3-1

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
3rd Year 1st Semester

Course Title: Design of Concrete Structures I Course Code: CE 315 Credit: 3.0
Time: 3 hour Full Marks: 100

Answer all questions

QUESTION 1 [20 MARKS] **[20]**

The floor system shown in Fig. 1 consists of 3-in. slabs supported by 14-ft-span beams spaced 10 ft on center. The beams have a web width, b_w, of 14 in. and an effective depth, d, of 18.5 in. Design the beam for the necessary reinforcement for a typical interior beam if the factored applied moment is 5080 K · in. Use f'_c = 3ksi and f_y =60 ksi

QUESTION 2 [20 MARKS] **[20]**

A 17-ft-span simply supported beam has a clear span of 16 ft and carries uniformly distributed dead and live loads of 4.5 k/ft and 3.75 k/ft, respectively. The dimensions of the beam section and steel reinforcement are shown in Fig. 2. Check the section for shear and design the necessary shear reinforcement. Given f'_c = 3 ksi normal-weight concrete and f_{yt} = 60 ksi.

QUESTION 3 [20 MARKS] **[20]**

A reinforced concrete slab is built integrally with its supports and consists of two equal spans, each with a clear span of 15 ft. The service live load is 100 psf, fc' = 4000 psi and fy = 60,000 psi. Design the slab, following the provisions of ACI code, considering safety and environmental issues.

QUESTION 4 [20 MARKS] **[10 + 10 = 20]**

b) Fig. 3 shows a beam-column joint in a continuous building frame. The negative steel required at the end of the beam is 2.90 in^2; however, two no. 11 bars are used, (As = 3.12 in^2.) Beam dimensions are: b = 10 in.; d = 18 in and h = 21 in. The design shear reinforcement will include no. 3 stirrups, first four of which are spaced at 3 in. and the remaining stirrups spaced at a constant 5 in. spacing in the region of the support, with 1.5 in. clear cover. Normal weight concrete with f'_c = 4000 psi and steel with f_y = 60,000 psi is used. Find the development length, l_d at which the negative bars can be cut off.

i. Using the simplified equation of table 6.1
ii. Using the basic equation Eq. 6.4

QUESTION 5 [20 MARKS] **[4*5 = 20]**

a) Illustrate with diagram, how diagonal tension is developed in beam without shear reinforcement.
b) Explain with diagram the two types of bond failure for concrete and tensile reinforcement.
c) Explain with diagram the different specifications of hook anchorage of rebar.
d) Discuss the significance of temperature and shrinkage reinforment in slabs.

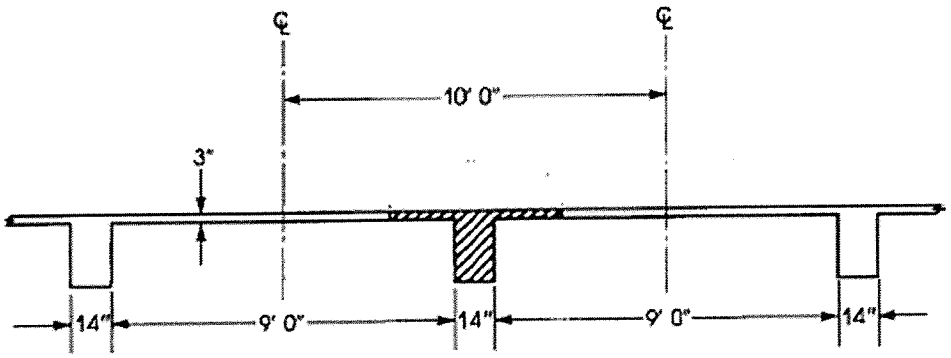


Figure 1: T-Beam floor system

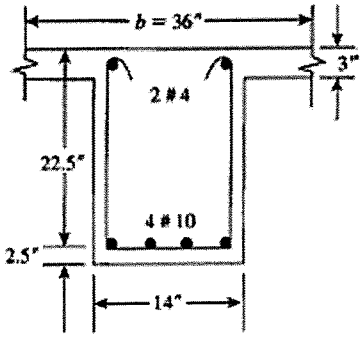


Figure 2: Section

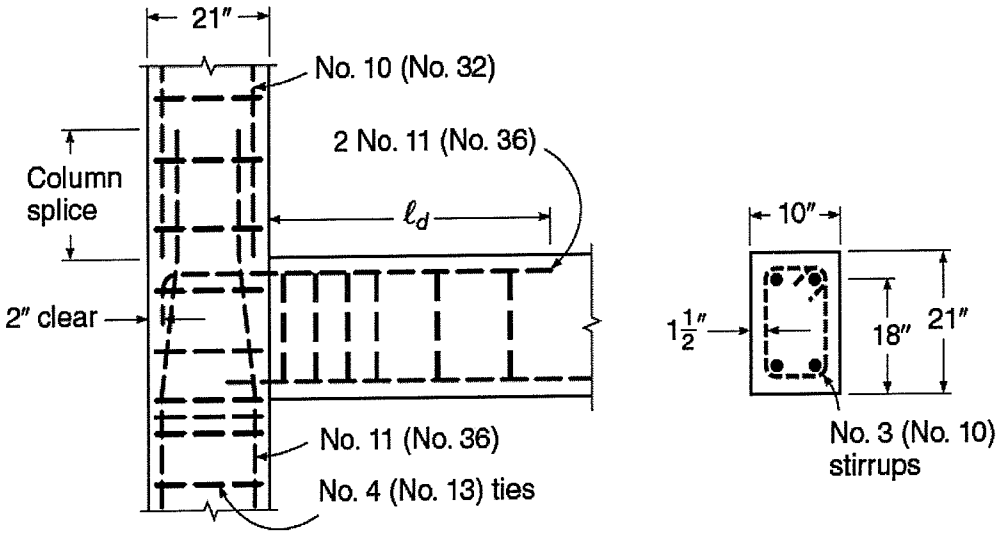


Figure 2: Bar details at beam-column joint

University of Asia Pacific
Department of Civil Engineering
Final Examination (Fall 2024)
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering I (Water Supply Engineering) Course Code: CE 331
Time: 3 hours Credit Hours: 3.00 Full Marks: 120

Answer all the FIVE questions in both sections. (24 + 12 + 24 + 24 + 36 = 120)
(Necessary formulae are attached; Assume reasonable data if necessary)

Section A

QEUSTION 1 [24 MARKS]

a. ***Construct*** a chlorine demand curve using the following information:

Chlorine Residual (mg/L)	Chlorine Dose (mg/L)
0	0 – 0.2
0.2	0.3
0.35	0.5
0.47	0.7
0.15	0.9
0.2	1.1
0.7	1.6

i. Please ***indicate*** the four zones on the curve and identify the free residual region. Also ***draw*** the "no chlorine demand" line on the same plot and ***identify*** the "chlorine demand" portion or measurement. **[6]**

ii. ***Calculate*** the chlorine dose if the system must maintain free residual of I) 0.1 mg/L; II) 0.2 mg/L and III) 0.5 mg/L. **[6]**

b. Consider you need to choose filtration technology for a community. The community requires a low-cost filtration unit; however, the source water is turbid especially during dry season.

i. ***Explain with justification*** which type of filter (mentioning pretreatment unit if needed) you can provide with specification on efficiency that you will achieve for turbidity and coliform removal. **[5]**

ii. ***Explain*** how the operator can keep the filter running without stopping operation in case of overuse and clogging. **[3]**

iii. If the source water has considerable hardness, ***explain with description*** which softening procedure would be simpler to operate with lesser quantities of sludge? **[4]**

QEUSTION 2 [12 MARKS]

Answer the following questions regarding tubewell design, installation and maintenance:

a. 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. 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).
[Table 1 and Table 2 are attached in the supplementary documents.] **[8]**

b. ***Explain*** your understanding on "Well Development" mentioning the targets to be achieved by effective well development. **[4]**

QEUSTION 3 [24 MARKS]

a. ***Recommend*** a system flow diagram for a water supply system in coastal area and ***evaluate*** the following to ensure safe and sustainable operation of the system: **[5+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 of the remaining risks

b. Consider the System you studied as a source or to evaluate water quality in the project of CE 332 course. Consider the contaminant discharge from outfalls or point sources lead to the concentrations of heavy metals such as lead and chromium to increase up to around 5 – 10 times more than discharge standards in the source water. ***Write*** the following for the water supply system from the source in consideration, according to the Water Safety Plan: **[5+5]**

- **i. Risk, Identification and Analysis** following the quantitative approach (attached table) based on the observed system with justification.
- **ii.** System Improvement and Supporting Programs to implement the **Water Safety Plan.**

Section B

QEUSTION 4 [24 MARKS]

a. A well of 10-inch diameter has a depth of 130 ft below the level of water table and the depth of water when is being pumped is 95 ft. As indicated by the test on a sample, the effective size of the soil in the water bearing stratum is 0.20 mm and the porosity is 35%. The radius of drawdown is assumed to be 1200 ft and the thickness of the confined water bearing stratum is 50 ft. ***Calculate*** the rate of discharge of the well in gpm. **[10]**

b. ***Compare*** the effects of drawdown (D – d) on the specific capacity of an unconfined and a confined aquifer. Please show necessary equations to justify your answers. **[8]**

c. ***Explain*** the following: **[6]**

- **i.** Flowing Artesian Well
- **ii.** Aquiclude
- **iii.** Zone of Aeration

QEUSTION 5 [36 MARKS]

a. *Calculate* the per capita water available and the capacity of the storage tank required for a family of 8 persons having a roof area of 32 m^2 with a runoff coefficient of 0.8. The family lives in a part of Bangladesh having a yearly rainfall of 3.1 m. The distribution demands 35% storage requirement for full utilization of rainwater. [8]

b. A pump that has the characteristic curve shown in **Figure 3** ***(attached in the supplementary documents)*** is to be installed as shown in **Figure 1**. ***Calculate*** the discharge of water in the system.
[Given, $K_{Entrance} = 0.02$, $K_{Bend} = 0.4$, $K_{Exit} = 0.8$]. [14]

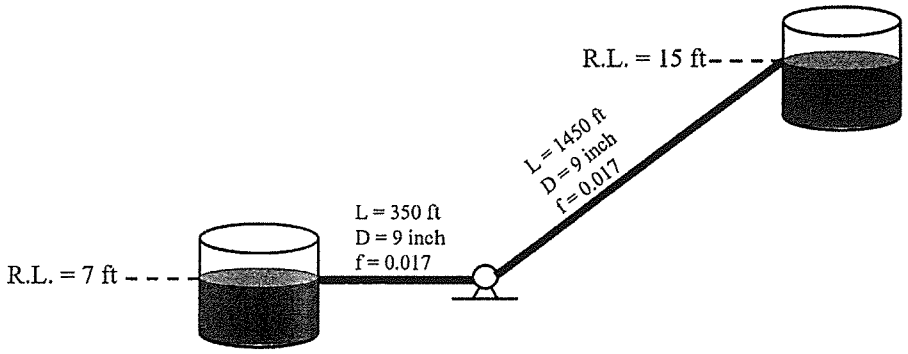


Figure 1. T&D system

c. ***Explain*** **"Infiltration Gallery"** technique with necessary figure as a low-cost conventional water supply system in Bangladesh to ensure safe drinking water to the people. [6]

d. You are appointed as an engineer to design a water distribution system for a rural area to supply water to the inhabitants. The area is flat and frequent power cut occurs due to insufficient supply of electricity. ***Outline*** any Transportation and Distribution **(T&D) system** that suits the best for that area and ***explain*** your reasons. [8]

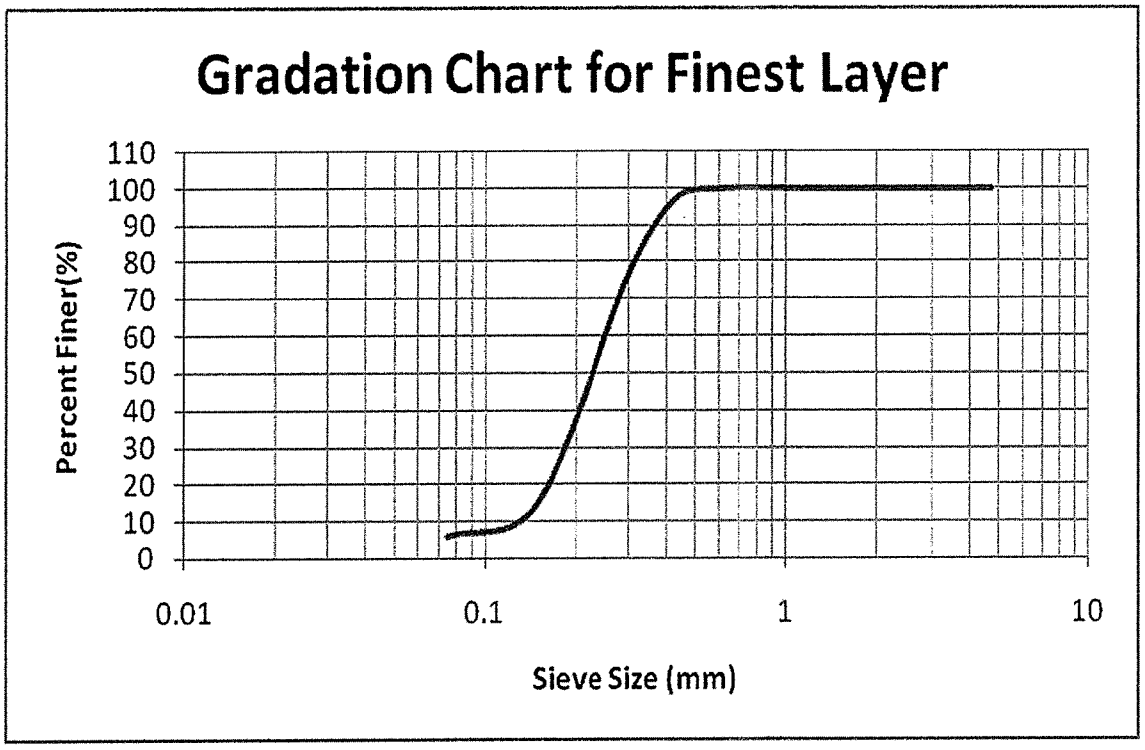
Supplementary Documents

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				



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.

Figure 2: Tables for risk estimation

[Please attach the graph with your answer script if you answer Q4(b).]

Student ID:

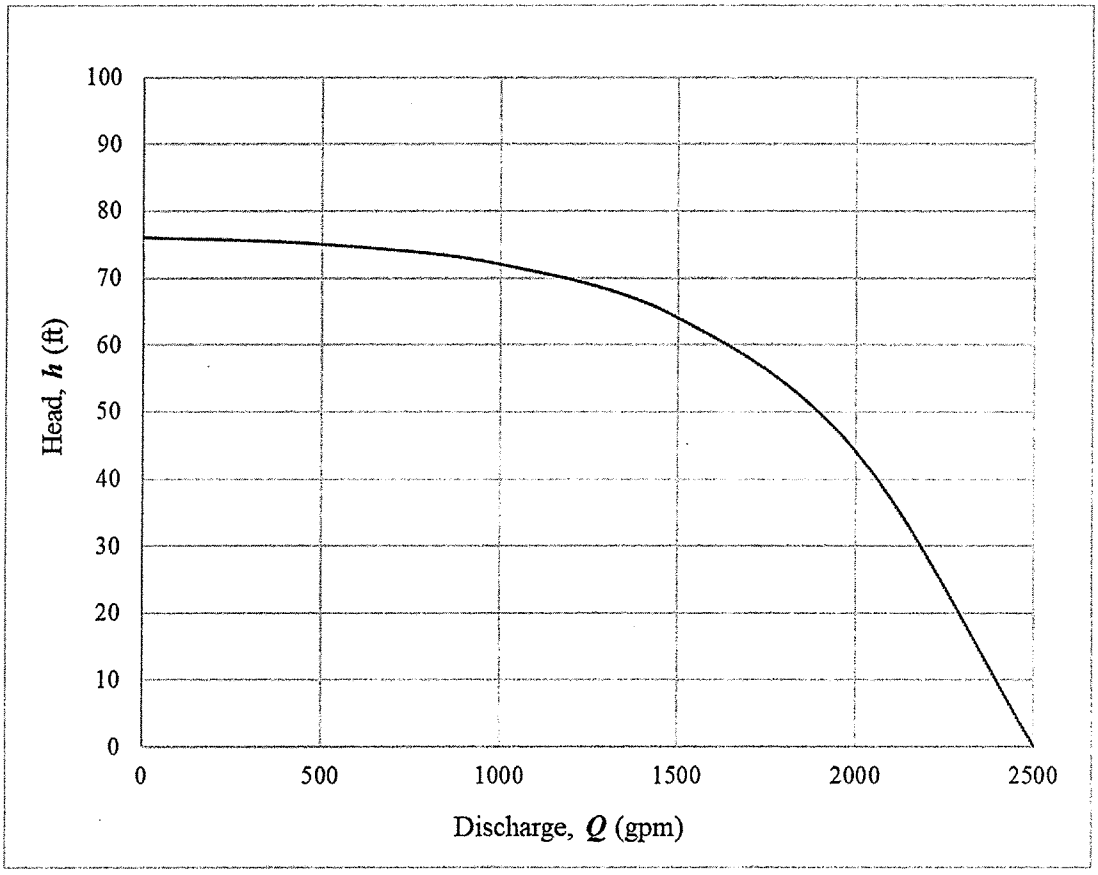


Figure 3. Pump characteristics curve

Table 3: Coefficient of Permeability (K)

Effective Grain Size (mm)	Porosity (%)	K (gpd/ft^2)
0.20	25	240 – 280
	30	520 – 580
	35	1000 – 1100
	40	1800 – 2000

Given formulae

1. 1 gpm = 0.002228 ft^3/s
2. 1 gallon = 3.78 Liters
3. Surface overflow rate = Q/Surface area
4. Detention time = Q/V
5. $G = \sqrt{(P/\mu V)}$
6. $Q = \pi D L(0.01p) v_c$
7. Risk = Likelihood × Impact

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
3rd Year 1st Semester

Course Title: Geotechnical Engineering I — Course Code: CE 341
Time: 3 hours — Credit Hour: 3.00 — Full Marks: 150

*[There are **Six** 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 first parenthesis indicate marks]*

PART-A [75 MARKS]

QUESTION 1 [21 MARKS]

a. Grain size analysis data of a sandy soil sample are shown below.

Sieve No.	Sieve Opening (mm)	Percent Finer by Weight
4	4.750	100
8	2.360	99
16	1.180	95
30	0.600	85
40	0.425	72
50	0.300	42
100	0.150	15
200	0.075	6

Draw the grain size distribution curve in a semi-log graph paper and estimate the values of Effective Diameter and Median Grain Size of the sample. [6]

b. A cone penetration test was performed on a silty clay sample and the following data were obtained:

Trial No.	1	2	3	4
Cone Penetration (mm)	16	22	26	30
Water Content (%)	33	54	68	82

Plot water content (%) versus cone penetration (mm) in a plain graph paper and hence estimate the liquid limit of the sample. [6]

c. With neat sketches define dispersed structure and flocculated structure of cohesive soil. [4]

d. For a soil, the following results were obtained from grain size distribution and Atterberg limit tests:

Percent finer No. 200 sieve (0.075 mm) = 90

Liquid Limit = 52%

Plastic limit = 25%

Classify the soil based on AASHTO Soil Classification System. [5]

QUESTION 2 [27 MARKS]

a. Explain thixotropy and critical void ratio of sands.
The following results were obtained in a consolidated drained (CD) direct shear test carried out on a clay sample:

Specimen No.	Normal Load (N)	Peak Shear Force (N)
1	317	312
2	634	529
3	951	744

Diameter of each specimen was 63.5 mm. Draw the failure envelope in a plain graph paper and determine the values of effective shear strength parameters (c′and ϕ') from it. Also comment on the stress history of the sample. [11]

b. Describe briefly the behaviour of saturated clay samples in unconsolidated undrained (UU) triaxial compression test. [4]

c. Two identical specimens of a saturated normally consolidated soft clay sample were fully consolidated in the triaxial cell under a cell pressure of 200 kN/m^2. Pore pressure within each specimen at the end of consolidation was zero. One specimen was then sheared under undrained condition and the other under drained condition until failure took place. The values of deviator stress at failure in the undrained and drained tests were found to be 150 kN/m^2 and 400 kN/m^2, respectively. Compute the following analytically:
(i) the values of ϕ_u and ϕ' of the sample
(ii) the values of pore pressure at failure (u_f) and the pore pressure parameter A at failure (A_f) in the undrained test. [7]

d. A clay sample (liquid limit = 47%, plastic limit = 23% and natural moisture content = 38%) was collected from a depth of 5 m below the existing ground level. Water table is at the existing ground level and saturated unit weight of the sample is 20 kN/m^3. From a laboratory one-dimensional consolidation test, the preconsolidation pressure of the sample was found to be 204 kN/m^2. Estimate the value of undrained shear strength of the sample at that depth. [5]

QUESTION 3 [27 MARKS]

a. The following results were obtained at failure in Consolidated Undrained (CU) triaxial compression tests performed on two specimens of a compacted clay sample:

Specimen No.	Cell Pressure (kN/m^2)	Deviator Stress (kN/m^2)	Pore Pressure (kN/m^2)
1	70	230	− 20
2	350	550	+ 90

Diameter of each specimen was 63.5 mm. Draw the failure envelope in a plain graph paper and determine the values of effective shear strength parameters (c' and ϕ') from it. Also comment on the stress history of the sample. [6]

b. Draw neatly the following qualitative curves:
(i) Shear stress versus shear displacement for loose sand and dense sand in consolidated drained (CD) direct shear tests.
(ii) Volume change versus axial strain for saturated samples of normally consolidated and overconsolidated clays in consolidated drained (CD) triaxial compression tests.
(iii) Variation of the magnitude of lateral earth pressures (at-rest, active and passive) with tilt or deformation of wall. [3]

c. A vane, 100 mm height and 50 mm diameter was pressed into a clay deposit at the bottom of a borehole and the bottom of the vane is flush with the surface of the clay. Torque was applied and its value at failure was found to be 15 N-m. The values of liquid limit and plastic limit of the clay are 58 and 20, respectively. Assuming uniform mobilization of end shear, calculate the design value of undrained shear strength of the clay. [4]

d. A smooth vertical wall of height 9 m retains a soft clay backfill of unit weight 17.5 kN/m^3. Undrained shear strength of the clay backfill is 35 kN/m^2. For undrained condition ($\phi = 0$) of the soft clay backfill, calculate the following:
(i) Active earth force before tension crack forms
(ii) Active earth force after tension crack forms
Also draw the active pressure diagram. [5]

e. Define active earth pressure and passive earth pressure.
For the retaining wall shown in Figure 1, water table is located at the existing ground level (EGL). Draw passive pressure diagrams due to backfill ($\gamma_{sat} = 20$ kN/m^3, $c' = 15$ kN/m^2 and $\phi' = 30°$), surcharge (30 kN/m^2) and ground water separately. Also determine the total passive force per metre length of the wall. [9]

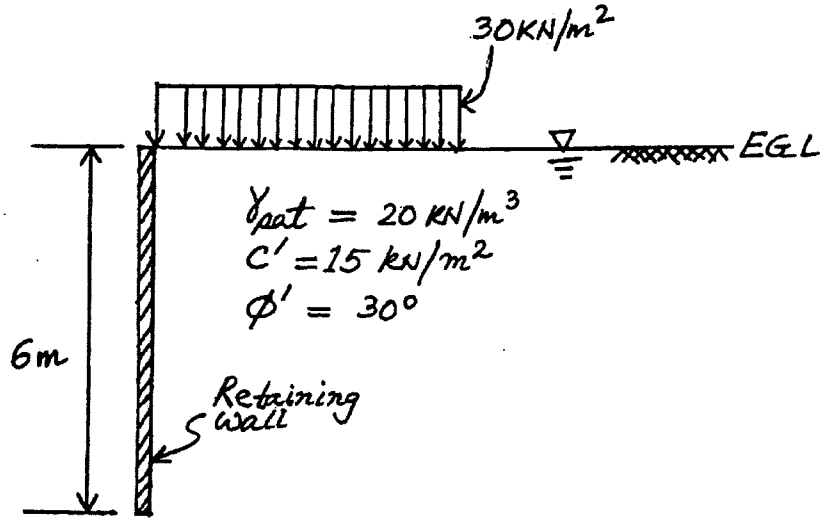


Figure 1

PART-B [75 MARKS]

QUESTION 4 [30 MARKS]

a. Draw a qualitative laboratory consolidation curve (e-logσ' plot) and show how virgin consolidation curve can be drawn from it for NC clay. [5]

b. A footing is placed on a sandy layer underlying successive sand and clay strata with properties shown in Figure-2.

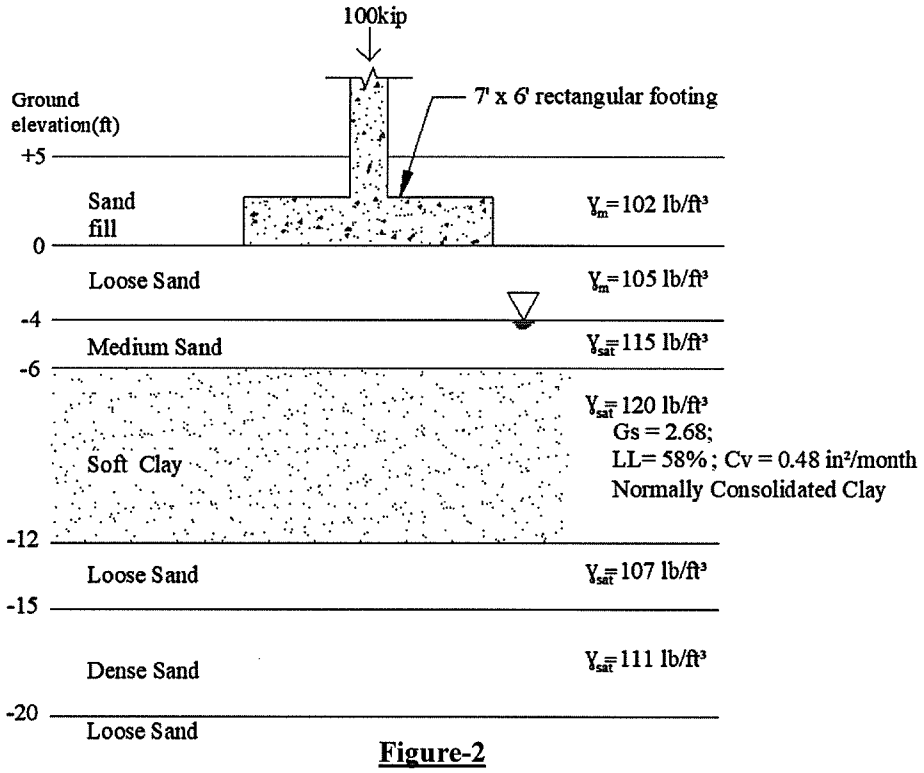


Figure-2

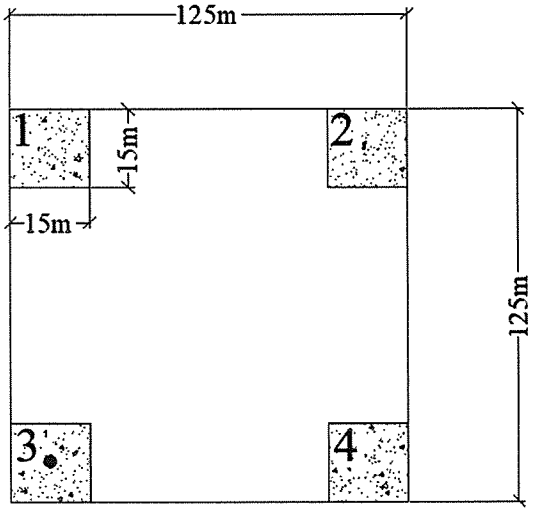
Calculate the followings: [10+5+5+5=25]

i. Primary consolidation settlement of the clay layer.
ii. Settlement after 70 years.
iii. Time required for 1.5 inch settlement.
iv. Calculate the required footing dimension(square) to control the settlement to 1 inch after 50 years.

QUESTION 5 [30 MARKS]

a. Differentiate among elastic settlement, primary consolidation settlement and secondary consolidation settlement. [5]

b. The Following figures showing the base and elevation of "Eiffel Tower", located in Paris, France. The square base (125 m × 125 m) consists of 4 independent footings at 4 corners of the tower. Dimensions are shown in Figure-3. Each footing is experiencing 40 kPa vertical stress at base level. Investigations has confirmed that a weak soil zone lies at a depth of 70 m from existing ground level at the center of footing-3. Now calculate the vertical stress at that weak zone caused by 4 footings. Use Newmark Influence Chart Method. [25]



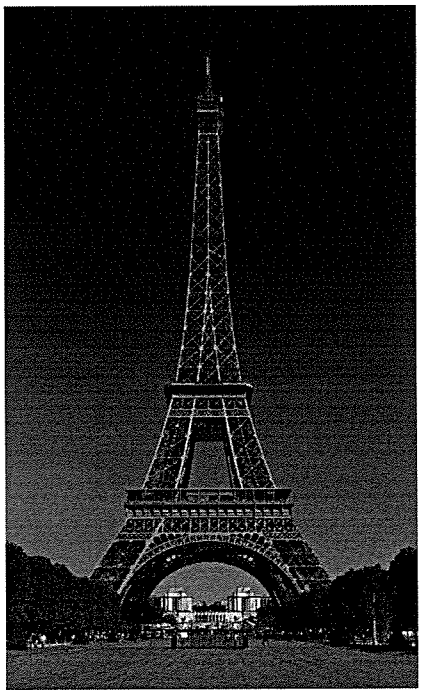


Figure-3

QUESTION 6 [15 MARKS]

a. Define Compaction. List the factors affecting compaction of soil. [5]

b. Calculate and compare the energy applied per cubic meter of soil in Standard Proctor test and Modified Proctor test. [5]

c. The following figure (Figure-4) shows a soil profile with different layer properties. Calculate the total stress, pore water pressure and effective stress at point A. [5]

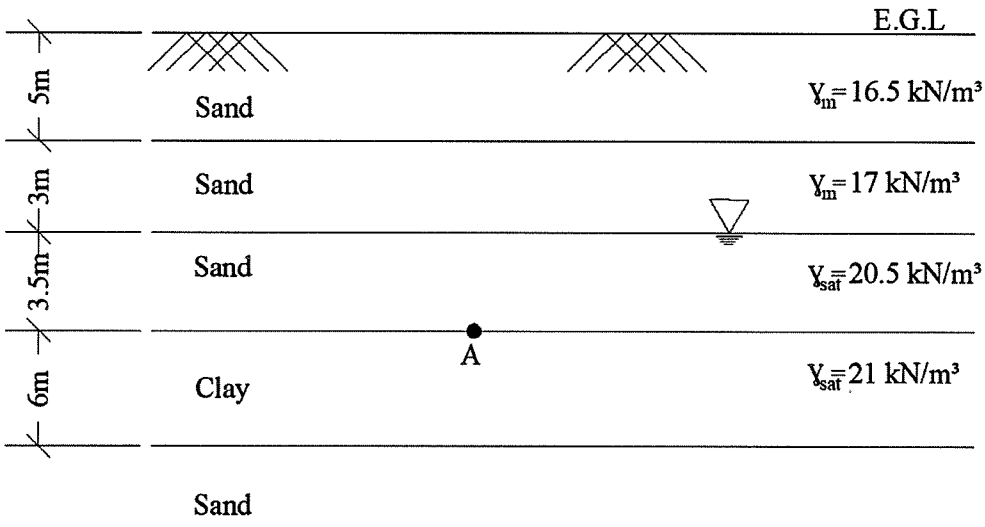

E.G.L
5m
Sand
γ_m=16.5 kN/m³
3m
Sand
γ_m=17 kN/m³
3.5m
Sand
γ_{sat}=20.5 kN/m³
A
6m
Clay
γ_{sat}=21 kN/m³
Sand

Figure-4

Group Index **(GI) = (F − 35)[0.2 + 0.005 (LL − 40)] + 0.01 (F − 15) (PI − 10)**

Where, PI = Plasticity index; LL = Liquid limit; F = Percent finer No. 200 sieve

Reduction factor (For Field Vane Shear Test), $\boldsymbol{\lambda = 1.7 - 0.54 \log_{10} PI}$

- vertical stress at a particular depth below the surface of a uniformly loaded area of any shape:

$$\sigma_z = q[1 - \frac{1}{\{1+\left(\frac{a}{z}\right)^2\}^{3/2}}]$$

- Time Factor:
  For U≤60%; $Tv = \frac{\pi}{4}\left(\frac{U\%}{100}\right)^2$
  For U>60%; $Tv = 1.781 - 0.933 \log_{10}(100 - U\%)$

Chart 1 AASHTO Soil Classification System

General Classification	Granular Material (35% or less passing No. 200 sieve)							Silt Clay Materials (More than 35% passing No. 200 Sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis; Percent 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	36 min	36 min	36 min	36 min
Characteristics of fraction passing No. 40											
Liquid Limit	---		---	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min*
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	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				Silty soils		Clayey soils	
General Rating as Subgrade	Excellent to good							Fair to poor			

- Plasticity Index of A-7-5 subgroup is equal to or less than L.L. minus 30.
- Plasticity Index of A-7-6 subgroup is greater than L.L. minus 30.

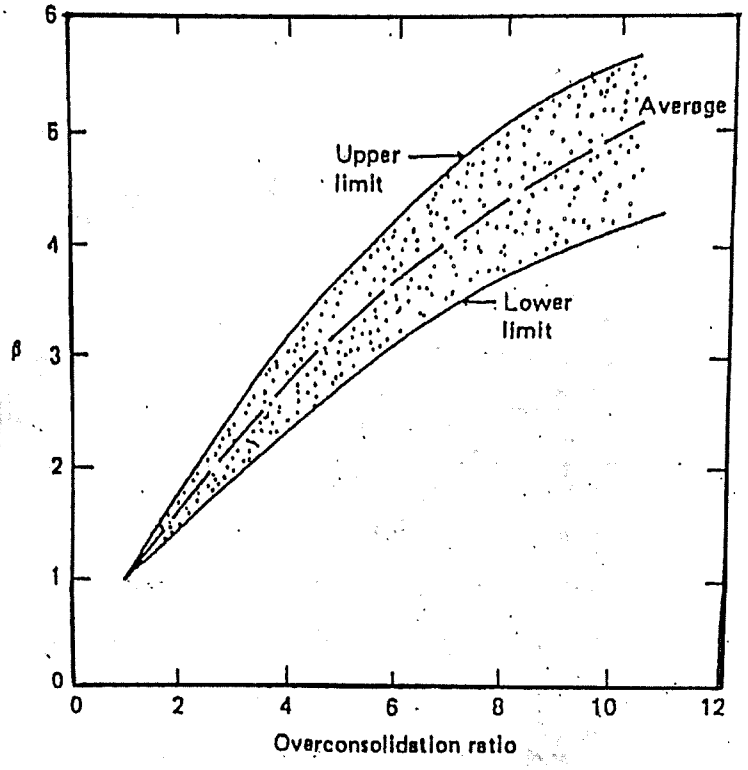


Chart 2 Plot of β versus Overconsolidation Ratio

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
3rd Year 1st Semester

Course Title: Open Channel Flow | Course Code: CE 361
Time: 3 hour | Credit Hour: 3 | Full Marks: 100

Answer all the questions

QUESTION 1 [20 MARKS]

a. Discuss the necessity of maintaining maximum and minimum permissible velocity in designing a channel. [5]

b. What are the three basic equations to describe open channel flow? State the principles on which these equations are based. [5]

c. Define hydraulic jump. Classify and sketch different type of hydraulic jump according to USBR (The United States Bureau of Reclamation) in the horizontal channel. [10]

QUESTION 2 [10 MARKS]

Water flows through a 4.5-meter wide rectangular channel at a mean velocity of 1.5 m/s having a depth of flow of 3.8 m. Compute the contraction in width of the channel to produce critical flow and the change in water level produced by the contraction. Neglect energy losses (friction and eddy) and consider α =1.1. [10]

QUESTION 3 [10 MARKS]

Derive the expression for normal depth in a wide channel based on (i) the Manning formula and (ii) the Chezy formula. [10]

QUESTION 4 [10 MARKS]

A sharp crested weir is placed in a rectangular channel. The upstream and downstream water level of the weir is 2.5 m and 1.5 m, respectively. If the discharge per unit weir is 4.5 m^2/s, estimate the energy loss due to the weir. [10]

QUESTION 5 [15 MARKS]

In a wide channel, the velocity varies along a vertical as $u = 1 + \frac{4z^2}{h^2}$, where h is the depth of flow and u is the velocity at a distance z from the channel bottom. [15]

(i) Compute the discharge per unit width
(ii) Determine the state of flow
(iii) Estimate the velocity distribution coefficeients (α and β)

QUESTION 6 [15 MARKS]

Show the first 3 trials to estimate the flood discharge through a river reach of 1000 m long having a fall in water surface of 0.85 m. Neglect eddy loss. Use the data given in the table below. [15]

Section	A (m^2)	P (m)	n	α
Upstream	12000	2150	0.03	1.15
Downstream	10500	2050	0.03	1.18

QUESTION 7 [20 MARKS]

(a) Design a stable alluvial channel using the Lacey method. The channel has to carry a discharge of 25 m^3/s through 1.5 mm sand. [10]

(b) A lined channel (n = 0.015) is to be laid on a slope of 1 in 2000. The side slope of the channel is to be maintained at 1.5:1. Determine the dimensions of a suitable section to carry a discharge 80 m^3/s when the maximum permissible velocity is 6.5 ft/s. [10]

APPENDIX

$$A = h^2(\phi + \cot\phi)$$

$$P = 2h(\phi + \cot\phi)$$

$$P = 4.75\sqrt{Q}$$

$$A = bh + h^2(\phi + \cot\phi)$$

$$P = b + 2h(\phi + \cot\phi)$$

$$R = 0.47(Q/f_s)^{1/3}$$

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

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

$$S_0 = \frac{f_s^{5/3}}{3340Q^{1/6}}$$

$$F_b = \sqrt{ch}$$

$$Q = K\sqrt{S_f}$$

$$f_s = 1.76\sqrt{d}$$

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
3rd Year 1st Semester

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

There are four questions. Answer all the questions [4x30=120]

QUESTION 1 [30 MARKS]

a. A trapezoidal channel carrying 20 m^3/s is built with non-erodible bed having a slope of 1 in 1000 and n= 0.025. Design the channel by the concept of best hydraulic section. Check for minimum and maximum velocity and Froude number criteria. Consult Table 1 for details on geometric elements of best hydraulic sections. [12]

Table 1: Geometric elements of some best hydraulic sections

Cross-section	A	P	R	B	D
Rectangular	$2h^2$	4h	h/2	2h	h
Triangular	h^2	$2\sqrt{2}h$	$\sqrt{2}h/4$	2h	h/2
Trapezoidal ($s=1/\sqrt{3}$)	$\sqrt{3}h^2$	$2\sqrt{3}h$	h/2	$4\sqrt{3}h/3$	3h/4
Circle	$\pi h^2/2$	πh	h/2	2h	$\pi h/4$
Parabola	$4\sqrt{2}h^2/3$	$8\sqrt{2}h/3$	h/2	$2\sqrt{2}h$	2h/3

b. Design a stable alluvial trapezoidal channel using the Lacey method. The channel has to carry a discharge of 25 m^3/s through 1.5 mm sand. Assume reasonable value of side slope. Consult Table 2 for necessary equations. [18]

Table 2: Equations proposed by Lacey for the design of stable channels

Silt factor	$f_s = 1.76\sqrt{d_{mm}}$
Wetted perimeter	$P = 4.75\sqrt{Q}$
Hydraulic radius	$R = 0.47(\frac{Q}{f_s})^{1/3}$
Bed slope	$S_o = \frac{f_s^{5/3}}{3340\,Q^{1/6}}$

QUESTION 2 [30 MARKS]

a. For a trapezoidal channel with b= 5 m, s= 2, n= 0.0225 and S_0= 0.001, compute the normal depth by the Newton-Raphson method if Q= 20 m^3/s. [10]

[$f(h)=A^{5/3}-\frac{nQ}{\sqrt{S_0}}P^{2/3}$ and $f'(h)=\frac{5}{3}A^{5/3}B-\frac{2nQ}{3\sqrt{S_0}}P^{-1/3}\frac{dP}{dh}$]

b. Evaluate the flood discharge through a river reach 1000 m long having a fall in water surface of 0.85 m. Neglect the eddy loss and assume n=0.03 and α=1. Use the following data: [20]

A_1= 12,000 m^2, P_1= 2,150m, A_2= 10,500 m^2, P_2= 2,050m

[$K=\sqrt{K_1K_2}$ ($K_1=A_1R_1^{2/3}$), h_f= F+ ($\alpha_1\frac{U_1^2}{2g}-\alpha_2\frac{U_2^2}{2g}$), $S_f=h_f/L$, $Q=K\sqrt{S_f}$]

QUESTION 3 [30 MARKS]

a. Water flows at a velocity of 12 m/s and a depth of 1 m in a horizontal rectangular channel 6 m wide. If a hydraulic jump forms in this channel, compute [3x10=30]

i) The discharge
ii) The type of jump,
iii) The downstream depth needed to form the jump,
iv) The downstream Froude number,
v) The efficiency of jump
vi) The actual and relative height of jump
vii) The length of jump
viii) The energy loss or energy dissipation in the jump
ix) The relative energy loss
x) The horse-power dissipation in the jump

Table 3: Characteristics of a hydraulic jump

Froude number	$Fr=\frac{U}{\sqrt{gh}}$
Specific energy	$E=h+\frac{U^2}{2g}$
Sequent depth	$\frac{h_2}{h_1}=\frac{1}{2}[\sqrt{(1+8Fr_1^2)}-1]$
Length of jump	$\frac{L_j}{h_1}=9.75(Fr_1-1)^{1.01}$
Energy loss (Relative loss=h_L/E_1)	$h_L=\frac{(h_2-h_1)^3}{4h_1h_2}$
Efficiency	$\frac{E_2}{E_1}=\frac{(1+8Fr_1^2)^{3/2}-4Fr_1^2+1}{8Fr_1^2(2+Fr_1^2)}$
Relative height of jump	$\frac{h_j}{E_1}=\frac{\sqrt{(1+8Fr_1^2)}-3}{(2+Fr_1^2)}$
Power dissipation	γQh_L

QUESTION 4 [30 MARKS]

a. An irrigation canal has to carry a discharge of 15 m^3/s through a moderately rounded coarse non-cohesive material having d_{50} = 2.5 cm, d_{75} = 3 cm and n = 0.025. The canal is to be trapezoidal in shape having s=2 and laid on a slope of 1 in 1000. Design the canal cross-section using the method of Lane (bottom width, depth, freeboard). Complete at least two trials utilizing Figures 1 and 2. [30]

$[K=\frac{\tau_s}{\tau_b}=\sqrt{1-\frac{sin^2\Phi}{sin^2\Psi}}$, $\tau_b(\frac{lb}{ft^2})=0.4d_{75\,(inch)}$, 1lb/ft^2=47.86 N/m^2]

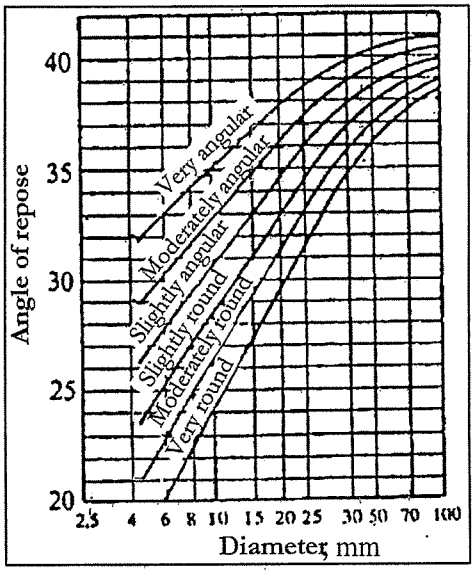


Figure 1: Angle of repose of non-cohesive material with respect to d_{75} (Lane, 1953)

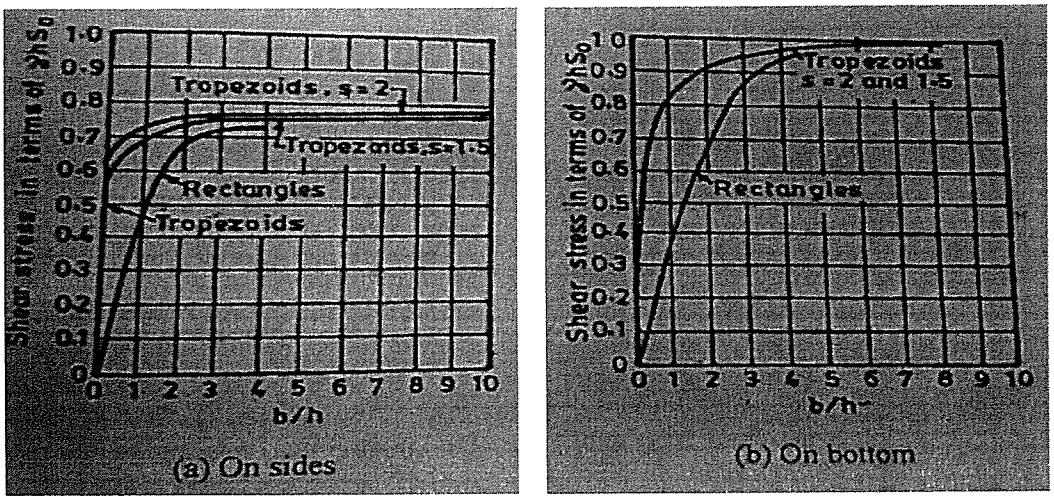


Figure 2: Maximum shear stresses on sides and bottom of trapezoidal channel

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
3rd Year 1st Semester

Course Title: Structural Engineering I — Course Code: CE 311
Time: 3 hours — Credit Hour: 3.00 — Full Marks: 100

ANSWER ALL QUESTIONS. Assume any missing data reasonably.
Note that dimensions are not in scale

PART-A

QUESTION 1 [15 MARKS]

For the truss shown in **Figure 1,** The stringers are simply supported on floor-beams at top-cord joints. A 20 kip concentrated live load moves across the stringers.

a) Calculate the maximum reaction at support ***"j"***.
b) Calculate the maximum forces (tension or compression) in members ***"bl"*** and ***"bc"*** [15]

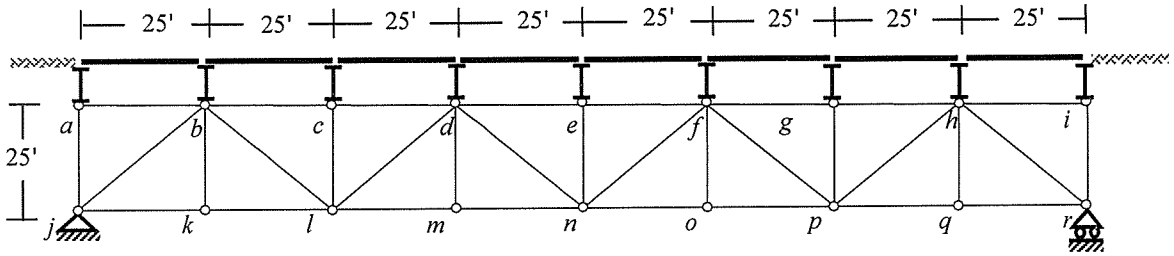


Figure 1. Warren with verticals truss bridge

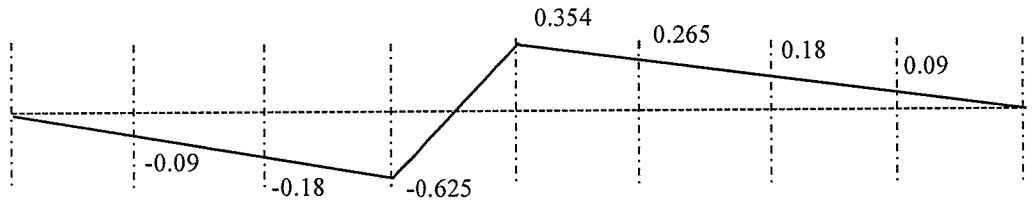


Figure 2. Influence line of force for the member ***"dn"***

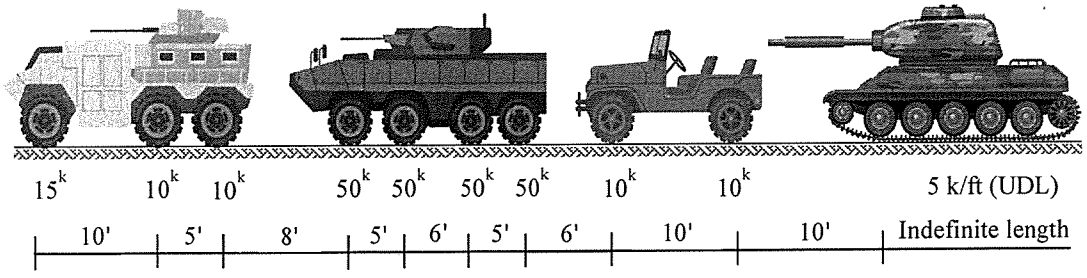


Figure 3. Wheel load arrangement

QUESTION 2 [15 MARKS]

The Influence line of force for the member ***"dn"***shown in **Figure 2.** Determine the maximum force in member ***"dn"*** of the truss when the wheel loads shown in **Figure 3** move from right to left across the bridge. [15]

QUESTION 3 [10 MARKS]

Analyze the simply supported beam AB, being subjected to the wheel load arrangement shown in **Figure 4.** Calculate the maximum reaction at *A* and maximum shear at *P* of the beam.

[10]

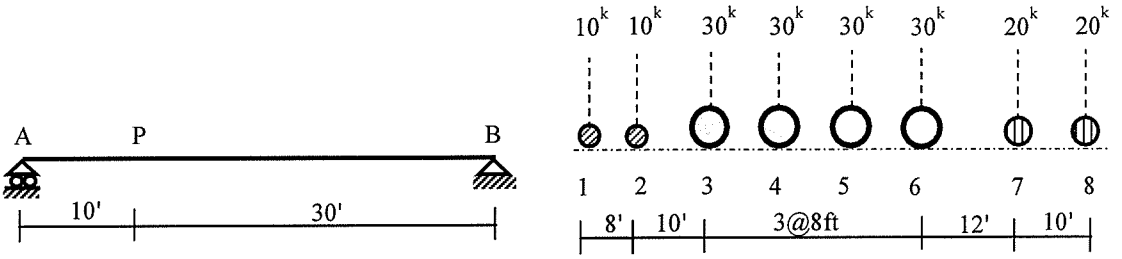


Figure 4

QUESTION 4 [10 MARKS]

Calculate the maximum moment, M_D at point D for the bridge shown in **Figure 5**, using the wheel loads shown **Figure 6.** and determine the greatest maximum moment within the span **CE** of the bridge. Where, W_{total} = 50 kip, L = 80 ft.

[10]

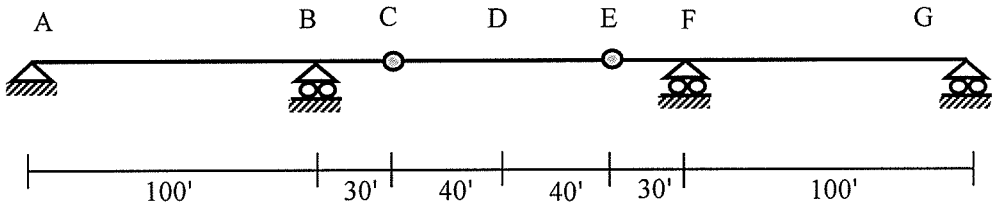


Figure 5

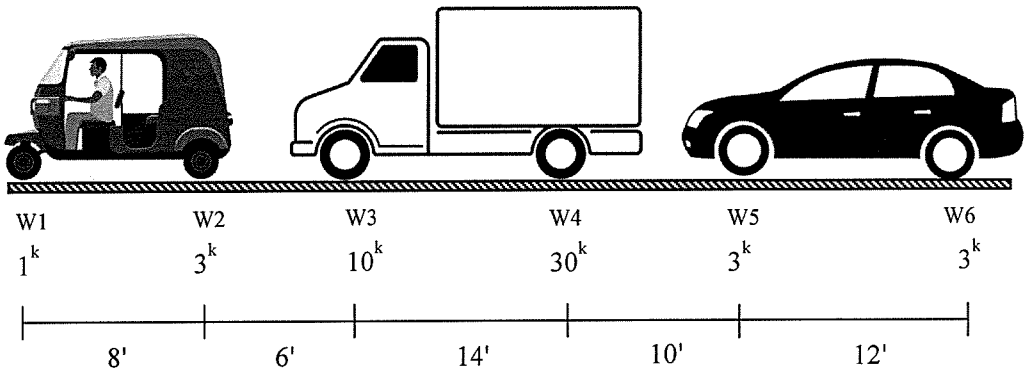


Figure 6

PART-B

QUESTION 5 [15 MARKS]

Analyze the frame shown in **Figure 7** by Cantilever Method to draw the Shear Force and Bending Moment diagrams.

[15]

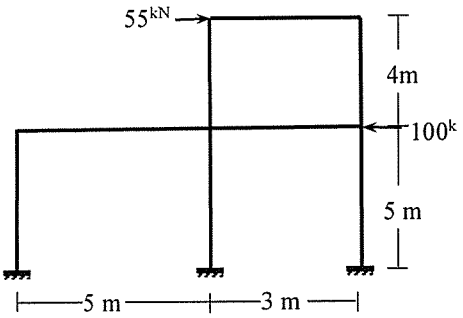


Figure 7

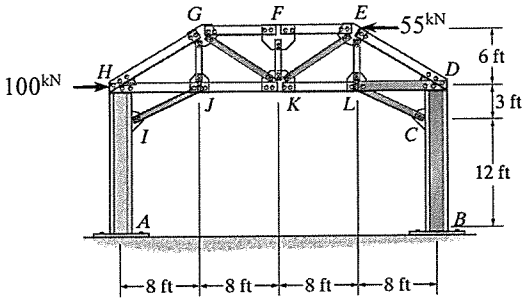


Figure 8

QUESTION 6 [05 MARKS]

Analyze the mill bent shown in **Figure 8** by Portal Method to determine the reactions at support **A** and **F.** Also, determine the force in members **EF** and **IJ**.

[05]

QUESTION 7 [08 MARKS]

Analyze the truss and determine the member forces of the statically indeterminate truss shown in **Figure 9.** assuming, diagonal members take an equal share of the sectional shear force

[08]

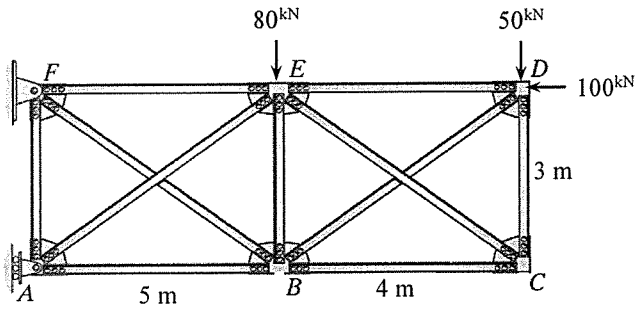


Figure 9

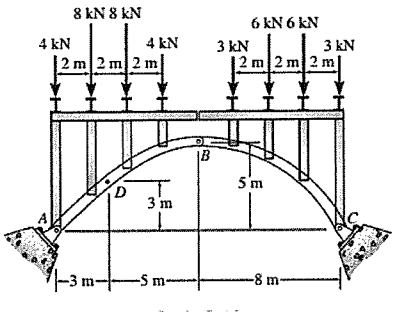


Figure 10

QUESTION 8 [05 MARKS]

The three-hinged spandrel arch is subjected to the loading shown in **Figure 10.** Determine the internal moment in the arch at point ***D***.

[05]

QUESTION 9 [12 MARKS]

Analyze the frame shown in **Figure 11** by Portal Method to draw the Shear Force and Bending Moment diagrams.

[12]

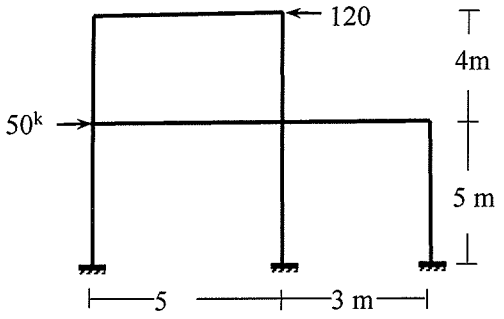


Figure 11

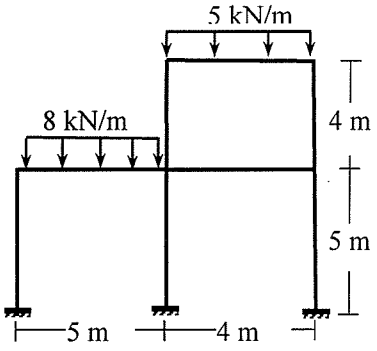


Figure 12

QUESTION 10 [05 MARKS]

Analyze the frame shown in **Figure 12** to draw the bending moment diagram using Approximate Method

[05]

Appendix

Formula (Reaction & Shear)

$\Delta R = \{(\sum P)\, d_1 + P'e\}/L - P_1$

$\Delta V = \{(\sum P)\, d_1 + P'e + P_0\, e_0\}/L - P_1$

Where,

$\sum P$ = Load remaining on the influence line throughout the wheel movement,
d_1 = Shift of the wheels,

P' = New load moving a distance e within the influence line
P_1 = Load which shifted off the section

P_0 = Load moving off the influence line from a distance e_0 inside.

Greatest Maximum moment

$M_{(Max)} = (\sum P/L)\,(L/2 - a/2)^2 - P_0\, b$, located a/2 from the beam midspan

Where,
Σ P = Loads above the Span, L = Span Length

a = Distance of the centroid of all loads from 'critical' load (often the load closest to centroid of loads)
P_0 = Load on the shorter side of the critical section,
b = Distance of the centroid of load P_0 from the 'critical' load

Formula (Maximum Moment)

W = Total wheel loads on Span

$$\frac{W}{L} = \frac{W_1}{a}$$

L = Total span length

W_1 = Total wheel loads on decreasing portion

a = Decreasing portion distance.

Dr. Mohammad Anwar Hossain
Rifat Sultana
Set A

University of Asia Pacific
Department of Civil Engineering
3rd Year 1st Semester Final Examination, Fall-2024

Course Title: Business Management, Course Code: IMG 303, Credit: 03

Time: 03 hours | Credit Hour: 3.00 | Full Marks: 50 (8+42)

PART ONE

Write any two short notes from the following: (2 × 4=8)

i. Maslow's hierarchy of need theory
ii. Four P's of Marketing
iii. Tactical planning
iv. Consumer market

PART TWO

Answer any Three questions from the following (3 × 14=42)

Question No.1 (7+ 7)

a) What is market segmentation? Discuss the different bases for segmenting the consumer market.
b) What are the characteristics of the different stages of a product life cycle? Discuss by drawing the graph of product life cycle.

Question No.2 (7+ 7)

a) Define the four parts of SWOT analysis and the benefit of this in strategy formulation.
b) Briefly discuss Porter's Generic business level Strategy formulation process with example.

Question No. 3 (7+ 7)

a) Describe the major process perspective of Expectancy Theory of Motivation.
b) Explain the two factors theory of Motivation as defined by Herzberg with its limitations.

Question No. 4 (7+ 7)

a) How would differentiate between an entrepreneur and a manager? Discuss.
b) What are the major problems of small scale industries in Bangladesh? Explain.

Question No. 5 (7+ 7)

a) What is standing plan? What are the different forms of standing plan? Discuss with example.
b) Discuss the major barriers of effective goal setting and planning process.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering

Course Title: Principles of Accounting
Time: 2 hours

Credit Hour: 2

Course Code: ACN 301
(Self- Study)
Full Marks: 50

Submit your question inside your answer script

(5*3=15)

1. Differentiate between:

i. Manufacturing cost and non- manufacturing cost
ii. Direct cost and indirect cost
iii. Variable cost and fixed cost

(8+4=12)

2. Consider the following account balances (in thousands) for the Shaler Corporation on Year 2022:

	Beginning of the year	End of the year
Raw Material	TK 130,000	TK 68,000
Work- in process	1 66,000	1 44,000
Finished goods	246,000	204,000

	End of the year
Purchase of direct materials	TK. 256,000
Direct manufacturing labor	212,000
Indirect manufacturing labor	96,000
Indirect materials	28,000
Plant insurance	4,000
Depreciation- plant, building, equipment	42,000
Plant utilities	24,000
Repair and maintenance- plant	16,000
Marketing and distribution expense	124,000
General and administration expense	68,000
Revenue	Tk 2,000,000

a) Prepare a schedule of cost of goods manufactured.
b) Prepare an income statement.

(6+6+3=15)

3. Real Holdings, a real estate company, has the following transaction:

January 1 The owner invested cash in the business TK 2,000,000.
2 Supplies purchased for TK 400000 on account.
5 Real holdings provided services for TK 500,000.
10 Real holdings again provided services for TK 200,000 on account.

25 Provided employees' salaries for TK 60,000.
31 Cash received but services has not been performed Tk 5,000.

Required:

- Prepare tabular analysis.
- Prepare journal entries.
- Prepare "Cash" ledger.

(8)

4. Data for Iftekhar Corporation are shown below:

	Total	Per unit
Sales	Tk. 500,000	Tk 100
(-) Variable expense	300,000	(60)
Contribution margin	200,000	Tk 40

Fixed expenses are Tk 70,000 per month and the company is selling 5,000 units per month.

i. Calculate the company's break-even point in unit sales. (1)
ii. Calculate the Taka sales needed to attain a target profit of Tk 55,000. (1)
iii. Refer to the original data, what is the revised net operating income if the selling price per unit increases by 10%, variable expenses increase by 0.80 cents per unit, and the number of units sold decreases by 10%? (3)
iv. Refer to the original data, how much will net operating income increase (decrease) per month if the monthly rent expense increases by Tk 5,000 and the monthly sales volume increases by 100 units? (3)