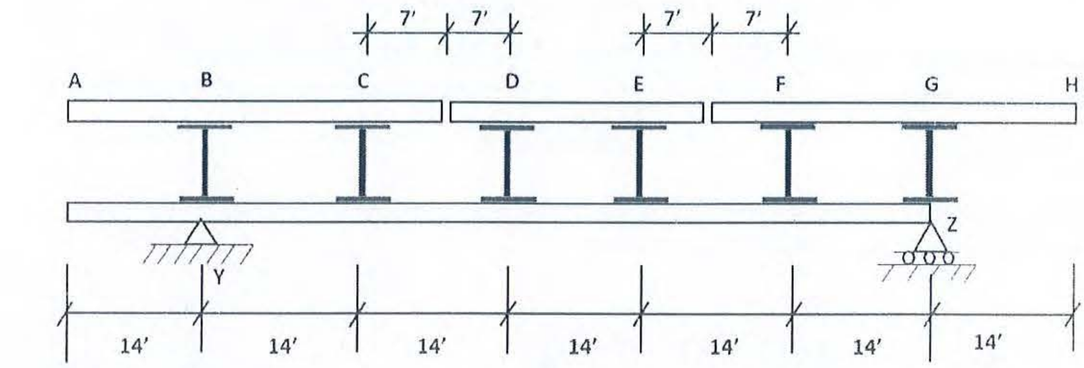


Figure 3

4. Analyze the truss shown in **Figure 4** and draw influence line diagram of member U_4U_5, U_3L_2, L_4L_5 and U_6L_6. [12]

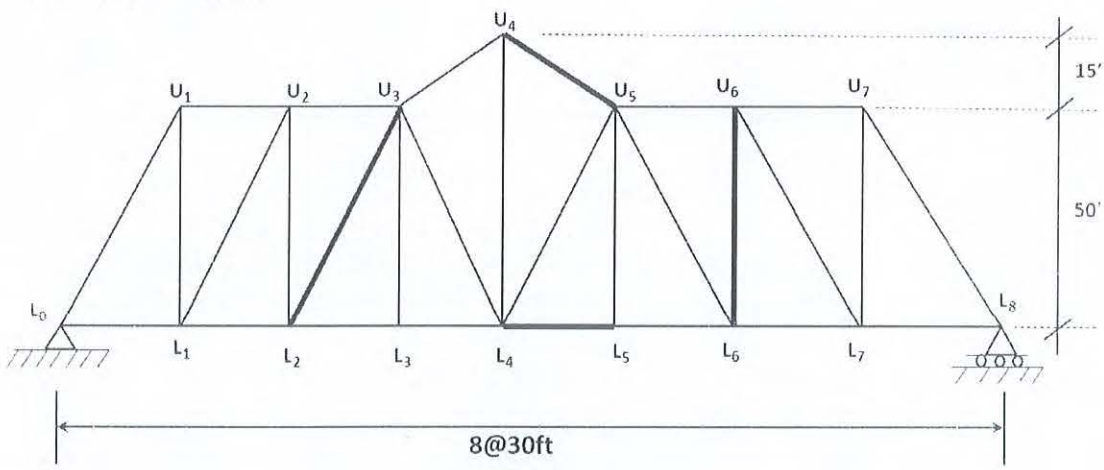


Figure 4

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2023
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering I | Course Code: CE 311
Time: 1.5 hours | Credit Hour: 3.0 | Full Marks: 50

ANSWER ALL QUESTIONS. Assume any missing data reasonably.

PART-B

1. Analyze the frame as shown in ***Fig.B1*** to draw the shear force and bending moment diagram [17]

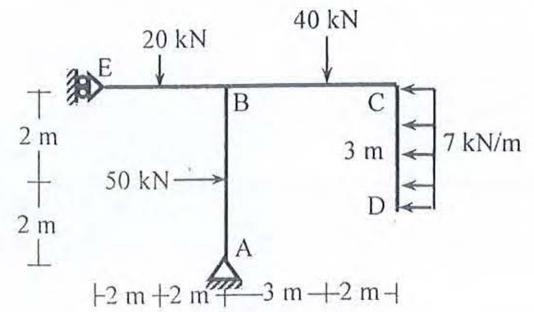


Fig.B1

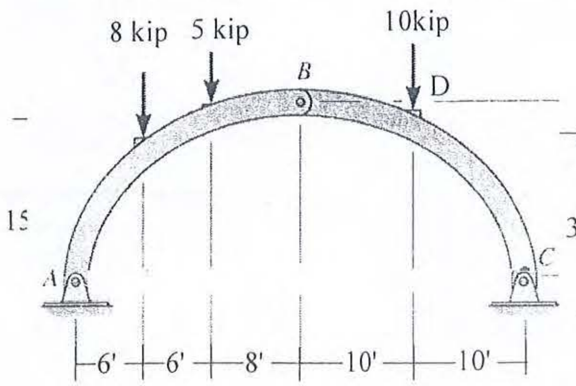


Fig.B2

2. The three-hinged arch is subjected to the loading shown in ***Fig.B2***. Analyze the arch to determine the reactions at *A* and *C*, and find the bending moment at *D*. [5]

3. Analyze a cable-suspended bridge is shown in ***Fig.B3***. The Ends of the cables are attached to saddles on the roller at the top of the piers. Determine the followings:
   i) maximum cable tension
   ii) maximum hanger tension
   iii) maximum anchor tension
   iv) maximum axial force, shear force, and bending moment in Piers. [18]

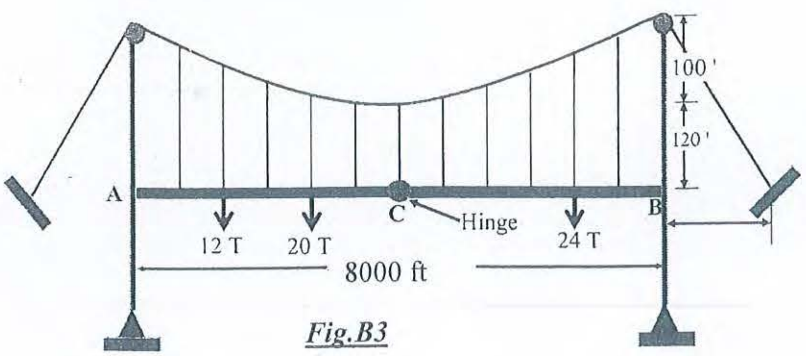


Fig.B3

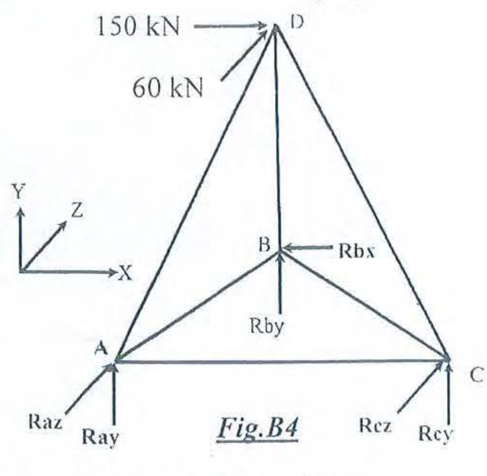


Fig.B4

4. Analyze the space truss shown in ***Fig.B4*** to determine the reactions and member force of *CD*. [Nodal Coordinates (m) are A(0,0,0), B(10,0,15), C(20,0,0) and D(10,20,10)]. [10]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2023
Program: B. Sc. Engineering (Civil)

Course: Design of Concrete Structures I **Course Code: CE 315**

Time: 3 Hours **Full Marks:100**

Assume any required data reasonably (If necessary)

1.

a) State the differences among under-reinforced, balanced and over-reinforced design conditions of a beam. Select the preferable one with justification. **(4)**

b) Define web shear crack and flexural crack. State the types of shear reinforcement with appropriate figures. **(3)**

c) State the functions of tie and spiral reinforcements in reinforced concrete column. **(2)**

d) Describe the reasons of providing temperature and shrinkage reinforcements in one-way slab. **(2)**

e) Draw the neat sketches of cut off or bend points of bars for equal spans of beam with uniformly distributed loads. **(3)**

2.

A beam section is limited to a width of 300mm and depth of 600 mm due to architectural reason. The beam has to resist a design moment of 500kN-m. Design the beam for flexure considering safety and environmental conditions of code (BNBC 2020) **(16)**

Given: Fy = 420 MPa
fc′ =28 MPa
$\beta_1 = 0.85$
$\varphi=0.9$

3.

A rectangular beam, shown in figure 1 has a width of 35.5cm & effective depth to the centroid of the tension reinforcement of 57cm. The tension reinforcement consists of six No.10 bars in two rows. Compression reinforcement consists of three No.8 bars are placed 6.35 cm from the compression face of the beam. Analyze the beam and calculate the moment resisting capacity of the beam. **(12)**

Given:

$F_y = 420$ MPa
$f_c' = 34.5$ MPa

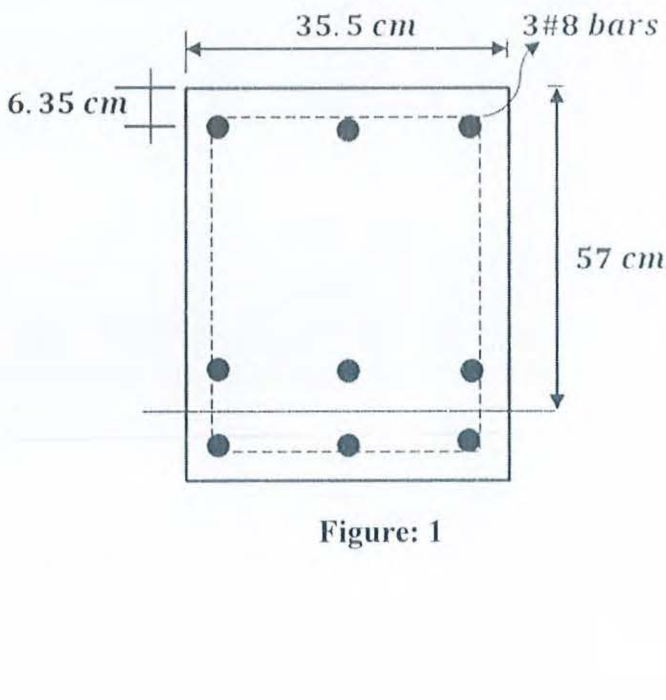


Figure: 1

4. A floor system, shown in Figure 2 consists of a 150mm concrete slab supported by continuous T beams of 8m span (simply supported). Cross section of the beams 280mm x 500mm as shown in Figure 2. At mid span, there are 3#9 bars at the bottom. Analyze the T-beam for flexure and calculate the nominal and design positive moment capacity of the beam at mid span. Given: fc′ =28 MPa, Fy = 420 MPa. **(12)**

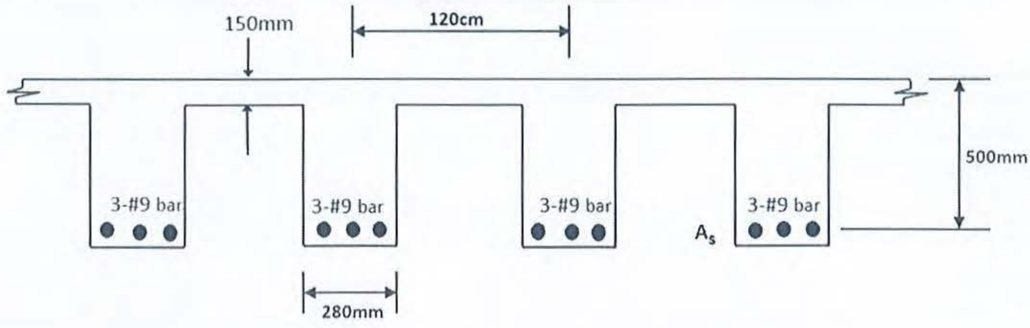


Figure:2

5. A simply supported beam (as shown in Figure 3) carries live load of 25kN/m, dead load of 30kN/m (excluding self-weight of beam) and 20 kN point load at the middle of the span. Design the beam for shear. Provide shear reinforcement details for design shear force and minimum shear reinforcement. Use Fy = 420 MPa and fc′ =28 MPa. **(16)**

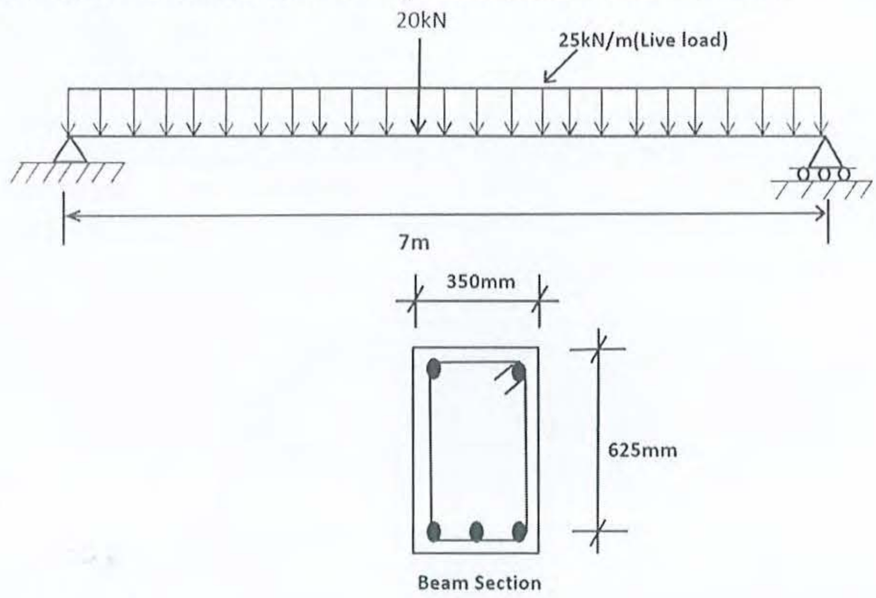


Figure:3

6. A beam section as shown in Figure 4 is made of normal density concrete and reinforced with 2-#11 bars, whereas the reinforcement required from structural analysis is 2.90 in^2, in addition to 4-#3 stirrups@3"c/c, followed by #3 stirrups @5" c/c. Cross section of the column is 21"× 16". **(12)**

Analyze the beam and calculate the development length as well as splice length of the column rebar as per BNBC. Use Fy = 420 MPa and fc′ =28 MPa.

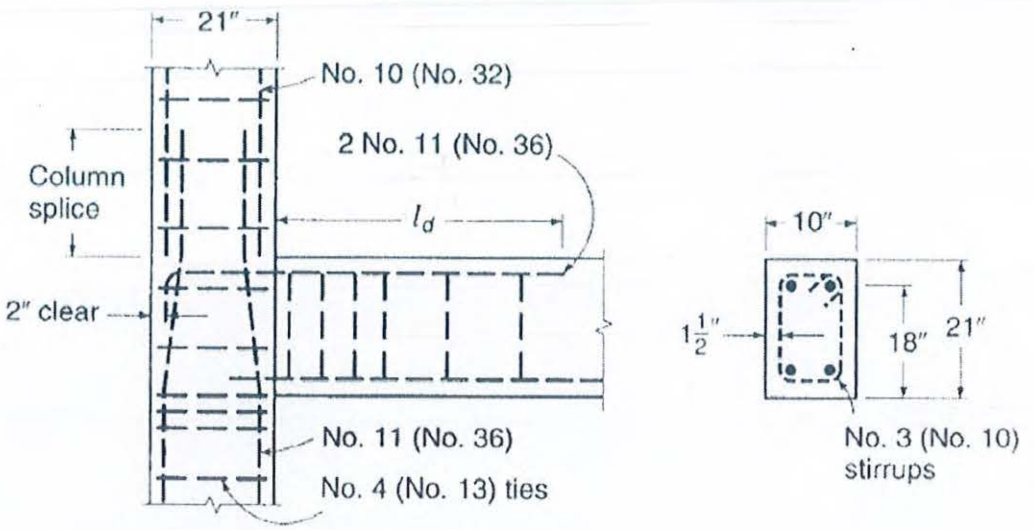


Figure:4

7. A reinforced concrete slab is built integrally with its supports and consists of two equal spans, each with a clear span of 6m as shown in figure 5. The service live load of the slab is 2.4kN/m^2, the concrete strength of 28 MPa and yield strength of steel 420 MPa would be used in design. Design the slab, following the provision of BNBC. Design moment of slab could be obtained using the approximate method shown in annexure. **(18)**

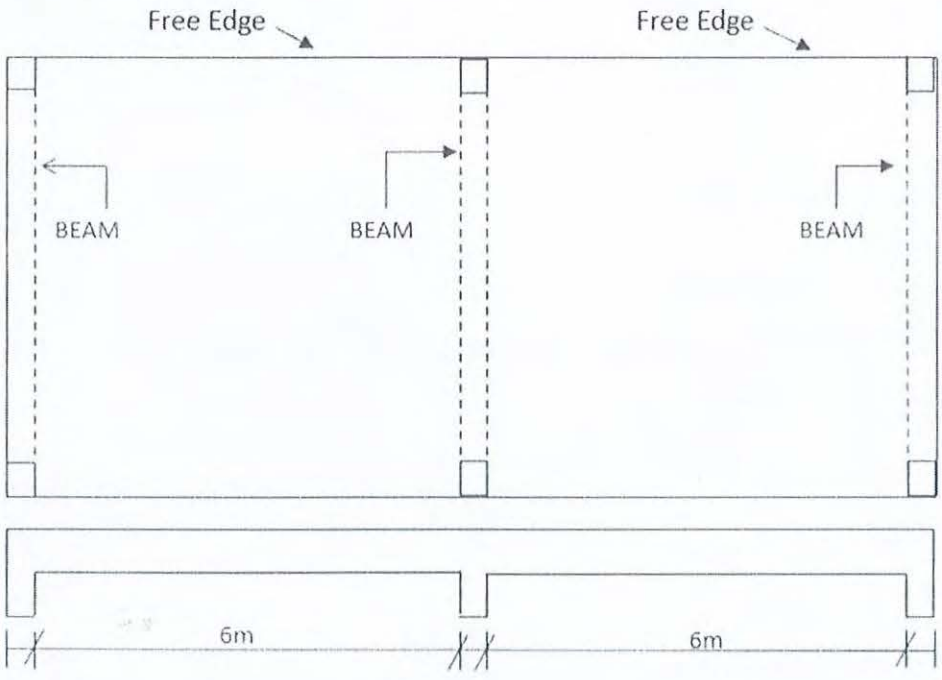


Figure:5

Formulae for CE 315

Singly Reinforcement Beam

$W_u = 1.2DL + 1.6LL$

$M_u = \frac{WL^2}{8}$

$\rho_{0.005} = 0.85 \times \beta_1 \times \frac{fc'}{fy} \times \frac{\epsilon_u}{\epsilon_u + \epsilon_y}$

$a = \frac{Asfy}{0.85fc'b}$; $a = \beta_1 C$

$M_u = \Phi As f_y (d - \frac{a}{2})$

Development Length

$l_d = \frac{1}{25}\frac{fy}{\vartheta\sqrt{fc'}}\psi_t\psi_e d_b \rightarrow$ for $\leq$#6no bar

$l_d = \frac{1}{20}\frac{fy}{\vartheta\sqrt{fc'}}\psi_t\psi_e d_b \rightarrow$ for $\geq$#7no bar

reduce $\rightarrow l_d \frac{A_s(req)}{A_s(prov)}$

spacing $< 3d_b \rightarrow 0.8 \times l_d$

cc of hook is $>$2mm $\rightarrow 0.7 \times l_{dh}$

Development Length of Hook

$l_{dh} = \frac{1}{50}\frac{fy}{\vartheta\sqrt{fc'}}\psi_e d_B$

$MF = \frac{A_s(req)}{A_s(prov)}$

$l_d = \frac{1}{50}\frac{fy}{\vartheta\sqrt{fc'}} d_B$ [column development length]

Lap length

$f_y < 60$ ksi: $l_{lap} = 0.0005\, f_y d_B \geq 12"$

$f_y > 60$ ksi: $l_{lap} = (0.0009\, f_y - 24) d_B \geq 12"$

If spiral tie: $l_{lap} \times 0.75 \geq 12"$

If square tie $l_{lap} \times 0.83 \geq 12"$

$A_{tie} \geq 0.0015\, h_c$

Doubly Reinforcement Beam

$\frac{\epsilon u}{c} = \frac{\epsilon s'}{c - d'}$; $\rho = \frac{A_s}{bd}$; $\rho' = \frac{A_s'}{bd}$

$\rho_{cy} = 0.85\beta_1 \frac{fc'}{fy}\frac{d'}{d}\frac{\epsilon_u}{\epsilon_u - \epsilon_y} + \rho'$

if $\rho \geq \rho_{cy} \rightarrow fs' = fy$

$a = \frac{(As - As')fy}{0.85fc'b}$

$M_n = As' f_y (d - d') + (As - As') f_y (d - \frac{a}{2})$

if $\rho < \rho_{cy} \rightarrow fs' < fy$

$As f_y = 0.85 fc' \beta_1 cb + As' Es \epsilon_u \frac{c - d'}{c}$

$a = \beta_1 c$

$f_s' = Es\epsilon_s' = E_s \epsilon_u \frac{c - d'}{c}$

$M_n = A_s' f_s' (d - d') + (A_s f_y - As' f_s')(d - \frac{a}{2})$

T-Beam

$a = \frac{Asfy}{0.85fc'b}$

$a < h_f \rightarrow$ Rectabgular Beam

$a > h_f \rightarrow$ T-beam

Symmertical T-beams:

- $b < 16h_f + b_w$
- $b <$ span/4
- $b <$ c/c beam spacing

$M_{n1} = A_f f_y (d - \frac{h_f}{2})$; $A_{sf} = \frac{\{0.85 fc' h_f (b - bw)\}}{f_y}$

$M_{n2} = (A_s - A_{sf}) f_y (d - \frac{a}{2})$; $a = \frac{(As - Asf) fy}{0.85 fc' bw}$

$M_n = M_{n1} + M_{n2}$; $M_u = \Phi M_n$

Shear Design

Shear Design

$V_c = 2\lambda\sqrt{fc'}bwd$

$\Phi V_c = 0.75\ V_c$

$V_u < (\frac{1}{2}\ \Phi V_c)$ = no shear rebar

$\frac{1}{2}\ \Phi V_c < V_u < \Phi V_c$ = Minimum shear rebar

$V_u > \Phi V_c$ = Design the stirrups/ shear rebar

$V_u = \Phi V_c + \Phi V_s$

$$\frac{Av}{S_{min}} = \frac{Vu - \Phi Vc}{\Phi dfyt}$$

$\Phi V_s = V_u - \Phi V_c$

$4\Phi\sqrt{fc'}bwd \rightarrow_{x2} 8\Phi\sqrt{fc'}bwd$

i) $\Phi V_s < 4\Phi\sqrt{fc'}b_w d$

$$S_{max} = \frac{d}{2}$$
$$= 24"$$
$$= \frac{A_v f_{yt}}{0.75\sqrt{fc'}bw}$$
$$= \frac{A_v f_{yt}}{50bw}$$

ii) $4\Phi\sqrt{fc'}bwd < \Phi V_s < 8\Phi\sqrt{fc'}bwd$

$$S_{max} = \frac{d}{4}$$
$$= 12"$$
$$= \frac{A_v f_{yt}}{0.75\sqrt{fc'}bw}$$
$$= \frac{A_v f_{yt}}{50bw}$$

iii) $\Phi V_s > 8\Phi\sqrt{fc'}bwd$ → Revise the x-section

Slab Design

Minimum thickness *h* of nonprestressed one-way slabs

Simply supported	$l/20$
One end continuous	$l/24$
Both ends continuous	$l/28$
Cantilever	$l/10$

Minimum ratios of temperature and shrinkage reinforcement in slabs based on gross concrete area

Slabs where Grade 40 or 50 deformed bars are used	0.0020
Slabs where Grade 60 deformed bars or welded wire fabric (smooth or deformed) is used	0.0018
Slabs where reinforcement with yield strength exceeding 60,000 psi measured at yield strain of 0.35 percent is used	$\frac{0.0018 \times 60{,}000}{f_y}$

Moment and shear values using ACI coefficients†

Positive moment	
End spans	
If discontinuous end is unrestrained	$\frac{1}{11} w_u l_n^2$
If discontinuous end is integral with the support	$\frac{1}{14} w_u l_n^2$
Interior spans	$\frac{1}{16} w_u l_n^2$
Negative moment at exterior face of first interior support	
Two spans	$\frac{1}{9} w_u l_n^2$
More than two spans	$\frac{1}{10} w_u l_n^2$
Negative moment at other faces of interior supports	$\frac{1}{11} w_u l_n^2$
Negative moment at face of all supports for (1) slabs with spans not exceeding 10 ft and (2) beams and girders where ratio of sum of column stiffness to beam stiffness exceeds 8 at each end of the span	$\frac{1}{12} w_u l_n^2$
Negative moment at interior faces of exterior supports for members built integrally with their supports	
Where the support is a spandrel beam or girder	$\frac{1}{24} w_u l_n^2$
Where the support is a column	$\frac{1}{16} w_u l_n^2$
Shear in end members at first interior support	$1.15\frac{w_u l_n}{2}$
Shear at all other supports	$\frac{w_u l_n}{2}$

† w_u = total factored load per unit length of beam or per unit area of slab.
l_n = clear span for positive moment and shear and the average of the two adjacent clear spans for negative moment.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2023
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering I		Course Code: CE 331
Time: 3.00 Hours	Credit Hour: 3.00	Full Mark: 120

Answer all the questions in both of the sections. (36+24+36+24= 120)
(Necessary formulae are attached; Assume reasonable data if necessary)

SECTION – A

1 Suppose in many areas of your rapidly growing home town, groundwater extraction is yielding very little water. So, the local authority is thinking of switching to using surface water from a river that is in the periphery of the town. You are consulted to give your insights and suggestions to develop a surface water collection and distribution system as an engineer. During a meeting with the stakeholders, though the affected people could agree to the depth of the problem they were facing regarding groundwater, concerns on using water of questionable quality and sustainability of the river as a water source were raised.

(a) Provide your opinion on the decision to switch to using surface water. (5)

(b) Identify the components of the intake station and select the design criteria. (8)

(c) As an engineer, propose a solution so that all the concerns can be managed effectively. (8)

(d) Recommend the pipe material that should be used based on the following data: (7)

TDS = 200 mg/L
Total Alkalinity = 70 mg/L as $CaCO_3$
Bicarbonate Alkalinity = 70 mg/L as $CaCO_3$
Hardness = 90 mg/L as $CaCO_3$
i. Calcium = 29 mg/L as Ca^{2+}
ii. Magnesium = 0.8 mg/L as Mg^{2+}

(Necessary tables are given in the next pages)
$[RI = 2\,pH_s - pH\,;$
$pH_s = (pK_2 - pK_s) + pCa^{2+} + pAlk]$

(e) Develop a plan to improve ground water lowering issue of your home town. (8)

2(a) Consulting your understanding and knowledge on the daily demand of water, estimate the annual water demand for your community and also the demand after 50 years. (5+7+6)
Convert the water demand in m^3/d for treatment capacity of a plant. Jar testing and pilot-plant analysis indicate that alum doses of 15, 25 and 35 mg/L are accompanied with turbidity levels of 6, 2.5 and 9 NTU respectively. With flocculation at a Gt value of 4×10^4 producing optimal results at the expected water temperature of 15 degree C, determine the following:

i) The monthly alum requirements for both optimum and minimum dosing;

$$Al_2(SO_4)_3 + 3\ Ca(HCO_3)_2 = 2\ Al(OH)_3 + 3CaSO_4 + 6\ CO_2$$

ii) The % change in power requirement if the temperature is 20 degree C with comment on the influencing parameter.

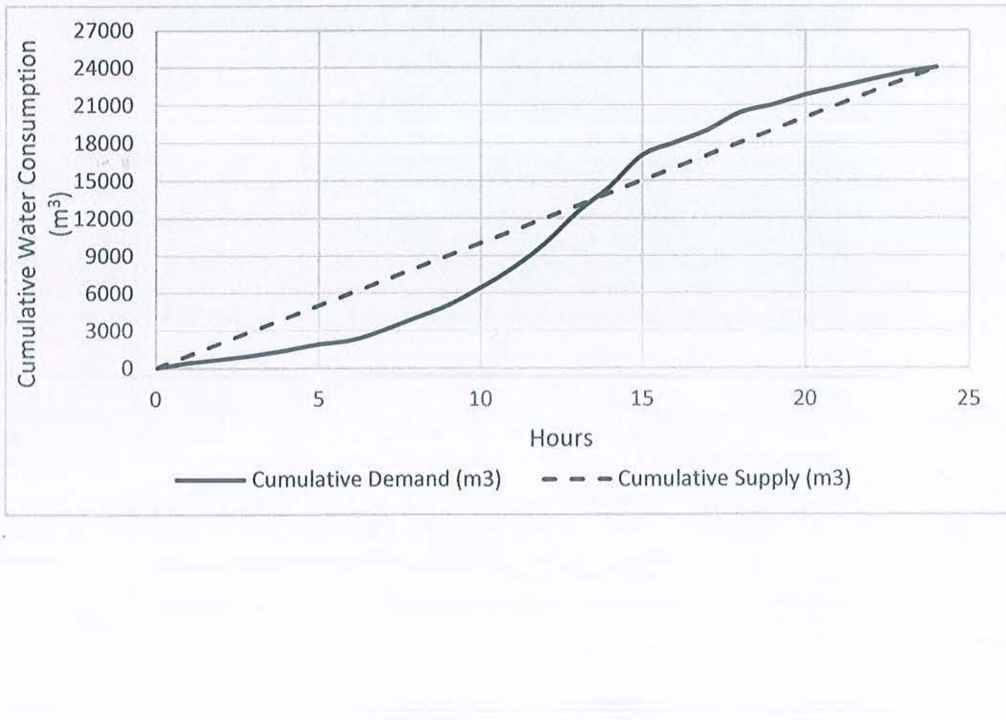
(b) Formulate a qualitative sketch of a break point chlorination curve (Axis of residual chlorine ranging from 0 - 1 mg/L and Axis of chlorine dosage ranging from 0 – 1.5 mg/L), show the different zones in chlorination (mentioning type of residual) and figure out the chlorine dosages required for keeping no residual and a free residual of 0.2 mg/L respectively. (6)

SECTION – B

3 (a) Choose between the two types of water distribution network for a new residential area being developed and defend your choice. (4)

(b) Interpret the term "Non-Revenue Water". (3)

(c) Recommend the storage volume of an overhead water tank. (5)



(d)	Explain the crucial factors in determining the most productive zone of the aquifer. Design the appropriate details of a well following the given steps and according to the data provided below:	(3+3+3 +7)

i) Find out the water bearing/most productive part of the aquifer (depth range) from the given grain size distribution summary at different depths (table 1) showing suitable reasoning.

ii) Find out the length of the casing pipe, considering static water level at 300 ft, drawdown of 15 ft with water level declination of 2 ft per year, design life of 25 years and a safe distance of 10 ft. Assume, 80% of the aquifer screening can be made and find out the length of the strainer.

iii) Using a graph paper, design gravel pack material using the attached gradation chart for the finest layer and complete table 2 (also mention the diameter of the gravel pack. Find out the strainer size (slot size).

(e) Water has to be pumped from an elevation of 25 ft to an elevation of 40 ft. The pump is located at an elevation of 32 ft. The pipe has total length of 1200 ft (supply main, 200 ft and distribution main, 1000 ft), diameter = 10 inches and friction faction = 0.01. Pump characteristics curve has to be plotted using the following data of flow versus head. (8)

Q, gpm	0	1000	2000	3000	4000	5000
H, ft	75	72	70	60	50	0

Find out the discharge of water in the system. [Assume: pipe entrance is well rounded i.e. r/D>0.2, $K_{entrance} = 0.03$, $K_{bend} = 0.35$, $K_{exit} = 1$]

4 (a) Provide details of alternative/low cost water supply options that you would recommend to provide safe water for the following cases: (8)

i) Irrigation purpose

ii) Areas with find sand

iii) Hilly Areas

iv) Tubewells with arsenic water with a nearby pond as the only source

(b) Explain the difference between a Hazard and a hazardous event with example. (3)

(c) Recommend a system flow diagram for an urban piped water supply system of your knowledge and evaluate the following to ensure safe and sustainable operation of the system : (4+9)

i) Identify the possible points of hazard and assess the risk ;

ii) Identify the controls and re-assess the risks with controls ;

iii) Prioritize the remaining risks

Given Formulae:

I. 1 Gallon = 3.78 L

II. Surface Overflow rate = Q/Surface Area ; Detention time = Q/V

$G = \sqrt{(P/\mu V)}$; $Q = \pi D L(0.01p) v_c$

Head loss due to friction $= f \frac{L}{D} \frac{V^2}{2g}$

TDS, mg/L	$pK_2 - pK_s$ 0°C	10°C	20°C	30°C	40°C	50°C	80°C
	2.45	2.23	2.02	1.86	1.68	1.52	1.08
40	2.58	2.36	2.15	1.99	1.81	1.65	1.21
80	2.62	2.40	2.19	2.03	1.85	1.69	1.25
120	2.66	2.44	2.23	2.07	1.89	1.73	1.29
160	2.68	2.46	2.25	2.09	1.91	1.75	1.31
200	2.71	2.49	2.28	2.12	1.94	1.78	1.34
240	2.74	2.52	2.31	2.15	1.97	1.81	1.37
280	2.76	2.54	2.33	2.17	1.99	1.83	1.39
320	2.78	2.56	2.35	2.19	2.01	1.85	1.41
360	2.79	2.57	2.36	2.20	2.02	1.86	1.42
400	2.81	2.59	2.38	2.22	2.04	1.88	1.44
440	2.83	2.61	2.40	2.24	2.06	1.90	1.46
480	2.84	2.62	2.41	2.25	2.07	1.91	1.47
520	2.86	2.64	2.43	2.27	2.09	1.93	1.49
560	2.87	2.65	2.44	2.28	2.10	1.94	1.50
600	2.88	2.66	2.45	2.29	2.11	1.95	1.51
640	2.90	2.68	2.47	2.31	2.13	1.97	1.53
680	2.91	2.69	2.48	2.32	2.14	1.98	1.54
720	2.92	2.70	2.49	2.33	2.15	1.99	1.55
760	2.92	2.70	2.49	2.33	2.15	1.99	1.55
800	2.93	2.71	2.50	2.34	2.16	2.00	1.56

RI Range	Indication
Less than 5.5	Heavy scale formation
5.5 to 6.2	Some scale will form
6.2 to 6.8	Non-scaling or non-corrosive
6.8 to 8.5	Corrosive water
More than 8.5	Very corrosive water

Risk = Likelihood × Impact

Estimation of "Risk Score" and Risk Categorization:

		Impact				
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Likelihood	Almost Certain (5)	5	10	15	20	25
	Likely (4)	4	8	12	16	20
	Possible (3)	3	6	9	12	15
	Unlikely (2)	2	4	6	8	10
	Rare (1)	1	2	3	4	5

Risk Severity		
High	Medium	Low
>15	15-5	≤5

Semi Quantitative Estimation of Risk Score: Risk Matrix

Estimation of "Risk Score" and Risk Categorization (semi-quantitative approach):

Likelihood	
Rating	Description
Almost Certain (5)	Is expected to occur in most circumstances; has been observed regularly in the field; confirmed by water quality data.
Likely (4)	Will Probably occur in most circumstances; has been observed occasionally in the field; confirmed by water quality data.
Possible (3)	Might occur at some time; has been observed occasionally in the field; no significant water quality data trends that confirm risk.
Unlikely (2)	Could occur at some time; has not been observed in the field; no water quality data trends that confirm risk.
Rare (1)	May occur in exceptional circumstances; has not been observed in the field; water quality data do not indicate any risk.

Estimation of "Risk Score" and Risk Categorization (semi-quantitative approach):

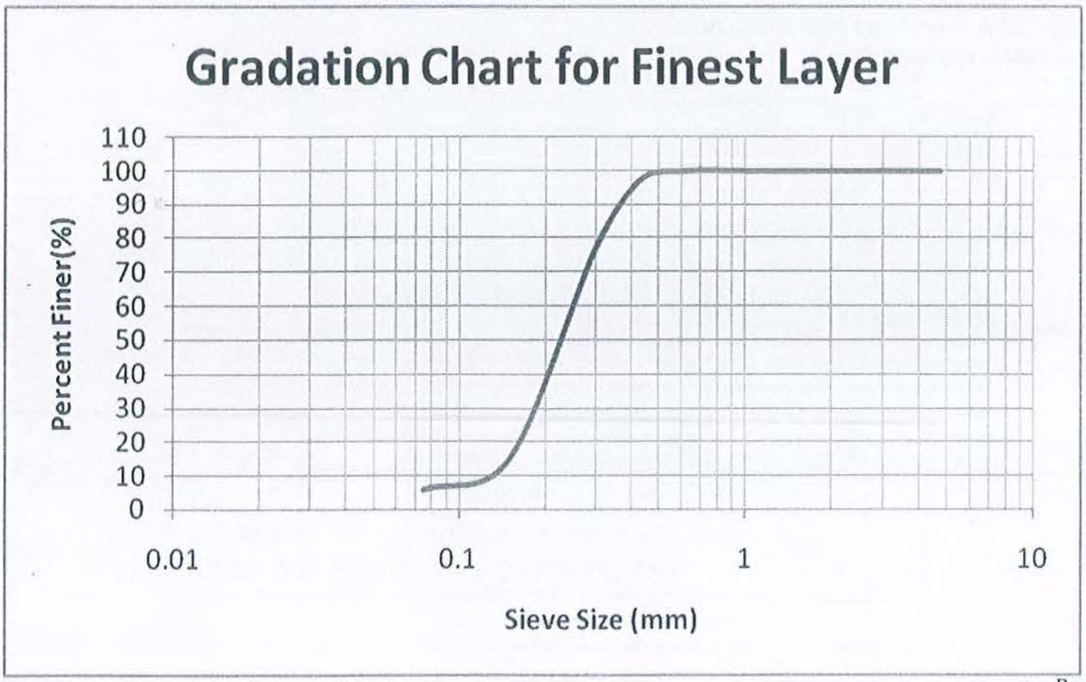
Impact	
Rating	Description
Insignificant (1)	Negligible impact on water quality, service delivery or normal operations.
Minor (2)	Minor water quality impact for a small percentage of customers; some manageable disruptions to operation; corrective action required for service delivery; rise in complaints not significant.
Moderate (3)	Minor water quality impact for a large percentage of customers; clear rise in complaints; community annoyance; minor breach of regulatory requirement; regulator interest; significant but manageable modification to normal operations; increased operational costs; increased monitoring.
Major (4)	Major water quality impact for a small percentage of customers; large number of complaints; significant level of customer concern; significant breach of regulatory requirement; regulatory interest and investigation; systems significantly compromised with abnormal operation if at all; high level of monitoring.
Catastrophic (5)	Major water quality impact for a large percentage of customers; illness in community associated with the water supply; litigation by customers; major regulatory.

Table 1: Summary of Grain Size Test Results

Sample depth	D_{10}	D_{30}	$U = D_{60}/D_{10}$	% of Coarse Sand	% of Medium Sand	% of Fine Sand	FM
(ft)	mm	mm		%	%	%	
240	0.17	0.25	1.4	0.5	89.5	20	1.5
260	0.18	0.24	1.46	0.5	89.5	20	1.49
280	0.2	0.3	1.3	4	86	10	1.68
300	0.15	0.24	1.58	12	68	20	1.60
320	0.18	0.25	1.52	2	82	16	1.56
340	0.18	0.27	1.11	10	75	15	1.67
360	0.15	0.22	1.55	1	76	23	1.38
380	0.16	0.21	1.38	0.5	75	24	1.30

Table 2: The relevant size of sieves and further information for gravel pack material

Sieve No.	Size (mm)	% Finer from graph	Cumulative % retained	% retained	Range of % retained
4	4.75				
8	2.36				
16	1.18				
30	0.6				
40	0.425				
50	0.3				
100	0.15				
200	0.075				



University of Asia Pacific
Department of Civil Engineering
Final Term Examination Spring 2023
Program: B.Sc. Engineering (Civil)

Course Title: Open Channel Flow | Course Code: CE 361
Time: 3 hours | Credit Hour: 3.00 | Full Marks: 120

[Answer all the questions. Assume any reasonable data if necessary]

1. The flow velocities measured at various flow depths in a wide rectangular flume are listed in the following table. Use the trapezoidal rule for the numerical integration. Compute (i) the velocity distribution coefficients, and (ii) the State of Flow. Flow velocities at different depths: **[12]**

h(m)	0.0	0.2	0.4	0.6	0.8	1.0	1.2
u(m/s)	0.0	3.87	4.27	4.53	4.72	4.87	5.0

2. A spillway of Tarbela Dam is shown here in ***Figure 1*** that discharges water over the spillway at a rate of $10 m^2/s$. Determine the intensities of pressure at points A, B, and C. **[8]**

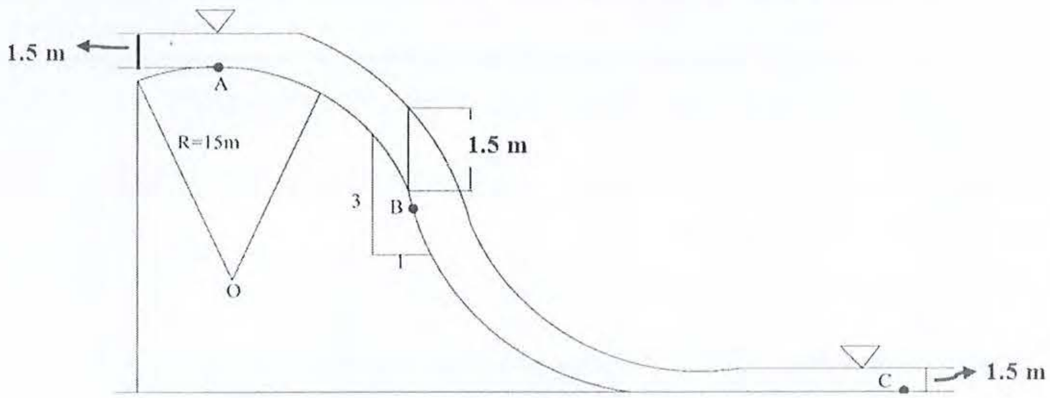


Figure 1

3. Explain why the Froude Number is more important than the Reynolds number in determining the state of flow in an open channel. **[4]**

4. A rectangular channel is 3.0 in wide and carries a discharge of 3.30 m3 /s at a depth of 0.9 m. A smooth contraction of the channel width is proposed at a section. Find the smallest contracted width that will not affect the upstream flow conditions. Neglect energy losses in the transition. **[10]**

5. Water flows in a Δ shaped channel shown in ***Figure 2***. Critical depth is known to occur at a section in this canal. Estimate the discharge and specific energy corresponding to an observed critical depth of 1.40 m. **[8]**

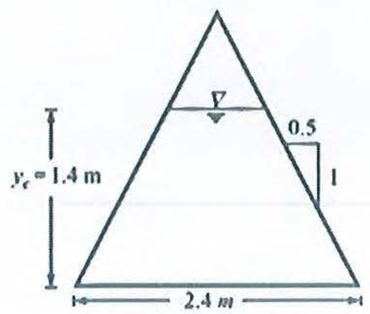


Figure 2

6. During the excavation of an irrigation channel, the Engineers of Bangladesh Agricultural Development Corporation (BADC) observed that the type of material in the channel body does not permit the slope required by the best hydraulic section channel. The need stems from the soil type that the side slope of the channel is to be maintained at 1.5H :2V and the channel bed is to be laid on a slope of 1 in 2500. The lining is expected to give n = 0.010. Design the channel if the water demand through this channel is 90 m^3/s and the maximum allowable velocity is 2m/s. **[12]**

7. Design a stable alluvial channel using the Lacey's method. The channel has to carry a discharge of 18 m^3/s and the silt factor of the bed material is 1.2. **[12]**

8. A vertical sluice gate having $C_c = 0.61$ and gate opening = 0.60 m discharges 27 m^3/s is into a horizontal rectangular channel 6 m wide. Compute the length of the flow profile between the vena contracta and the location where the depth is 0.50 m. Take n = 0.013. **[12]**

9. A channel consists of a main section and two side sections as shown in ***Figure 3***. Compute the total discharge, the mean velocity of flow, and 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 velocity distribution coefficients for the entire section assuming that $\alpha = \beta = 1.00$ for the main and the side sections. **[14]**

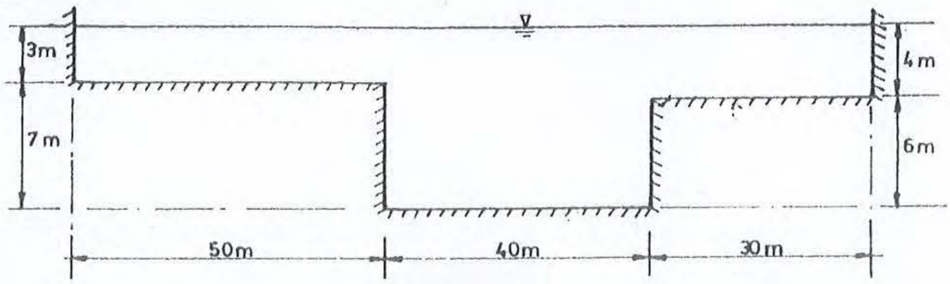


Figure 3

10. Sketch the possible flow profiles in the following combination of slopes: **[12]**
    i. Mild – steeper mild
    ii. Steep - critical
    iii. Adverse - horizontal

11. A company has given assignments to two teams to present a design for the hydraulic jump section downstream of a sluice gate in a horizontal rectangular channel. Team A and Team B came up with the following designs: **[16]**

Parameters (u/s of the jump)	Team A	Team B
Velocity (m/s)	10	6
Depth (m)	1.2	0.8
Width (m)	6	6

The company expects a design that will take into account efficiency, energy dissipation, and limitation of length space.

i. Select three parameters to analyze the systems which will consider the companies requirements.
ii. Select a design between Team A and B that is more suitable for application with proper explanation.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2023
Program: B.Sc. Engineering (Civil)

Course Title: Geotechnical Engineering I — Course Code: CE 341
Time: 3 hours — Credit Hour: 3.0 — Full Marks: 120

*[There are **Eight** questions here. **Answer all** the questions. Related formulae, charts are given in the Appendix. Assume reasonable values of any data, if missing. Digits in the right margin inside the 1st parentheses indicates marks]*

1. a) Draw the phase diagrams for saturated and dry soils. (5)

b) An undisturbed soil sample was collected from the field in steel Shelby tubes for laboratory evaluation. The porosity and degrees of saturation of the soil sample are found as 34% and 58% respectively. If the specific gravity of the soil sample is 2.71. Then determine the following: (10)

i. Void ratio of the soil sample
ii. Moist unit weight
iii. Dry unit weight
iv. Submerged unit weight

2. a) From the e-logp' plot shown in **Fig-1**, find (using the attached figure) the value of pre-consolidation pressure by Casagrande graphical procedure_ (5)

[please attach the page-5 of your question paper with your answer script]

b) A footing is placed on a sandy layer underlying a normally consolidated silty clay stratum, with properties shown in **Fig. 2**.

Calculate__ (10)

i. Primary consolidation settlement of the clay layer.
ii. Time required to attain 2 inches of settlement.
iii. Settlement after 3 months.

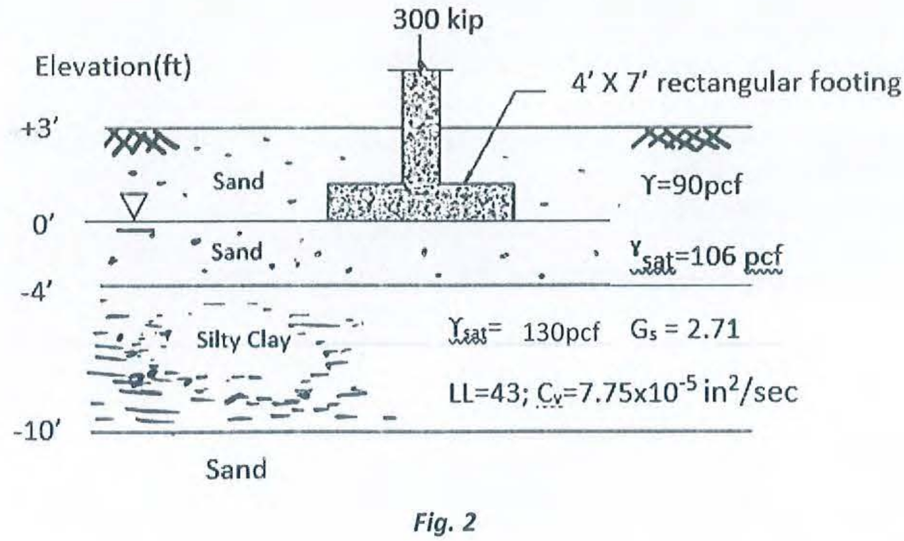


Fig. 2

3. a) Differentiate between __ (2+3=5)

   i) Compaction and Consolidation

   ii) Normally Consolidated clay and Over Consolidated clay.

   b) For the retaining wall shown in **Fig.3**, determine the total force per unit length of the wall for Rankine's Passive state. Also find the location of the total passive force. (10)

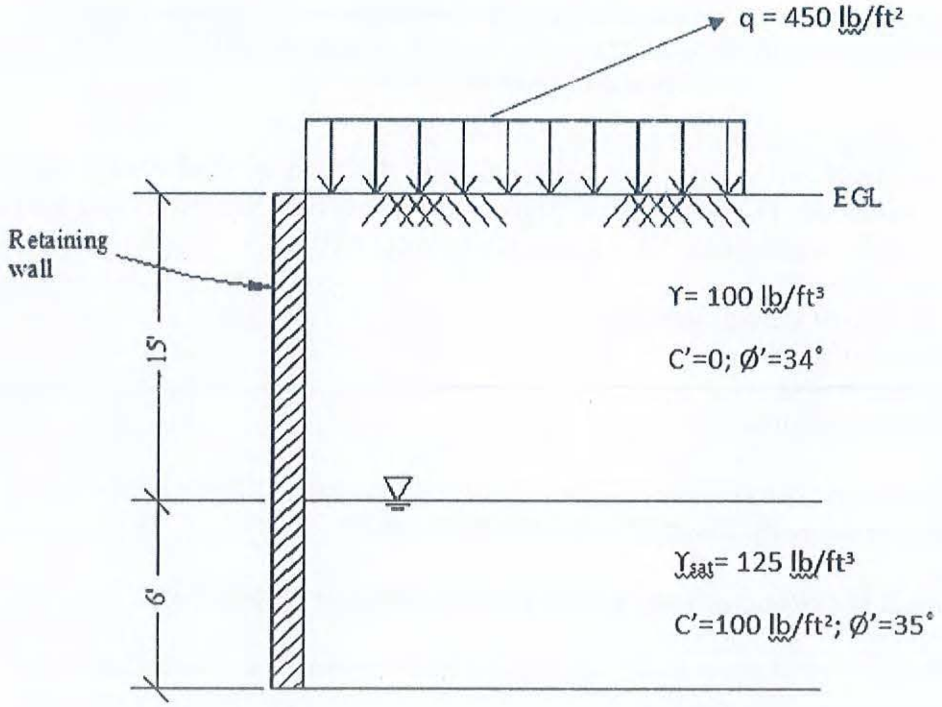


Fig. 3

4. a) Differentiate between alluvial and colluvial soil deposit. (5)

   b) Classification tests were done on an inorganic soil sample and the following results were Obtained__ (10)

   Percent finer No. 4 sieve (4.75 mm) = 100
   Percent finer No. 40 sieve (0.425 mm) = 92
   Percent finer No. 200 sieve (0.075 mm) = 86

   <u>Consistency test results of soil fraction finer than No. 200 sieve (0.075 mm):</u>
   Liquid limit (%) = 70
   Plastic limit (%) = 38

   Classify the soil using AASHTO Soil Classification System

5. a) Write short note on Black Cotton soil. (5)

b) A "L" shaped foundation is loaded with a uniform vertical load of 100kN/m^2. The foundation is adjacent to a swimming pool as shown in **Fig-4.** Assume uniform water pressure of 60kN/m^2. Estimate the vertical pressure at a point which is 8.0 m below the point "A". (10)

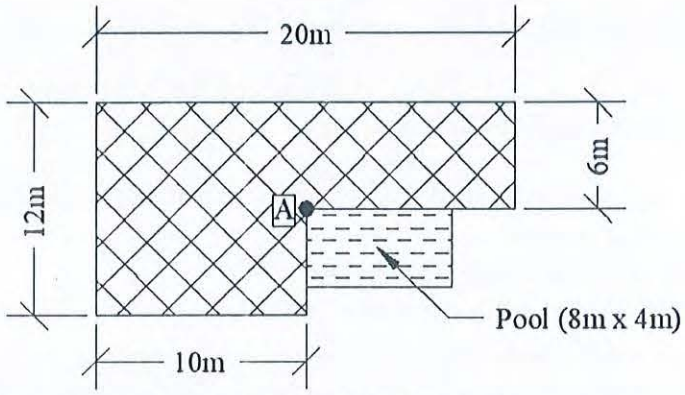


Fig. 4

6. a) Define Liquid, plastic and shrinkage limits of soil. (5)

b) The following data were obtained in a shrinkage limit test: (10)

Weight of shrinkage dish = 11.24 gm
Volume of shrinkage dish = 18.79 cm^3
Weight of shrinkage dish + saturated soil = 40.74 gm
Weight of shrinkage dish + oven-dry soil pat = 29.25 gm
Weight of mercury displaced by oven-dry soil pat = 137.56 gm

Calculate the shrinkage limit, shrinkage ratio and specific gravity of soil solids (G_s). Assume unit weight of water at test temperature to be 0.99689 gm/cm^3.

7. a) Complete the following data table for CU triaxial test_(symbols have their usual meaning) (5)

$\sigma 3$	u	$\sigma 3'$	$\Delta\sigma$	$\sigma 1$	u_f	$\sigma 1'$
130				310		250
190				460		380
250				630		510

b) A specimen of saturated normally consolidated clay sample was fully consolidated in the triaxial cell under a cell pressure of 75 kN/m^2. Pore pressure within the specimen at the end of consolidation was zero. Deviator stress was then applied under undrained condition and increased until failure took place. The values of deviator stress and pore pressure at failure were found to be 130 kN/m^2 and 50 kN/m^2 respectively. A second specimen of the same sample was fully consolidated in the triaxial cell under a cell pressure of 185 kN/m^2. Pore pressure within this specimen at the end of consolidation was zero. Deviator stress was then applied under undrained condition and increased until failure took place. Calculate the following: (10)

(a) the values of $\text{Ø}'$ and Ø_u of the sample.

(b) the value of deviatory stress for the second specimen.

8. a) Derive relationship between moisture content, degrees of saturation, void ratio and specific gravity of soil solids. (5)

b) The data from a Modified Proctor compaction test on a soil (G_s=2.66) are given as:

Water Content (%)	10	12.5	14.5	16	18.5
Dry density (kg/m³)	1890	1920	1960	1958	1930

Plot the compaction curve along with zero air void line and find the optimum water content and the maximum dry unit weight for this test. (10)

OR,

b) The following are the results of a field density test performed on a soil following sand cone method on a highway project.

Calibrated dry density of Ottawa sand = 1778 kg/m³

Calibrated mass of Ottawa sand to fill the cone = 0.732 kg

Weight of jar + cone + sand (before use) = 7.73 kg

Weight of jar + cone+ sand (after use) = 5.28 kg

Weight of wet soil from hole = 2.03 kg

Moisture content of wet soil = 18.19%

Maximum dry density found in lab test= 1923 kg/m³

If the specification of this highway project demands 100±5% relative compaction which must be achieved, then check whether the field compaction meets the demand or not.

Appendix

➤

a) For $\mathbf{m^2+n^2+1>m^2n^2}$

$$\sigma_z = \frac{q}{4\pi}\left[\frac{2mn\sqrt{(m^2+n^2+1)}}{(m^2+n^2+1+m^2n^2)} \times \frac{m^2+n^2+2}{m^2+n^2+1} + \sin^{-1}\frac{2mn\sqrt{(m^2+n^2+1)}}{m^2+n^2+1+m^2n^2}\right]$$

b) For $\mathbf{m^2+n^2+1<m^2n^2}$

$$\sigma_z = \frac{q}{4\pi}\left[\frac{2mn\sqrt{(m^2+n^2+1)}}{(m^2+n^2+1+m^2n^2)} \times \frac{m^2+n^2+2}{m^2+n^2+1} + \pi - \sin^{-1}\frac{2mn\sqrt{(m^2+n^2+1)}}{m^2+n^2+1+m^2n^2}\right]$$

➤ For U≤60%; $T_v = \frac{\pi}{4}\left(\frac{U\%}{100}\right)^2$

For U>60%; T_v= 1.781-0.933$\log_{10}$(100-U%)

General classification	Granular materials (35% or less of total sample passing No. 200)						
	A-1			A-2			
Group classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7
Sieve analysis (percentage passing)							
No. 10	50 max.						
No. 40	30 max.	50 max.	51 min.				
No. 200	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.
Characteristics of fraction passing No. 40							
Liquid limit				40 max.	41 min.	40 max.	41 min.
Plasticity index	6 max.		NP	10 max.	10 max.	11 min.	11 min.
Usual types of significant constituent materials	Stone fragments, gravel, and sand		Fine sand	Silty or clayey gravel and sand			
General subgrade rating	Excellent to good						

General classification	Silt-clay materials (more than 35% of total sample passing No. 200)			
Group classification	A-4	A-5	A-6	A-7 A-7-5[a] A-7-6[b]
Sieve analysis (percentage passing)				
No. 10				
No. 40				
No. 200	36 min.	36 min.	36 min.	36 min.
Characteristics of fraction passing No. 40				
Liquid limit	40 max.	41 min.	40 max.	41 min.
Plasticity index	10 max.	10 max.	11 min.	11 min.
Usual types of significant constituent materials	Silty soils		Clayey soils	
General subgrade rating	Fair to poor			

[a]For A-7-5, $PI \leq LL - 30$
[b]For A-7-6, $PI > LL - 30$

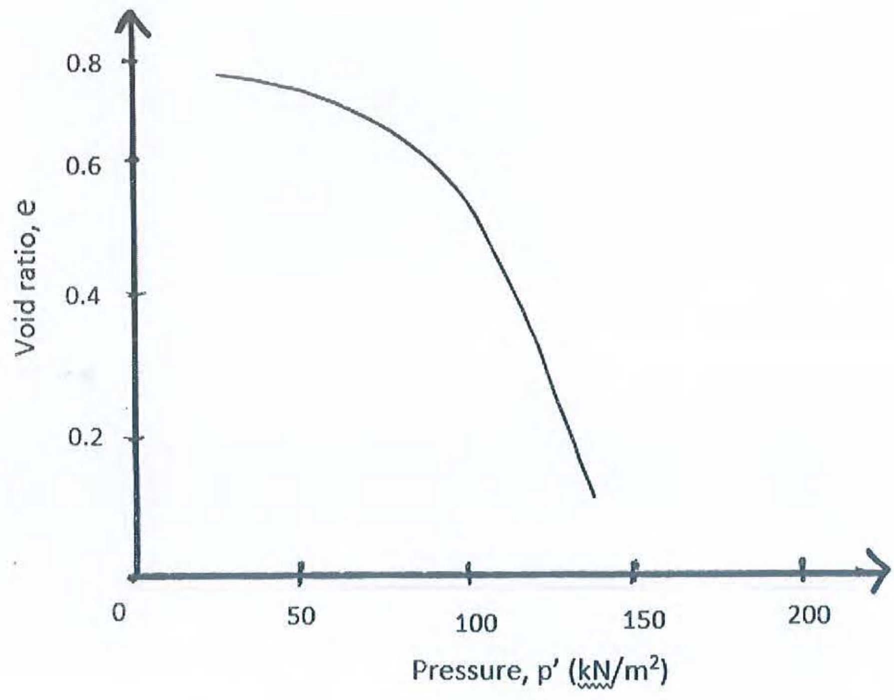


Fig. 1