3-1

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2022
Program: B.Sc. Engineering (Civil)

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

(Answer all the questions)

1. MCA Corporation is reviewing an investment proposal. The initial investment is $104,000. Estimates of the book value of the investment at the end of each year, the net cashflows for each year, and the net income for each year are presented in the schedule below. All cash flows are assumed to take place at the end of the year. The salvage value of the investment at the end of each year is equal to its book value. There would be no salvage value at the end of the investment's life.

Investment Proposal

Year	Book Value	Annual Cash Flows	Annual Net Income
1	70,000	45,000	10,000
2	45,000	40,000	12,000
3	20,000	35,000	14,000
4	6,000	30,000	16,000
5	0	25,000	18,000

The company uses a 12% target rate of return for new investment proposals.

a) Calculate the payback period, profitability index and net present value for the investment. **[07]**

b) Define payback period. Name the most preferred capital budgeting technique. **[2+1]**

2. The controller of Standard Industries has collected the following monthly expense data for analyzing the cost behavior of electricity costs.

Month	Total Electricity Costs	Total Machine Hours
January	$2,500	300
February	3000	350
March	3600	500
April	4500	690
May	3200	400
June	4900	700

July	4100	**650**
August	3800	**520**
September	5100	**680**
October	4200	**630**
November	3300	**350**
December	6100	**720**

a) Compute the fixed- and variable-cost components using high-low method. **[6]**

b) Calculate the electricity cost for a level of activity of 500 machine hours using the cost equation. Also, calculate by what amount this differs from March's observed cost for 500 machine hours. **[2+2]**

3.

Kevin Corporation
Comparative Income Statement

	2020 (in $)	**2019 (in $)**
Sales	5,000,000	4,000,000
Cost of goods sold	3,160,000	2,400,000
Gross margin	1,840,000	1,600,000
Selling and administrative expenses:		
Selling expenses	900,000	700,000
Administrative expenses	680,000	584,000
Total selling and administrative expenses	1,580,000	1,284,000
Net operating income	260,000	316,000
Interest expense	70,000	40,000
Net income before taxes	190,000	276,000
Tax expenses	76,000	110,400
Net income	114,000	165,600

The company paid cash dividends of $45,600 and $69,552 in 2020 and 2019 respectively.

a) Prepare horizontal analysis and vertical analysis for the income statement data. **[3+3]**

b) Compute and explain the profit margin, times interest earned and payout ratio of the company for 2020. **[4]**

4. Sylvia Hill established a cleaning service company on May, 1. The following transactions were completed during the month.

May 1 Invested $15,000 cash in the business.
2 Paid $600 cash for May office rent.
5 Purchased equipment for $3,000 cash.
8 Incurred $700 of advertising costs in the *Daily Sun,* on account.

12 Paid $900 cash for office supplies.
16 Performed services worth $10,000: $3,000 cash is received from customers, and the balance of $7,000 is billed to customers on account.
20 Withdrew $600 cash for personal use.
25 Paid *Daily Sun* $500 of the amount due from May 8.
27 Paid employees' salaries $2,500.
31 Received $4,000 in cash from customers who have previously been billed on May 16.

Prepare an income statement, owner's equity statement for May and a balance sheet at May 31. **[10]**

5. Entor Corporation produces and sells specialized cordless telephones for high electromagnetic radiation environments. The company's contribution format income statement for the most recent year is given below:

	Total	**Per Unit**	**Percent of Sales**
Sales (20,000 units)	$1,200,000	$60	100%
Variable expenses	900,000	45	? %
Contribution margin	300,000	$15	? %
Fixed expenses	240,000		
Net operating income	$ 60,000		

Management is anxious to increase the company's profit and has asked for an analysis of a number of items.

a) Calculate the company's CM ratio and break-even point in both units and sales dollars. **[5]**
b) Assume that next year management wants the company to earn a profit of at least $90,000. How many units will have to be sold to meet this target profit? **[3]**
c) Compute the company's margin of safety in percentage form. **[2]**

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2022
Program: B. Sc. Engineering (Civil)

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

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

Use separate Answer Script for each part

Part– A

1. Draw Influence Line for : **(13)**
a) Bending moment at Section 1-1 and section 2-2
b) Shear force at Section 1-1 and Section 2-2
of the Frame Structure Shown in Fig 1. Load moves over the beam KD.
L=12ft for Even Student ID.
L=16ft for Odd Student ID.

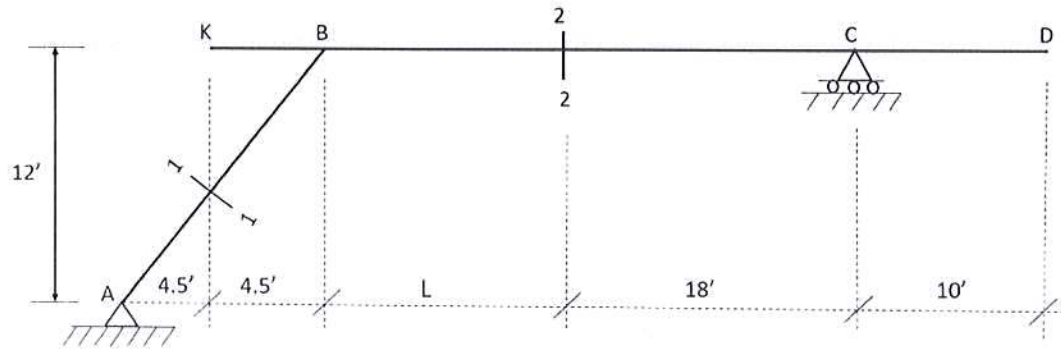

Fig: 1

2. Calculate maximum positive bending moment and maximum shear force at D of the Beam shown in Fig 2 for the combination of the following loads. **(12)**
Moving concentrated Live Load =P
Moving uniform Live Load = 6 kip/ft
Dead Load = 4 kip/ft
P=16^{k} and L=8 ft for Even Student ID.
P=11^{k} and L=9 ft for Odd Student ID.

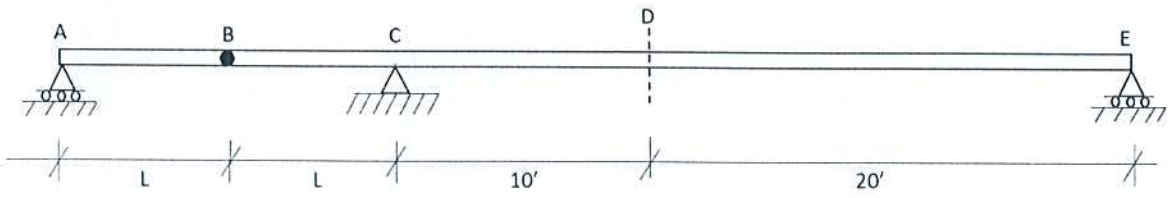

Fig:2

3. Calculate the Maximum Bending moment at L/3 from left support of a simply supported Beam of L feet for the Wheel Load shown in Fig 3. **(12)**
L=72ft for Even Student ID.
L=60 ft for Odd Student ID.

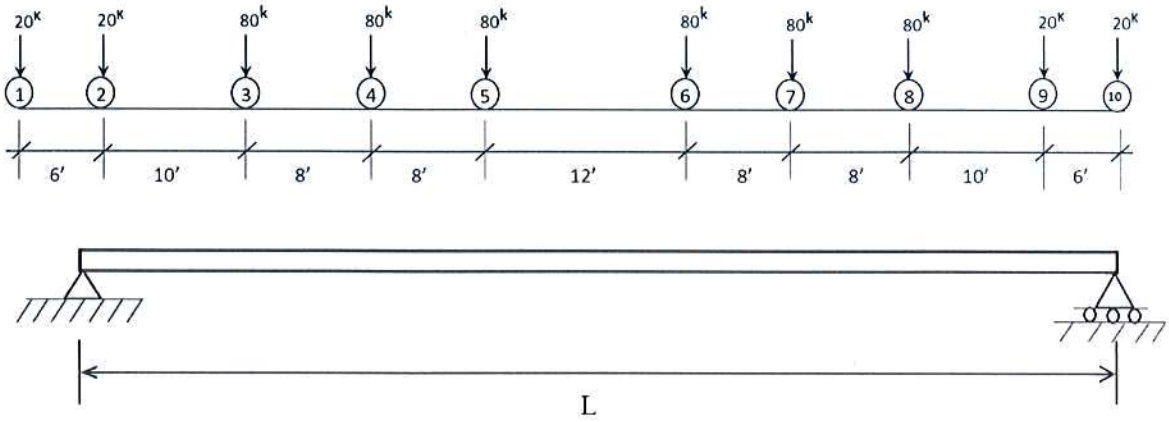

Fig:3

4. Calculate the Maximum Shear force at Quarter point from left support of a simply supported Beam of L feet for the Wheel Load shown in Fig 3. **(13)**
L=60 ft for Even Student ID.
L=72 ft for Odd Student ID.

Part B

5. Draw Influence Line for shear force in panel 4-5 and bending moment at panel point 5 of the girder with floor beam system as shown in Fig 4. **(12)**
L=14 ft for Even Student ID.
L=11 ft for Odd Student ID.

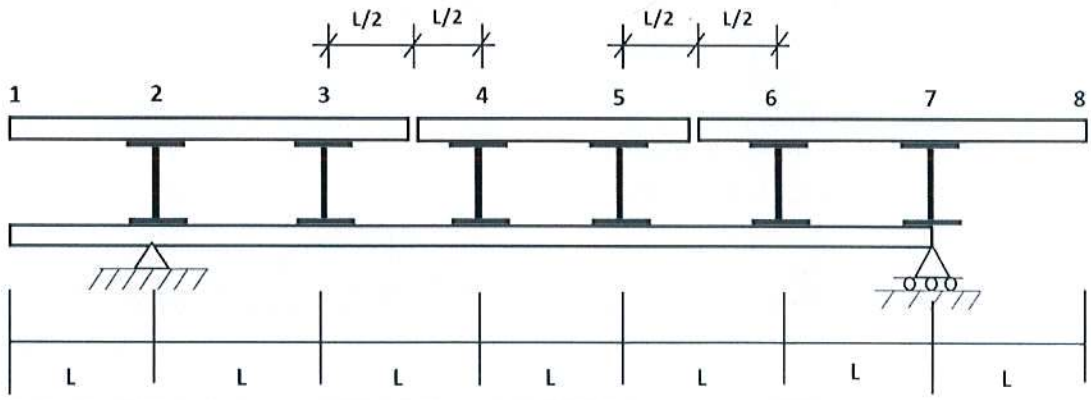

Fig: 4

6. Draw influence line of the truss (shown in Fig 5) for force in bar U_3U_4 ,U_3L_4 ,L_2L_3 and U_5L_5. **(13)**
L=25 ft for Even Student ID.
L=30 ft for Odd Student ID.

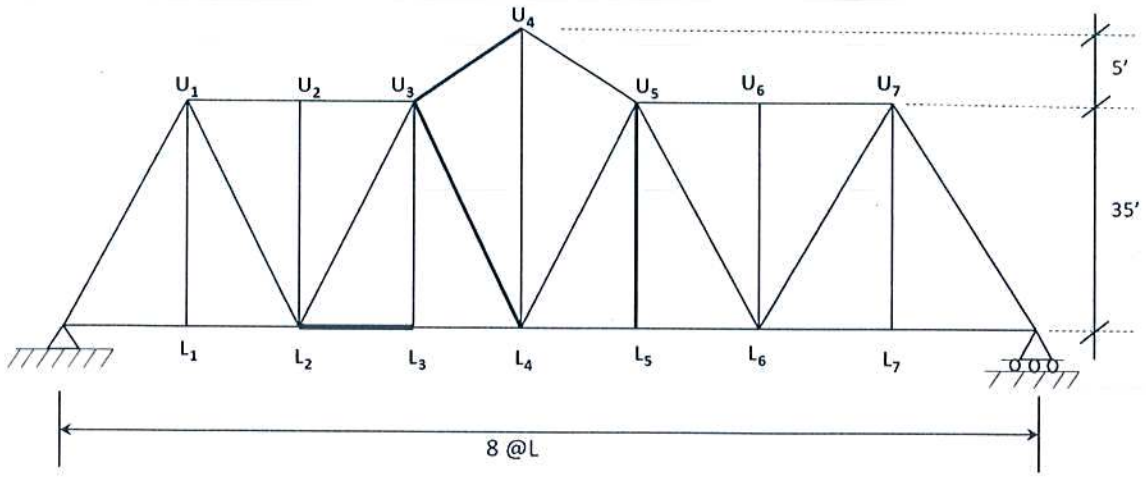

Fig:5

7. For the Suspension bridge with parabolic cable and two stiffening trusses shown in Fig 6, determine the maximum and minimum tension of the cable. The trusses are pin connected at C, Supported by a pin at A and roller at B. Also Calculate the force in truss member mn. **(13)**

P=60^k for Even Student ID.

P=40^k ft for Odd Student ID.

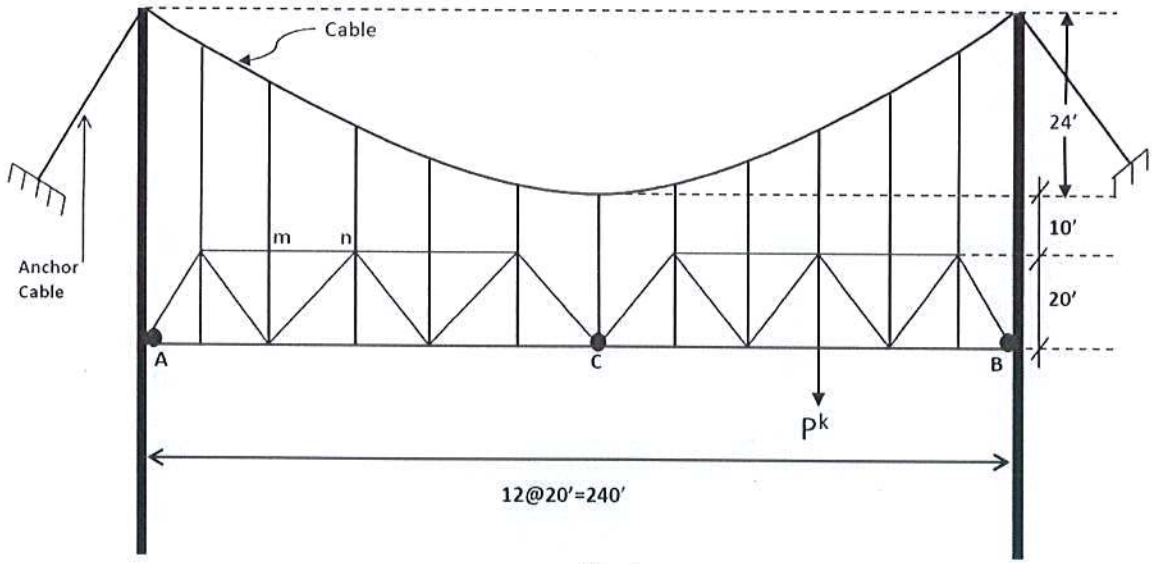

Fig: 6

8. A foot bridge of width 10m is carried over a river of span L meter by means of two cables. The Supports M and N are 8m and 20m respectively higher than the lowest point Q of the Cable. The Roadway carries a UDL of w kN/sq.m including self weight.Calculate the tension at the two supports of a cable considering that the cables will carry equal load. **(12)**

Also Calculate the maximum and minimum tension of the cable, maximum sag and sag at the lowest point Q of the cable.

w=6.5 kN/sq.m and L=150m for Even Student ID.

w=8.5 kN/sq.m and L=180m for Odd Student ID.

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2022
Program: B. Sc. Engineering (Civil)

Course: Design of Concrete Structures I **Course Code: CE 315**
Time: 3 Hour **Full Marks:100**

Assume any missing data reasonably (If required)

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1. a) State the differences between under-reinforced and over-reinforced condition of a beam. Select the preferable one with justification. **(4)**
   b) Describe briefly the factors that influence development length of a reinforcing bar. **(2)**
   c) State the minimum length of lap for column splices as per ACI/BNBC code. **(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 for bars in approximately equal spans with uniformly distributed loads. **(5)**

2. A rectangular beam carries a service live load (unfactored) of 28 kN/m and an unfactored superimposed dead load of 20 kN/m (including it's self weight) on a 7m simple span. The beam will have a cross-section of 350mm x 700mm for architectural reasons. Design the beam for flexure. **(15)**

   Given:

   Fy = 420 MPa
   fc′ =28 MPa
   $\beta_1 = 0.85$
   φ=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. Calculate the resisting moment capacity of the beam. **(15)**

   Given:

   F_y = 420 MPa
   f_c' = 34.5 MPa

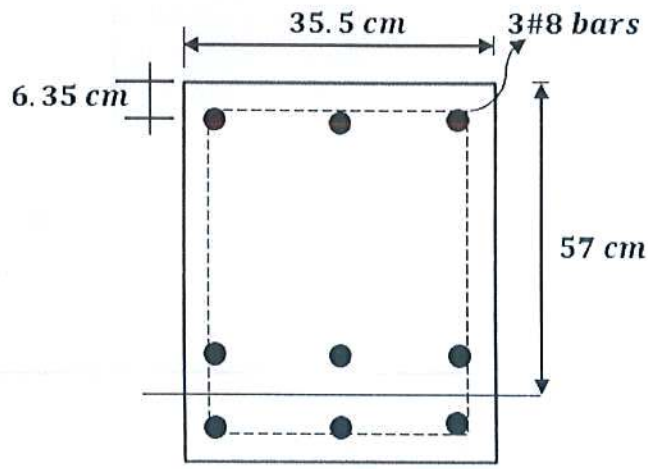


Figure: 1

4. A floor system, shown in Figure 2 consists of a 125mm 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. Calculate the required tensile steel area of beam at mid-span to resist a factored moment of 950 kN-m. **(15)**

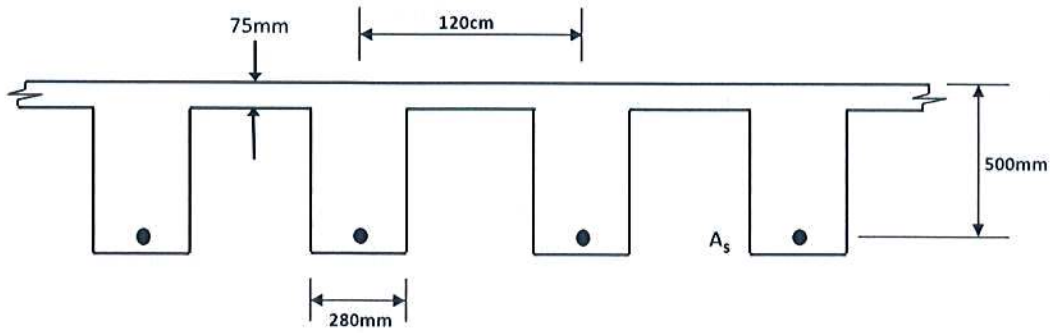


Figure:2

5. Design the beam for shear shown in Figure 3. Use Fy = 420 MPa and fc′ =28 MPa. Calculate shear stirrups with 2 sets of spacing. Show the stirrups in a neat sketch. The live load of the beam is 25 kN/m and dead load 30 kN/m (excluding self-weight of beam). **(20)**

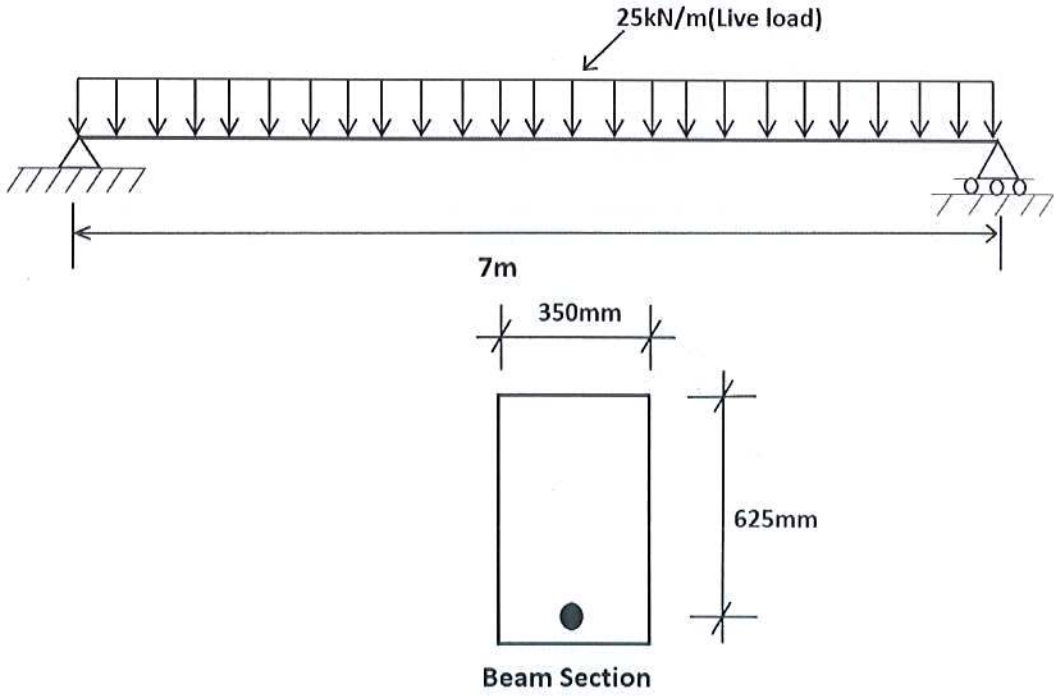


Fig:3

6. A footbridge is to be constructed, consisting of a one way solid slab spanning 5m between masonry abutments as shown in Figure 4. The service live load of the slab is 4 kN/m^2. A 50 mm asphalt wearing surface will be used, weighing 1 kN/m^2. Design the slab by USD method following the ACI provisions. **(20)**

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2022
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 (a) Provide an account of the planning and design considerations during the design of water supply system elements. Illustrate which qualities would you desire while choosing pressure pipes? While you use metal pipes for conveyance, provide pointers on how you can prevent the pipe from galvanic corrosion. (8+5+7)

(b) Provide your brief understanding on "intakes" and elaborate on "river intakes". (8)

(c) The table below shows the properties of two types of soil. Mention which type of soil is capable of retaining most of the water and which one is capable of discharging most of the water. Also, mention the options of groundwater recharge and discharge that could be done artificially. (4+4)

Soil type	Porosity (%)	Specific yield (%)
Clay	45	3
Sand	35	25

2(a) Indicate the chemical or chemicals (write the chemical formula with name) needed for each of the water treatment processes indicated below. Also, indicate the name of the precipitate if formed during the treatment process. (12)

Treatment	Chemical Added	Precipitate Formed
Coagulation-Flocculation		
Disinfection		
Softening (Hardness Removal) If water only has temporary hardness $Ca(HCO_3)_2$, $Mg(HCO_3)_2$		
Softening (Hardness Removal) If water only has $MgSO_4$		

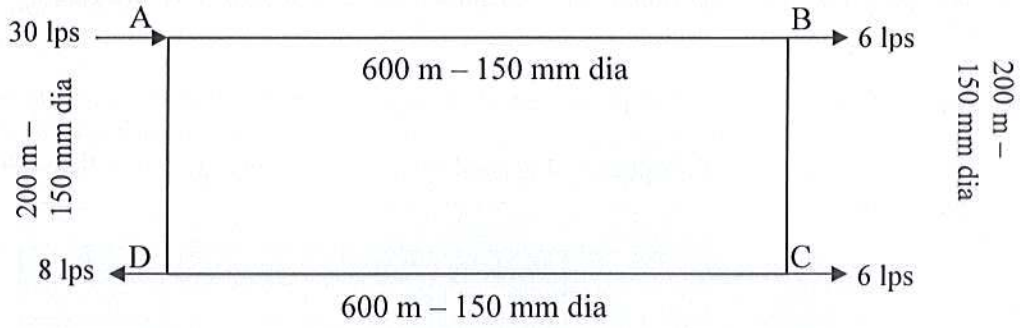
(b) One million gallons of water per day (1 mgd) passes through a sedimentation tank which is 20 ft wide, 50 ft long and 10 ft deep: (12)

(a) Find the detention time for the basin.
(b) What is the average velocity of flow through the basin?
(c) If the suspended solids content of the water averages 40 ppm, what weight of dry solids will be deposited every 24 hours assuming 75% removal in the basin?
(d) What is the overflow rate?

SECTION – B

3 (a) Explain the comparative benefits and problems of gravity system, direct pumping system, and pumping with storage system to design a distribution network. (5)

(b) Calculate the flow in each of the pipes in the following looped pipe network (using the Hardy Cross method and using trials until the desired level of correction is obtained): (15)



(c) Explain the reasoning for providing pumps in a water supply system. Explain the operations of any pump that is widely used in modern waterworks. (6)

(d) Water is supplied at a rate of 35 gallons per capita per day for a city with a population of 50000. The pump house is located at 135 ft from ground, and the treatment plant is located at 220 ft. The total length of the pipe has to be within 2500 ft, and the velocity through the pipe has to be maintained at 5 fps. The pump has to work for 10 hours daily at an efficiency of 65%. Design the transmission main (diameter of the pipe) and the pumping unit (working and break horse power). Assume friction factor, f = 0.01 (10)

OR

Evaluate how much power must be supplied by the pump to the flow if water ($\nu = 10^{-6}$ m^2/s) is pumped through the 300 mm steel pipe ($\varepsilon = 0.046$ mm, L = 140 m) from the lower tank (Elevation = 200 m) to the upper one (elevation = 235 m) at a rate of 0.314 m^3/s? [Assume, $K_{entrance} = 0.03$, $K_{bend} = 0.35$, $K_{exit} = 1$]

4 (a) Provide a comparative summary of the tube well technologies in your knowledge that are mostly used as groundwater extraction technologies, mainly in rural areas. (8)

OR

Provide insightful justification for using rainwater harvesting as an alternative source of drinking water, explaining the problems and the benefits.

(b) For a water safety plan, if a system description has to cover all steps of the water supply system from source to consumer, provide a process flow diagram for **the water supply system of your home town.** (7)

(c) Drinking water is supplied to a pourashava from groundwater extracted via deep tubewells (DTWs) and through a piped distribution system recently constructed with good quality control measures in place. The groundwater contains high concentrations of both dissolved Arsenic (10 mg/L) and Manganese (20 mg/L). Water supply line is connected with corroded pipes where corrosion interferes with the quality of incoming water. Ignoring any control measure, calculate the "raw risk" score and category for these three hazardous events : (i) high Mn concentration in groundwater, (ii) high Fe concentration in groundwater; and (iii) entry of corrosion blockage into the distribution system. Use the attached tables for a semi-quantitative approach and provide suitable justification for choosing the likelihood and impact categories. Also, point out the possible control measures with sustainability perspectives. (9)

Given Formulae

I. $t_d = V/Q$

II. 1 Gallon = 3.78 L

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

$t_d = V/Q$; $G = \sqrt{(P/\mu V)}$

$$h_L = 1.39 \times 10^6 Q^{1.85} D^{-4.87} \quad \textit{(when C = 130)}$$

$$\Delta = -\frac{\sum H}{x \sum H / Q_a}$$

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

Risk = Likelihood × Impact

Estimation of "Risk Score" and Risk Categorization:

Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
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.

University of Asia Pacific
Department of Civil Engineering
Final Examination (Fall-2022)
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) Differentiate between __ (2+3=5)

i) Residual and transported soil deposit.
ii) Primary consolidation settlement and secondary consolidation settlement.

b) For the retaining wall shown in **Fig.1**, 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)

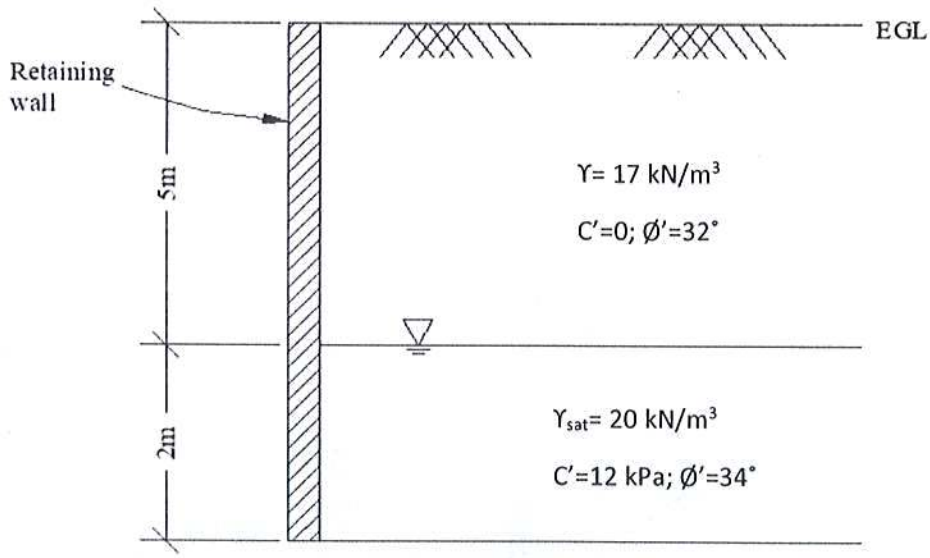


Fig. 1

2. a) Establish a relationship between void ratio and porosity of a soil. (5)

b) An undisturbed soil sample was collected from the field in steel Shelby tubes for laboratory evaluation. The tube sample has a diameter of 7.5 cm, length of 58 cm, and a moist weight of 45 N. If the moisture content and specific gravity of soil solids are 12% and 2.7 respectively, then calculate the following: (10)

a) Degrees of saturation and air content.
b) Saturated and effective unit weight.
c) Porosity of the soil sample.

3. **a)** Draw a 3 phase diagram of a soil and show its elements. Also show the change in diagram when the soil is saturated. (3+2=5)

b) A "**L**" shaped mat foundation is loaded with a uniform load of $2k/ft^2$ as shown in **Fig.2.** Estimate the vertical pressure at a point which is 10ft below the point "A". (10)

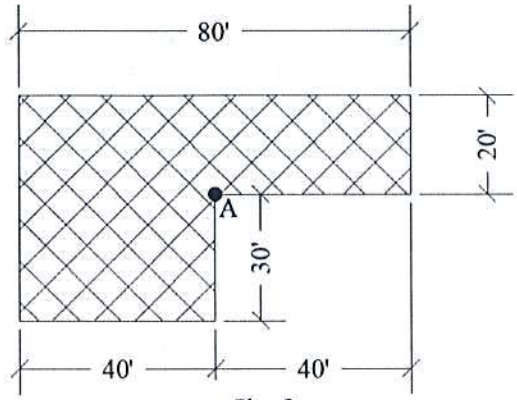


Fig. 2

OR,

b) Calculate the magnitude of vertical pressure(kN/m^2) at point "B" which is 6.0 m below the ground level due to the two orthogonal continuous wall shown in **Fig.3.**

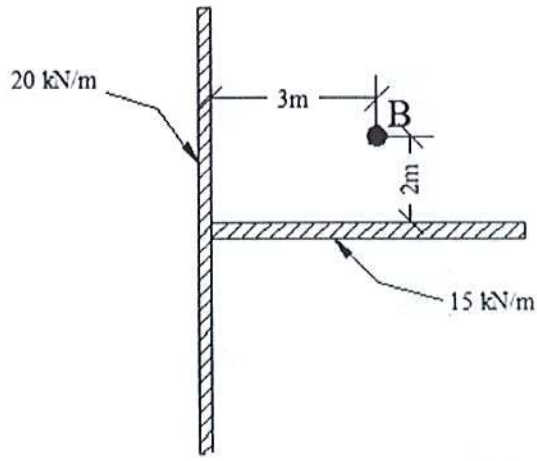


Fig. 3

4. **a)** What are the factors that affect compaction? Discuss in brief. (5)
b) The data from a standard Proctor compaction test on a soil (G_s=2.68) are given as:

Wt. of can + wet soil (gm)	38.54	40.73	42.43	36.34	33.23
Wt. of can + dry soil (gm)	35.94	37.32	38.20	32.32	29.12
Wt. of can (gm)	10	10	10	10	10
Dry density (kg/m^3)	1880	1930	1810	1705	1570

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

5. **a)** Illustrate the 4 different states and 3 different limits of a cohesive soil. (5)

b) Results from liquid limit test conducted on a soil are given below: (8+2=10)

Number of blows (N)	Moisture Content, w (%)
12	38
16	37
20	35
30	33
34	32
41	23

From Plastic limit tests: PL =15.7%

a. Draw the flow curve in appropriate graph paper and obtain the liquid limit also find the flow index.

b. What is the value of plasticity index of this soil?

6. **a)** From the laboratory consolidation plot shown in **Fig-4**, construct the field e-log(p) curve (Virgin consolidation curve) on this figure for over consolidated clay using procedure suggested by Terzaghi and Peck. Also show the indices (Cc, Cs) in your plot. (5+2=7)

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

b) A footing is placed on a sandy layer underlying a silty clay (G_s=2.68) stratum, with properties shown in **Fig. 5.**

Calculate__ (8)

i. Primary consolidation settlement of the clay layer.
ii. Time required to attain 15 mm settlement.
iii. Settlement after 3 months.

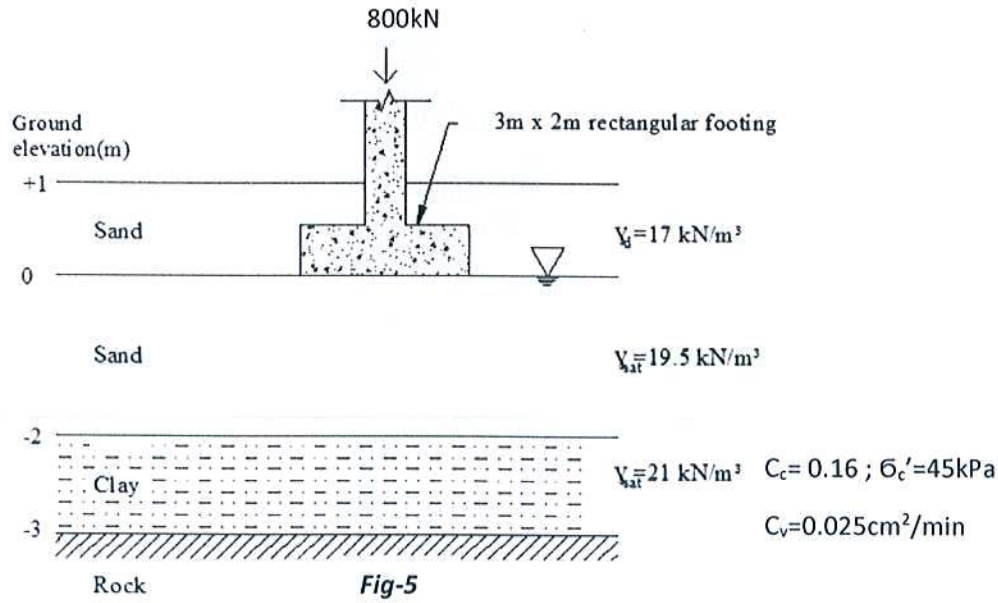


Fig-5

7. **a)** Write short notes on__ (2+3=5)
   i. Pre-consolidation pressure
   ii. Water transported soil deposits

b) A triaxial NC clay sample was subjected to an ambient (cell) pressure of 200 kN/m^2, and the pore pressure recorded was 50 kN/m^2. In this state, the sample was found to be fully saturated. Then under drained condition the cell pressure was raised to 300 kN/m^2. What would be the value of pore pressure? Then under undrained condition, a deviator stress of 150 kN/m^2 was applied to the sample. Assuming the pore pressure parameter A to be 0.5, determine the failure pore pressure value(u_f) and the equation of shear strength in terms of effective stress. (10)

OR,

A vane, 200 mm height and 100 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 58 N-m. Calculate the in-situ undrained shear strength of the clay. Assume uniform mobilization of end shear. If the values of liquid limit and plastic limit of the clay are 45 and 20 respectively, what would be the design value of undrained shear strength of the clay?

8. The following are the test results of 2 soil samples. Classify the soil A as per USCS and soil B as per AASHTO. (10+5=15)

Soil A:
Percent finer No. 4 sieve (4.75 mm) = 96
Percent finer No. 10 sieve (2 mm) = 60
Percent finer No. 40 sieve (0.425 mm) = 30
Percent finer No. 200 sieve (0.075 mm) = 10

Liquid limit (%) = 44
Plastic limit (%) = 24

Soil B:
Percent finer No. 4 sieve (4.75 mm) = 98
Percent finer No. 10 sieve (2 mm) = 80
Percent finer No. 40 sieve (0.425 mm) = 70
Percent finer No. 200 sieve (0.075 mm) = 52

Liquid limit of air dried soil= 55
Plastic limit of air dried soil= 33

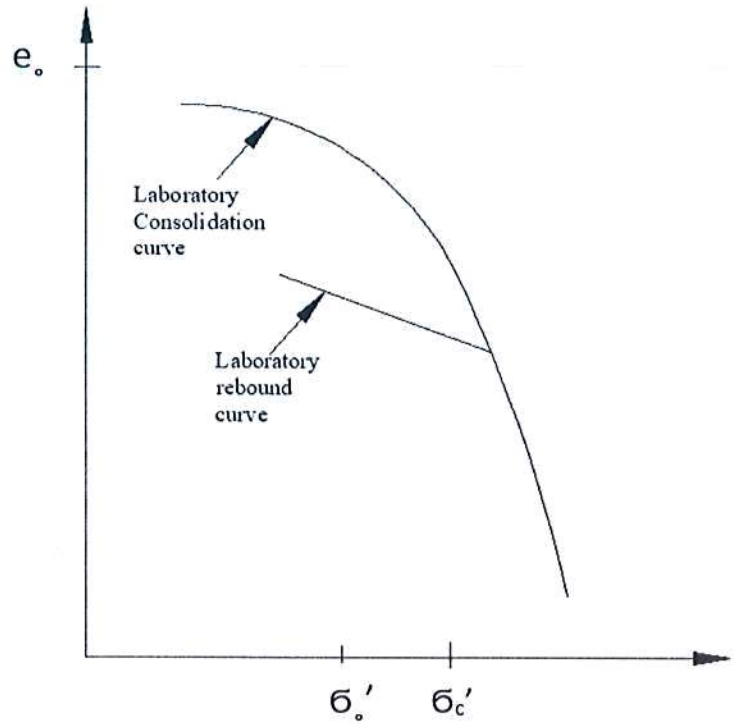


Fig. 4

Appendix

- Stress due to finite area loading__

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

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

- Stress due to infinite line load_

When load is distributed along y-axis, $\sigma_z = \frac{2qz^3}{\pi(x^2+z^2)^2}$

When load is distributed along x-axis, $\sigma_z = \frac{2qz^3}{\pi(y^2+z^2)^2}$

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

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

➢ AASHTO soil classification chart__

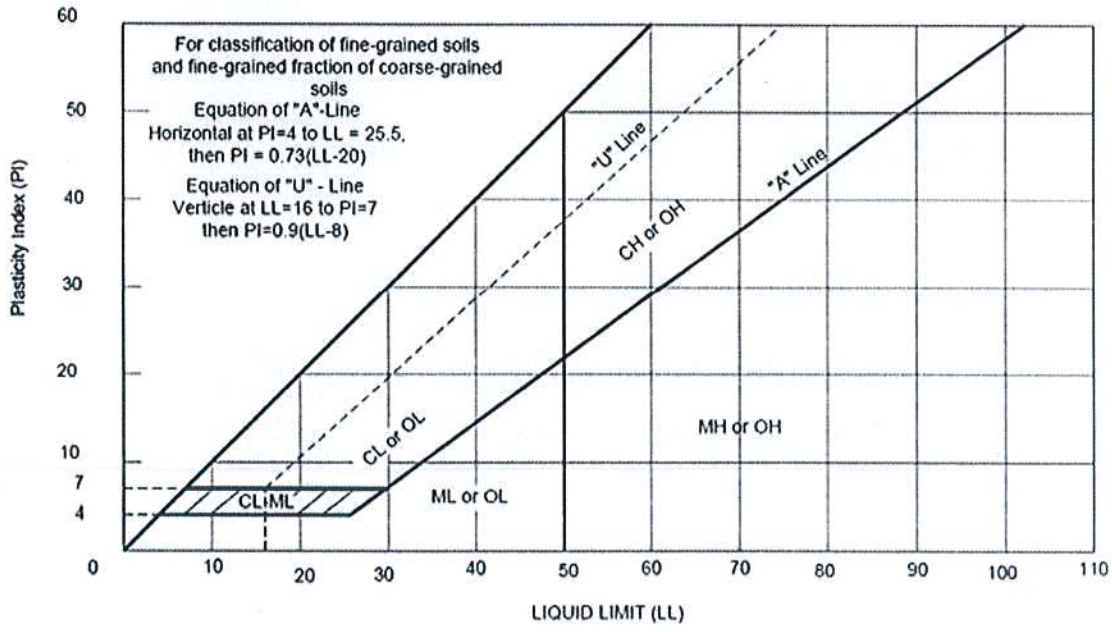
General classification	Granular materials (35% or less of total sample passing No. 200)						
	A-1			A-2			
Group classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7
Sieve analysis (percentage passing)							
No. 10	50 max.						
No. 40	30 max.	50 max.	51 min.				
No. 200	15 max.	25 max.	10 max.	35 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, $PI > LL - 30$

$$GI = (F_{200} - 35)[0.2 + 0.005(LL - 40)] + 0.01(F_{200} - 15)(PI - 10)$$

➢ Plasticity Chart__



University of Asia Pacific
Department of Civil Engineering
Final Term Examination Fall 2022
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. In a wide channel, the velocity varies vertically as $u = 1 + 2(z/h)^{1/2}$ where h is the total depth of water and u is the velocity at a distance z from the channel bottom. The river is 5 m deep. Compute i) the mean velocity using the integration method, ii) the discharge per unit width, iii) the state of flow, and iv) the velocity distribution coefficients. **[12]**

2. A steep rectangular chute has a slope of 1H:3V. Compute the pressure at the bed of the chute if the vertical depth of water flowing over the chute is 1 m. Also, compute the shear force and the overturning moment on its side walls. **[8]**

3. Explain how we identify the types of flow in a stream based on celerity. **[4]**

4. Show that at the critical state of flow, the discharge is maximum for a given specific energy. **[10]**

5. Water is flowing at a velocity of 2 m/s and a depth of 2.5 m in a long rectangular channel 6 m wide. Compute the height of a smooth upward step in the channel bed to produce critical flow. Also, compute the change in water level produced by the step. Neglect energy loss and take $\alpha = 1$. **[8]**

6. A trapezoidal channel has a bottom width of 6.0 m, side slopes of 1.5H:1 V, a depth of flow of 2.0 m, Manning's roughness coefficient of 0.025, and a bottom slope of 0.0001. Assuming that the flow is uniform, compute (i) the flow, (ii) Chezy's C, friction factor f, and τ_o (iii) the median diameter of the bed materials, (iv) drag velocity, and (v) k_s, if the channel boundary is rough. Assume that the velocity distribution is logarithmic. **[14]**

7. 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 1.5H:1V. Determine the section dimensions of a channel that carries a discharge of i) 40 m^3/s, and ii) 80 m^3/s when the maximum permissible velocity is 2 m/s. **[12]**

8. 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. **[12]**

9. Explain why Hl profile is not practically possible. **[4]**

10. A wide rectangular channel with Chezy's roughness coefficient of 45 $m^{1/2}/s$ and a bottom slope of 0.0001 carries a discharge of 1.8 m^2/s. A weir causes the water level to be raised by 0.50 m above the normal depth. Determine the length of the resulting flow profile between the weir site and the location when the depth is 2.80 m by the Bresse method. **[12]**

11. Sketch the possible flow profiles in the following combination of slopes: **[12]**
    i. Mild - steeper mild
    ii. Mild - critical
    iii. Horizontal - mild

12. Water flows at a velocity of 6.1 m/s and a depth of 1 m in a horizontal rectangular channel 6.1 m wide. Calculate (i) the type of jump, (ii) the downstream depth necessary to form a jump, (iii) the height of the jump, (iv) the length of the jump, (v) the horsepower dissipation in the jump, and (vi) the efficiency. **[12]**