3-2

University of Asia Pacific

Department of Civil Engineering

Final Examination, Fall- 2023

Course Title: Principles of Management. Course Code : IMG 301. Credit : 2

Time : 02 Hours. Marks : 50 .

❒ **Answer any 04(Four) questions. All questions carry equal marks.**

1.	a) What are the Leadership Theories ?	4
	b) Critically explain Charismatic Leadership Theory.	8.5
2.	a) What is the difference between Theory X and Theory Y ?	4
	b) Delineate Maslow's Needs Theory.	8.5
3.	a) Mention the key Characteristics of Teams.	4
	b) Examine the conflict management techniques.	8.5
4.	a) What is SWOT ? Give an example.	4
	b) Graphically represent Porter's Model	8.5
5.	Describe TOWS Matrix.	12.5

Best of Luck

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

Course Title: Design of Concrete Structures II | Course Code: CE 317
Time: 3 hours | Credit Hour: 3.00 | Full Marks: 100

QUESTION 1 [20 MARKS]

a. A flat slab panel of a residential building (live load 2 kN/m^2) is shown in **Figure 1**. The floor carries 3 kN/m^2 dead load due to random wall and floor finishes. Thickness of the slab should be based on defection and punching requirements of code. The concrete strength (f_c') could be used as 24 N/mm^2. Column size is 600 mm x 600 mm. Positive and negative moment coefficients of the panel are 0.35 and 0.65, respectively. Apply the concept to design the slab for **long span** only. [14 Marks]

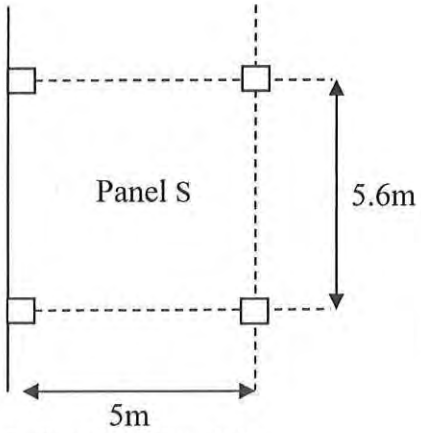


Figure 1. Panel of flat slab

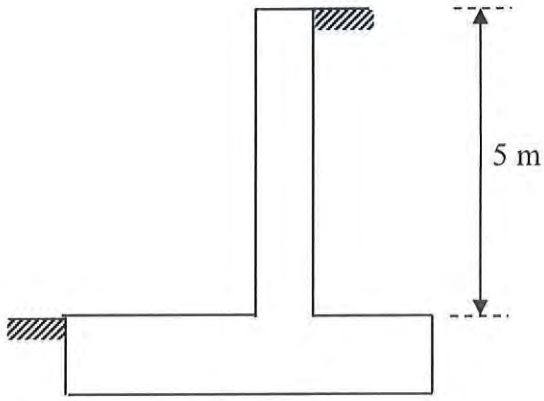


Figure 2. Retaining wall

b. A cantilever retaining wall of an artificial lake is shown in **Figure 2**. Density of soil beside the wall is 1700 kg/m^3, active soil pressure coefficient is 0.33, soil is saturated with water (void ratio of the soil is 50%). Deflection of the wall is required to be controlled. Apply the concept to design the wall with optimal thickness in accordance to BNBC 2020. Concrete strength (fc') could be used as 24 N/mm^2. [6 Marks]

QUESTION 2 [20 MARKS]

a. Two columns of a multi-storeyed building are 3.5 meters apart is supported by combined footing. Both columns having the same load (dead load is 1000 kN, live load is 300 kN). Bearing capacity of the soil is 180 kN/m^2. Size of both columns are 600 mm x 600 mm, 24 MPa concrete could be used in design. Assume, width of the footing is 3 m and thickness is 600 mm. Apply the concept to design long span of the combined footing. [14 Marks]

b. A 10 m span of simply supported post-tensioned one way slab is subjected to uniformly distributed dead load (including self weight) of 10 kN/m and live load of 2.4 kN/m. Section of the slab is 1000 mm x 300 mm. Eccentricity of the tendon is 75 mm from bottom of the slab. Apply the concept to obtain required minimum pre-stressing force and stresses at mid-span of the slab. [6 Marks]

QUESTION 3 [20 MARKS]

The floor plan of a 10-storeyed RC frame structure of residential building is shown in **Figure 3**. Slabs of the floor is supported by beams (300 mm x 600 mm). Thickness of slab could be minimized in accordance with the requirements of flexure, shear and deflection of code of practice. Propose a solution to have the minimum required thickness of slab "S1". Design the **short span** of slab panel "S1" with the minimum thickness considering safety and environmental issues of BNBC 2020. The slab is contineous, thus, support moment at contineous edge of the slab is subjected to analysis of contineous slab. Required data has to be assumed in design. Shear force co-efficient is 0.5.

[20 Marks]

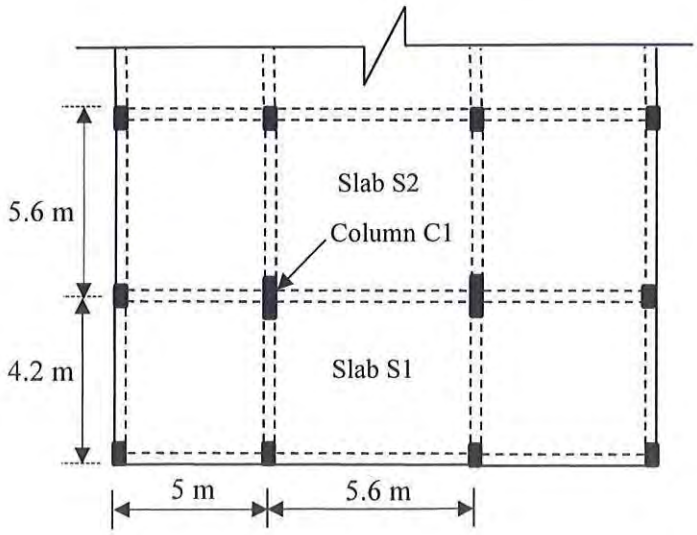


Figure 3: Floor Layout Plan of 10-Storeyed Residential Building

QUESTION 4 [20 MARKS]

The ground floor column "C1" of the project stated in **Question 3** has to be designed. The column is subjected to 700 kN-m moment on its critical axis due to lateral load. As per the floor plan, the maximum width of the column is 500 mm. Design the ground floor column of "C1" considering safety, environment and societal requirements. Dimension of the column is required to be minimized as much as possible in accordance to the provisions of BNBC 2020. [20 Marks]

QUESTION 5 [20 MARKS]

The column "C1" of the project (**Question 3**) is supported by pile foundation. The maximum capacity of 600 mm diameter bore pile can be consider as 1200 kN. High strength concrete (above 40 MPa) has to be used to reduce depth of pile cap for optimal design. **Propose a solution for optimal design** of the pile cap considering all options (flexure, shear, punching shear, number of piles) of code (BNBC 2020). **Formulate required design equations** for high strength concrete, **design the pile cap** with minimum depth and steel considering safety and environmental issues of BNBC 2020. [20 Marks]

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

Course Title: Transportation Engineering I Credit Hour: 3.00 Course Code: CE 351
Time: 3 hours Full Marks: 100

Answer all the questions

1. a) Fuad is observing and taking notes of traffic on a busy highway during a weekday. Based on his observation, he made the following statements throughout the day.

   Morning Rush: Inbound lanes are congested with slow-moving traffic. Outbound lanes are clear.

   Midday: Traffic is light, and vehicles move smoothly with a constant flow rate.

   Evening Rush: Outbound lanes are congested with slow-moving traffic. Inbound lanes are clear.

   New Bypass: A new bypass road opens, increasing traffic on this new route and reducing congestion on the old highway.

   i) What type of flow is seen in the morning rush on inbound lanes?
   ii) How would you describe the midday traffic flow?
   iii) What type of flow occurs in the evening rush on outbound lanes?
   iv) What type of flow results from the new bypass road opening? [8]

   b) In the bustling city of Metroville, traffic never seemed to relent. To manage the chaos, the city installed system "X" at various intersections. At a single intersection, system "X" ensured that traffic lights changed with precision, guiding vehicles efficiently through the intersection. However, as Metroville expanded, the need for a coordinated system became evident. Surprisingly, the head city planner, Sadman, decided to place isolated control systems at closely spaced junctions along busy corridors, intending to reduce congestion and improve safety. Alternatively, traffic engineer Arafat advocated for Demand Responsive Controllers.

   i) What is System "X"? Discuss the efficiency of that system in cities like Metroville highlighting its advantages and disadvantages.
   ii) Between Sadman and Arafat, whose opinion is most feasible? Give justification for your answer. If neither opinion seems appropriate to you, suggest your options according to the scenario. [5+7]

2. a) What do you understand by approach capacity, effective green time and all red period at an intersection? Discuss the conditions under which all red period is needed to include in designing traffic signals. [6+4]

   b) Between traffic signs and traffic markings, which one will you recommend to use in roads? Demonstrate why. [5]

3. a) Draw and discuss two special mandatory road signs for priority typed intersections and their applicable usage scenarios. [6]

   b) Discuss in brief the provisions of designing the following

   i. Staggered Intersection
   ii. Roundabout [4]

   c) Draw a typical trumpet interchange with proper flow directions. [5]

4. a) At a manually controlled four-legged intersection, the ratio of cycle length and effective green time is found 2.5 for each direction. The approach capacity is 2520 PCU/hr for north and south directions individually, and 4320 PCU/hr for east and west directions individually.
The number of vehicles passing the intersection during the intervals of the saturation flow count is given as follows:

Interval	Duration	PCU (North-South)	PCU (East-West)
First	6 sec	7	9
Last	4 sec	3.5	6

Calculate

i) Saturation flow for each direction.
ii) Lost time for North-South and East-West. **[4+6]**

b) The above-mentioned intersection is to be converted into a two-phase signalized intersection.
In addition to the data obtained from ques 4(a), following data are given:

	North-South	East-West
Inter green period, sec	9	8
Arrival flow, PCU/hr (individually in both directions)	1260	3240

i) Design the signal.
ii) Draw the concerned bar diagram.
iii) Draw the phase diagram. **[10+6+4]**

5. The secondary street of a city is a two-way road and has 2 lanes on each direction. Determine lighting layout of the road with mounting height of 40 ft, surface reflectance of 20% and a maintenance factor of 0.7. Consider, Fluorescent bulb.
Given, Night-time vehicle flow (both direction) = 1000 vph
Refer to the annexure (Table 1-4, Figure 1) for necessary data. **[10]**

6. A survey has been conducted on six vehicles traversing throughout a 20 km stretch of a road to calculate spot speed. Data are obtained as follows

Vehicle No.	Travel Time (hr)	Spot Speed (kmph)	Cumulative Frequency
1	4	A	5
2	2	B	20
3	1.33	C	50
4	1	D	80
5	0.8	E	90
6	0.67	F	100

i) Determine time-mean speed.
ii) Determine design speed and safe speed for the road (use graph paper). **[4+6]**

Annexure

TABLE 1 RECOMMENDED AVERAGE ILLUMINATION (LUMENS/FT^2)

Pedestrian traffic(1)	Vehicular traffic(2) (vph)			
	Very light (< 150 vph)	Light (150 – 500 vph)	Medium (500 – 1,200 vph)	Heavy (> 1,200 vph)
Heavy	-	0.8	1.0	1.2
Medium	-	0.6	0.8	1.0
Light	0.2	0.4	0.6	0.8

Notes: (1) Heavy: As on main business street
Medium: As on secondary business streets
Light: As on local streets
(2) Night hour flow in both directions

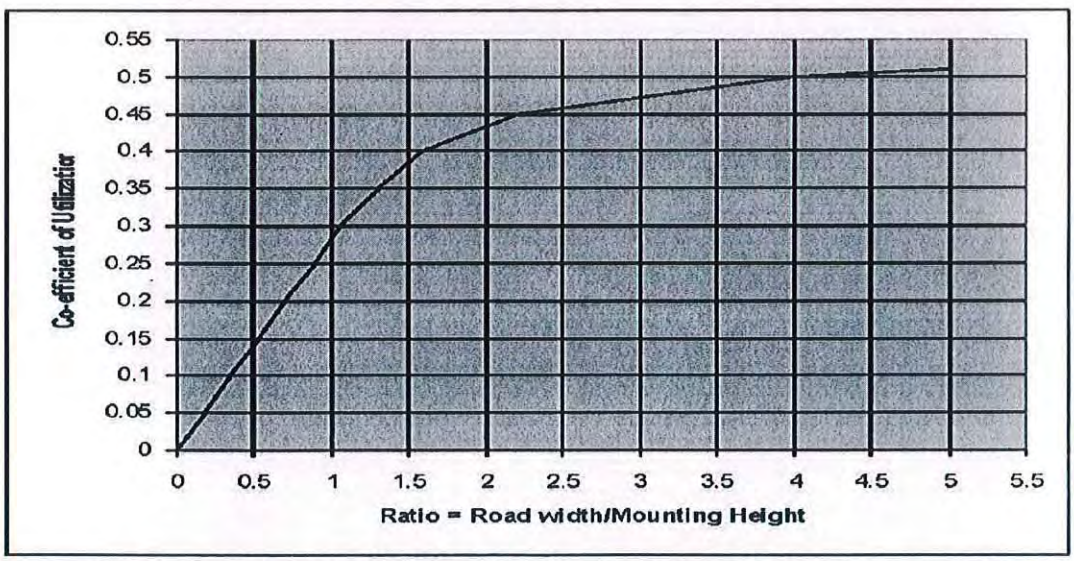
TABLE 2 ADJUSTMENT FACTORS FOR RECOMMENDED AVERAGE ILLUMINATION VALUES

Surface Reflectance	Adjustment Factors
3 % or less	1.5
10%	1.0
20% or more	0.75

TABLE 3 LIGHTING SOURCE CHARACTERISTICS

Source Types	Expected Life (hrs)	Lighting Efficiency (Lumens/Watt)	Wattage (Watt)
Tungsten	1000	8 – 14	Up to 1000
Fluorescent	6000	50 – 75	Up to 250
Sodium	6000	100 – 120	Up to 160
Mercury	7500	20 – 60	Up to 400

FIGURE 1 CO-EFFICIENT OF UTILIZATION CURVES *(FOR LIGHT DISTRIBUTION TYPE III)*



Note: Due to poor maintenance, the actual co-efficient of utilization is reduced by a factor usually 0.8 (i.e. taken as 80%).

TABLE 4 RECOMMENDED ARRANGEMENT OF STREET LIGHTING

Type of Arrangement	Pavement Width
One side	Width <= 30ft
Both sides – Staggered	30ft > Width <= 60ft
Both sides – Opposite	Width > 60ft

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

Course Title: Engineering Hydrology | Credit Hour: 3.0 | Course Code: CE 363
Time: 3 hours | Full Marks: 100

Answer all the questions (10+20+25+20+25). The numbers inside the brackets indicate marks.

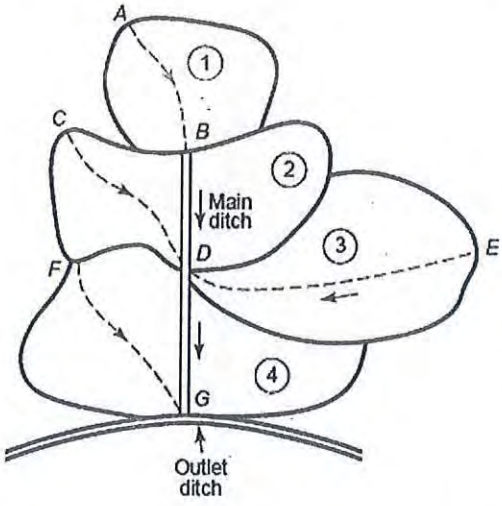
1 (a) What happens to the hydrograph when it travels downstream? Discuss the reasons. (5)

(b) Discuss the importance of peak flow estimation. (5)

2 (a) "Through aquifer, Darcy's velocity is lower than the seepage velocity. For estimating travel time of water through aquifer, it requires seepage velocity". Prove the statement mathematically. (10)

(b) Discuss the applications and characteristics of deterministic and stochastic models in hydrology. (10)

3 (a) An urban watershed is shown below along with the travel paths from the most remote points in each subarea. The details of the subareas are given in the accompanied Table (Table 1). Use the provided Intensity-Duration-Frequency (IDF) curve with Kirpich formula to determine the 20-yr peak flow at the drainage outlet G. Kirpich formula for overland flow time, $t_i = 0.0078 \frac{L^{0.77}}{S^{0.385}}$ (15)



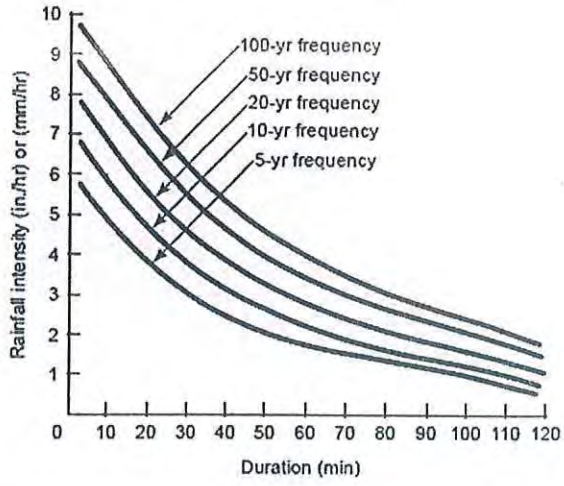


Table 1

Area	Drainage Area (acres)	Type of Surface	Path	Length (ft)	Slope (%)
1	12.0	Bare surface, $C = 0.4$	*AB*	1300	6.0
2	13.5	Asphalt paved, $C = 0.8$	*BD*	1250	1.5
			CD	1420	2.0
3	11.8	Lawn, $C = 0.3$	*ED*	1800	1.0
4	14.1	Concrete paved, $C = 0.9$	*DG*	1510	1.5
			FG	1660	2.5

(b) Groundwater flows through an aquifer with cross-sectional area of 10^4 m^2 and a length of 1500 m. Hydraulic heads are 300 m and 250 m at the groundwater entry and exit points in the aquifer, respectively. Groundwater discharges into a stream at the rate of 750 m^3/day. Determine the hydraulic conductivity of the aquifer. (10)

4 Determine the hydrograph at the downstream section using the Muskingum routing method if a storm produced the hydrograph at the upstream section given in the table below. The Muskingum constants are K = 8 hours and x = 0.15 for the reach. In the beginning, the outflow is 15 m^3/s. (20)

$$C_0 = \frac{-kx + \frac{1}{2}\Delta t}{\left(\frac{1}{2}\Delta t + k - kx\right)} \qquad C_1 = \frac{\left(kx + \frac{1}{2}\Delta t\right)}{\left(\frac{1}{2}\Delta t + k - kx\right)} \qquad C_2 = \frac{\left(k - kx - \frac{1}{2}\Delta t\right)}{\left(\frac{1}{2}\Delta t + k - kx\right)}$$

Time, hr.	0	1	2	3	4	5	6	7	8	9	10
Flow, m^3/s	15	27	75	160	220	200	160	88	50	25	12

5 The annual maximum flood measured at a local valley for 20 years are given below. (25)

Year	Max. Flood (ft^3/s)	Year	Max. Flood (ft^3/s)
2004	5200	2014	4200
2005	2100	2015	3900
2006	5000	2016	3200
2007	4500	2017	4100
2008	3600	2018	3400
2009	3500	2019	7100
2010	2400	2020	5100
2011	2100	2021	800
2012	3000	2022	680
2013	2300	2023	700

Plot the data using the Weibull plotting position formula. Based on the graphical method and the frequency factor method estimate the 15-year annual maximum flood, the exceedance probability and return period for an event of 3500 ft^3/s using (i) lognormal and (ii) normal distribution. The standard deviation of normally and lognormally distributed data are 1657.45 and 0.29, respectively.

Based on the statistical analysis used in (i) and (ii) investigate whether the data follows lognormal or normal distribution. If the data does not follow any of these distributions, what will you suggest. Justify your suggestions. Use the frequency factor table given below (Table 2).

Table 2

Table Frequency Factor for Normal Distribution

Exceedance Probability	Return Period	*K*	Exceedance Probability	Return Period	*K*
0.0001	10,000	3.719	0.450	2.22	0.126
0.0005	2,000	3.291	0.500	2.00	0.000
0.001	1,000	3.090	0.550	1.82	−0.126
0.002	500	2.88	0.600	1.67	−0.253
0.003	333	2.76	0.650	1.54	−0.385
0.004	250	2.65	0.700	1.43	−0.524
0.005	200	2.576	0.750	1.33	−0.674
0.010	100	2.326	0.800	1.25	−0.842
0.025	40	1.960	0.850	1.18	−1.036
0.050	20	1.645	0.900	1.11	−1.282
0.100	10	1.282	0.950	1.053	−1.645
0.150	6.67	1.036	0.975	1.026	−1.960
0.200	5.00	0.842	0.990	1.010	−2.326
0.250	4.00	0.674	0.995	1.005	−2.576
0.300	3.33	0.524	0.999	1.001	−3.090
0.350	2.86	0.385	0.9995	1.0005	−3.291
0.400	2.50	0.253	0.9999	1.0001	−3.719

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

Course Title: Environmental Engineering II — Course Code: CE 333
Time: 3.00 Hours — Credit Hour: 3.00 — Full Mark: 120

There are five (5) questions. Answer all the questions in both sections. Assume any missing data. (Necessary formulae are attached; Assume reasonable data if necessary)

Section A

1.(a) In a rural area, families have been using traditional pit latrines for generations. However, in recent years, there has been a concerning rise in the number of children falling ill due to waterborne diseases.

(i) Identify the problems associated with pit latrines in that area and select an onsite sanitation system for the community that can overcome this problem. **[5]**

(ii) Explain how human waste generated from your proposed sanitation system can be converted into energy. **[5]**

1.(b) **(i)** Differentiate between septic tank and small-bore sewerage systems. **[7]**

(ii) Explain how septic tank brings a change in the SBS in terms of sewer network and treatment plant design. **[7]**

2.(a) Determine the size of the required anaerobic digester for treating sludge with the following properties: **[10]**

Average design flow	5000 m^3/d
Dry solid removed	0.25 kg/m^3
Ultimate BOD removed	0.16 kg/m^3
Solids content	5%
Θ_c	20d
Y	0.07 kg/kg BOD
k_d	0.03 d^{-1}
Solid specific gravity	1.02
Waste utilization efficiency	75%

Necessary equations are attached below:

$$V = (350\ \text{L/kg}) \times [Q(S_0 - S) - 1.42P_x] \quad P_x = \frac{Y[Q(S_0 - S)]}{1 + k_d\Theta_c}$$

2.(b) Discuss the nutrient removal routes of waste stabilization ponds and the problem associated with phosphorus removal in these ponds. **[8]**

3.(a) Explain the process of treatment of tannery effluent with a flow diagram. **[9]**

3.(b) Wastewater flow from an area averages 5000 m^3/d during November (winter) and 7000 m^3/d during June (summer). The average temperature of November is 10°C and in June (summer) average temperature is 30°C. The mean concentration of influent BOD_5 is 300 mg/L. Reaction coefficient K is 0.25 d^{-1} at 20°C, and θ is 1.06. Select a facultative pond treatment system for the area to remove 90% of the incoming BOD_5. Assume dispersion factor 0.5. Use the following graphical plot of the Thirumurthi equation if required. **[9]**

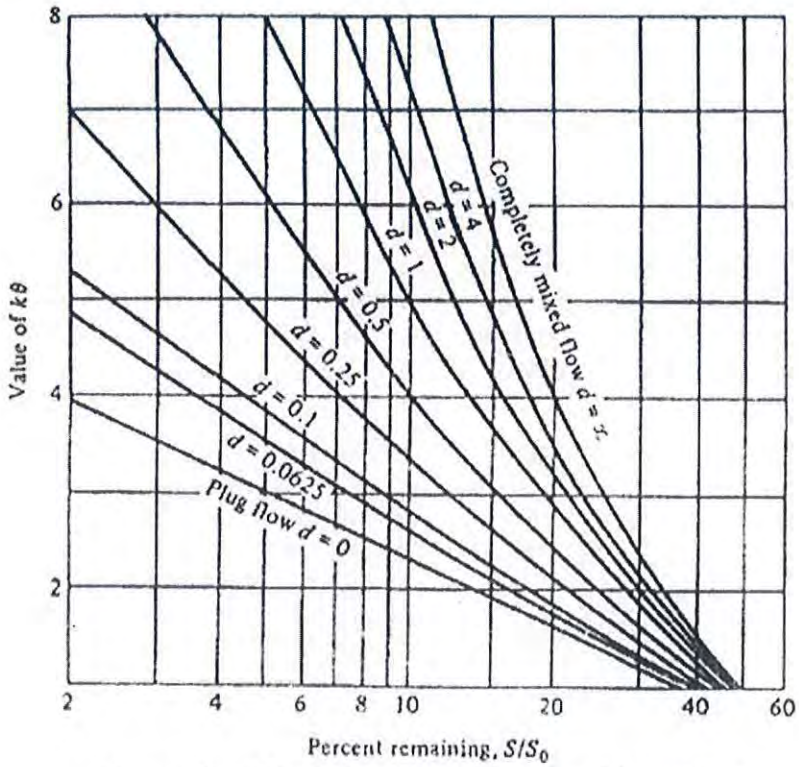


Figure: Graphical plot of the Thirumurthi equation.

Section B

4. (a) The BOD_5 of a wastewater sample is 300 mg/L at 20°C. k at 20°C is 0.20 per day. Calculate the BOD_9 of the sample at 12°C. **[15]**

(b) Explain the differences between step and tapered aeration processes employed for wastewater organic removals. **[10]**

(c) Identify the role of the disk-shaped plastic media in a rotating biological contactor (RBC) treatment system. **[5]**

5. (a) Indicate the effect of oxygen and carbon availability on nitrogen removal processes in a tertiary wastewater treatment system. **[10]**

(b) The wastewater produced from an area of a city corporation is directly discharged into an adjacent lake. Because of the substantial pollutant composition of the discharged wastewater, the receiving water body is severely polluted. The city corporation appointed you as an environmental engineer to design a natural-based treatment plant (for example, constructed wetlands) to treat the generated wastewater

in that area and protect the ecological balance of the receiving water body. The water quality parameter of the generated wastewater is provided in the following Table.

Table. Pollutants concentration of the wastewater.

	Unit	Concentration
pH	---	7.3
DO	mg/L	0.4
NH_4-N		40
NO_3-N		30
TN		100
BOD_5		700
COD		1100
TP		7

(i) Propose a flow diagram of the natural treatment processes that will only remove organic pollutants (BOD and COD). **[7.5]**

(ii) Propose a natural treatment process flow diagram if nutrient removal (nitrogen and phosphorus) is also required, along with organic removals. **[7.5]**

(iii) Analyze ways to achieve higher organic removals if the available land area restricts you from designing multiple nature-based treatment units? **[5]**

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

Course Title: Structural Engineering II | Course Code: CE 313
Time: 3 hours | Credit Hour : 3.0 | Full Marks: 100

ANSWER ALL QUESTIONS. Assume any missing data reasonably.
(Roll=Last two digits of your registration number)

PART-A

1. Calculate the horizontal deflection at D of the frame in ***Fig.1*** by the Unit Load Method [Consider:E=200×10^6 kN/m^2 and I=300×10^{-6}m^4]. **[15]**

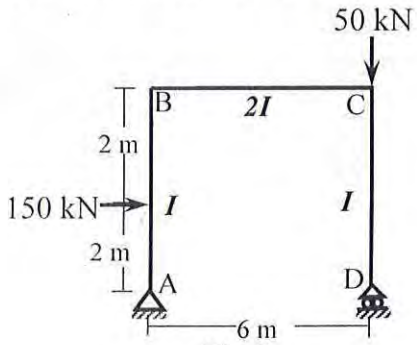


Fig.1

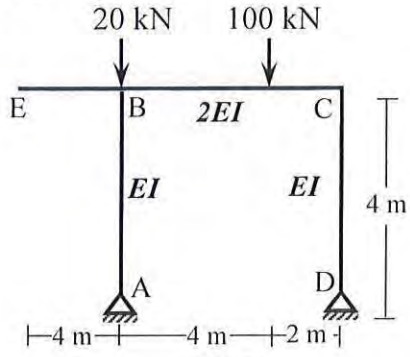


Fig.2

2. Analyze the frame in ***Fig.2*** by Force Method and determine the support reactions. Consider the horizontal reaction at ***A*** as redundant. **[15]**

3. Analyze the Beam in ***Fig.3*** by Force Method and determine the reactions and draw the bending moment diagram[EI=Constant]. **[10]**

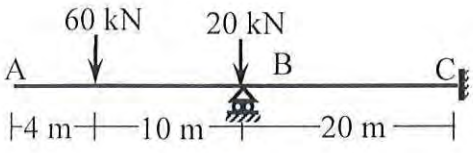


Fig.3

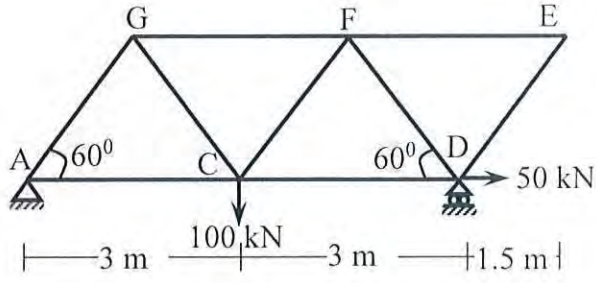


Fig.4

4. Calculate the vertical deflection of joint **F** of the truss in ***Fig.4*** by the Unit Load Method [EA=Constant]. **[10]**

PART-B

5. Analyze the frame shown in ***Fig.5*** by Portal Method to draw the Shear Force and Bending Moment diagrams. **[10]**

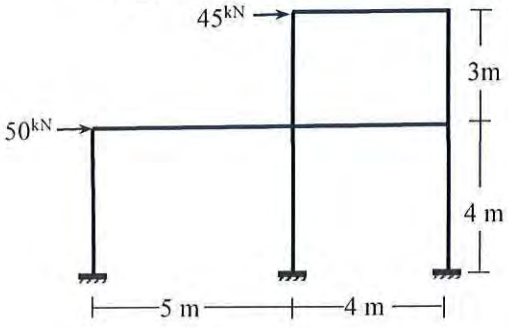


Fig.5

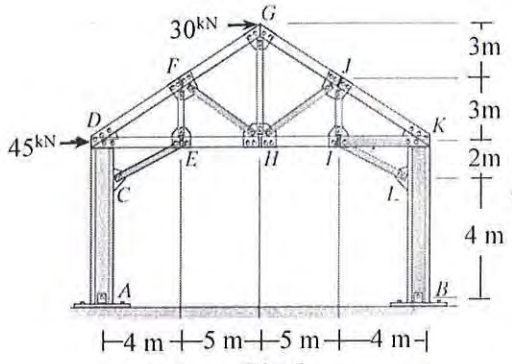


Fig.6

6. Analyze the mill bent shown in ***Fig.6*** by Portal Method to determine the reactions at support **A** and **F**. Also, determine the force in members **DF** and **IL**. **[05]**

7. (i) Draw the qualitative influence lines of the beam shown in ***Fig.7***, **[05]**

(a) Bending moments M_E, M_G, M_C

(b) Support reactions R_E, R_D and

(c) Shear forces $V_B^{(L)}$, $V_C^{(L)}$

(ii) Analyze the beam to calculate the maximum value of R_E , if the beam ***(Fig.7)*** is subjected to a uniformly distributed dead load of 20 kN/m, moving live load of 25 kN/m and 100 kN concentrated load [Given: EI = constant]. **[10]**

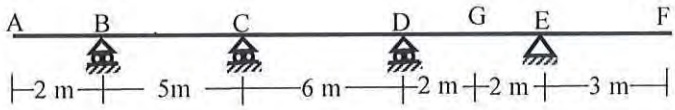


Fig.7

8. Analyze the frame in ***Fig.8*** using Moment Distribution Method to draw the bending moment diagram [EI = Constant]. **[15]**

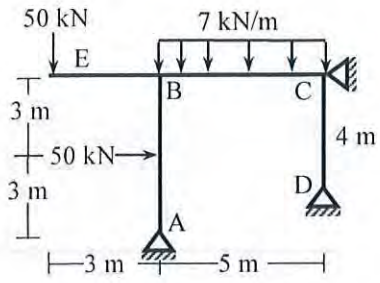


Fig.8

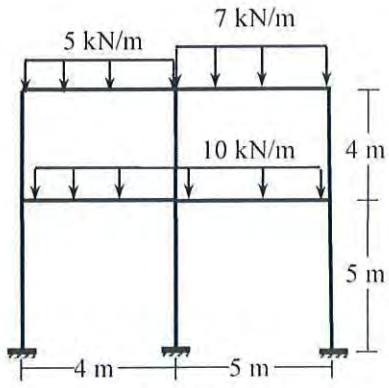
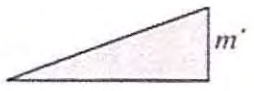
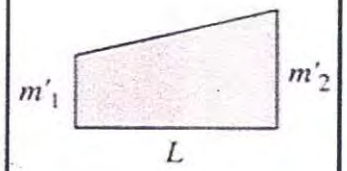
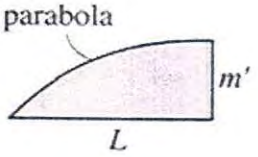
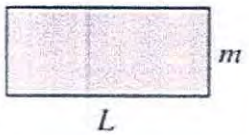
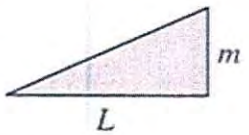
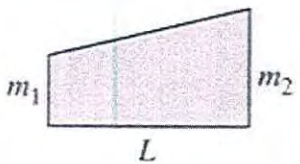
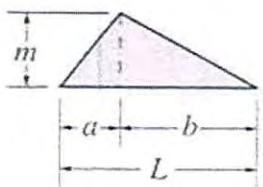
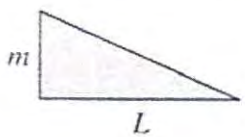


Fig.9

9. Analyze the frame shown in ***Fig.9*** to draw the bending moment diagram using Vertical Load (Approximate) Method and of the frame. **[05]**

$\int_0^L m\,m'\,dx$				
	$mm'L$	$\frac{1}{2}mm'L$	$\frac{1}{2}m(m'_1 + m'_2)L$	$\frac{2}{3}mm'L$
	$\frac{1}{2}mm'L$	$\frac{1}{3}mm'L$	$\frac{1}{6}m(m'_1 + 2m'_2)L$	$\frac{5}{12}mm'L$
	$\frac{1}{2}m'(m_1 + m_2)L$	$\frac{1}{6}m'(m_1 + 2m_2)L$	$\frac{1}{6}[m'_1(2m_1 + m_2) + m'_2(m_1 + 2m_2)]L$	$\frac{1}{12}[m'(3m_1 + 5m_2)]L$
	$\frac{1}{2}mm'L$	$\frac{1}{6}mm'(L + a)$	$\frac{1}{6}m[m'_1(L + b) + m_2(L + a)]$	$\frac{1}{12}mm'\left(3 + \frac{3a}{L} - \frac{a^2}{L^2}\right)L$
	$\frac{1}{2}mm'L$	$\frac{1}{6}mm'L$	$\frac{1}{6}m(2m'_1 + m'_2)L$	$\frac{1}{4}mm'L$