B-2

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

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

(Answer any five questions)

1. a. Define Cognitive Dissonance. **(2)**

b. Nizam Corporation uses Management by Objectives (MBO) for setting specific goals for each department. While this has improved focus and accountability, employees report high stress levels, and there is concern that short-term goals are overshadowing long-term strategy.

Analyze the advantages and disadvantages of MBO in this case. **(8)**

2. a. Briefly describe the strategic management process. **(5)**

b. Discuss about different types of competitive strategies and select the best one according to you. **(5)**

3. a. In the recent years various remote and hybrid work models have been implemented in our workplaces. Discuss about these models with appropriate examples. **(5)**

b. Shortly explain the stages of Human Resource Management process. **(5)**

4. a. Prepare a Job Description (JD) for the post of a **'site engineer'**. **(5)**

b. Propose the managerial actions to address resistance to change. **(5)**

5. a. Explain Fiedler's contingency model of leadership. **(5)**

b. Differentiate between transactional and transformational leadership. **(5)**

6. a. Mariya Gadgets manufactures smartphones, laptops, and home appliances where:

- Smartphones: High growth, low market share.
- Laptops: Low growth, high market share.
- Home Appliances: Slow growth, low market share, but a new eco-friendly line is gaining attention.

Using the BCG Matrix, classify each product and give reasons behind your classification. **(8)**

b. Name the elements of organizational structure. **(2)**

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2024
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.

PART-A

1. Calculate the horizontal deflection at **K** of the frame shown in ***Fig.1*** by the Unit Load Method [EI=Constant]. **[12]**

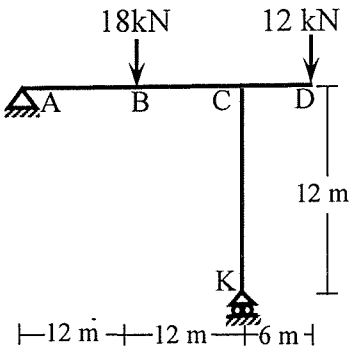


Fig.1

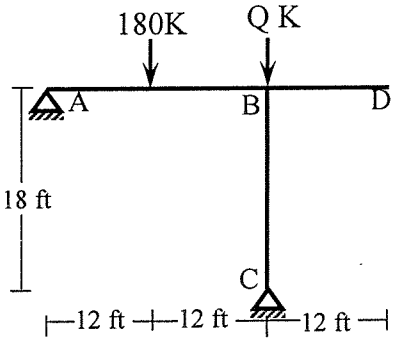


Fig.2

2. Analyze the frame shown in ***Fig.2*** by Force Method and determine the support reactions. Consider the horizontal reaction at ***A or C*** as redundant. [EI=Constant and Q=Last digit of your Roll (ID) +40]. **[16]**

3. Analyze the Beam shown in ***Fig.3*** by Force Method and determine the reactions and draw the bending moment diagram. Consider the vertical reaction at ***C*** as redundant [EI=Constant]. **[12]**

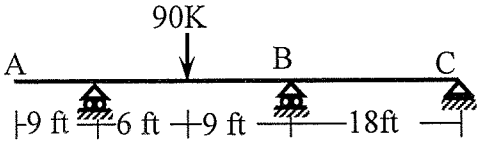


Fig.3

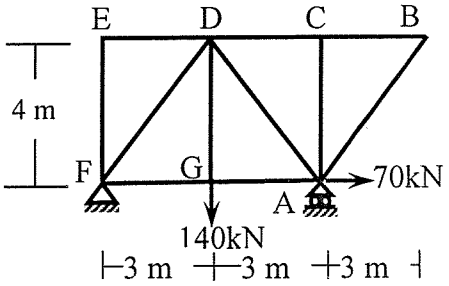


Fig.4

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

PART-B

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

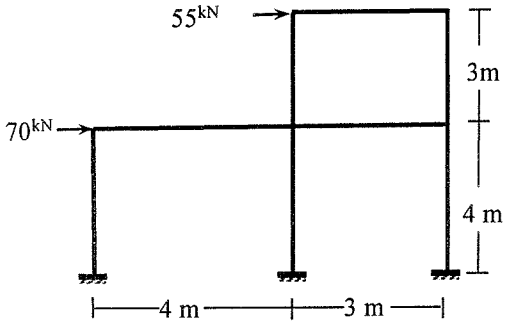


Fig.5

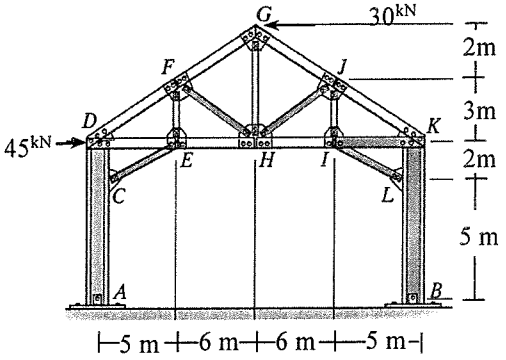


Fig.6

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_C, and
   (c) Shear forces $V_C^{(L)}$, $V_D^{(L)}$

   (ii) Analyze the beam shown in ***Fig.7*** to calculate the maximum value of R_C, if the beam ***(Fig.7)*** is subjected to a uniformly distributed dead load of 15 kN/m, moving live load of 25 kN/m and 150 kN concentrated load [Given: EI = constant]. **[10]**

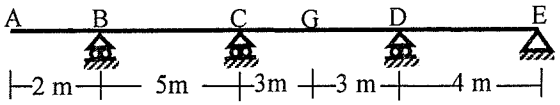


Fig.7

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

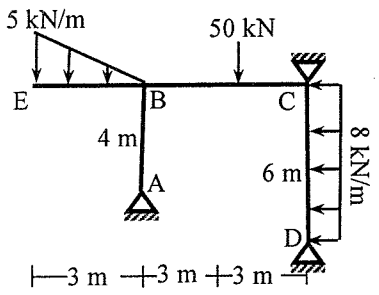


Fig.8

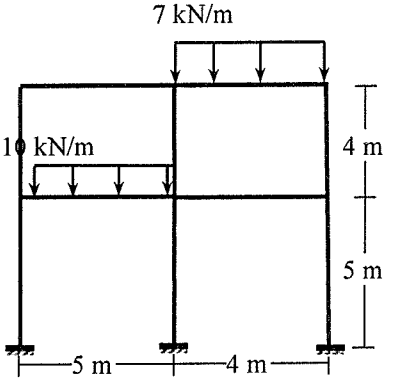


Fig.9

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

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2024
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 car park of a residential building is constructed with **flat slab** as shown in **Figure 1.** Live load of car park is 2 kN/m^2. Thickness of slab could be considered as 200 mm. The concrete strength (f_c') is 24 N/mm^2 and column size is 600 mm x 600 mm. Positive and negative moment coefficients of the panel are 0.35 and 0.65, respectively. Design the **Slab S4** for **short span column strip** only. [14 Marks]

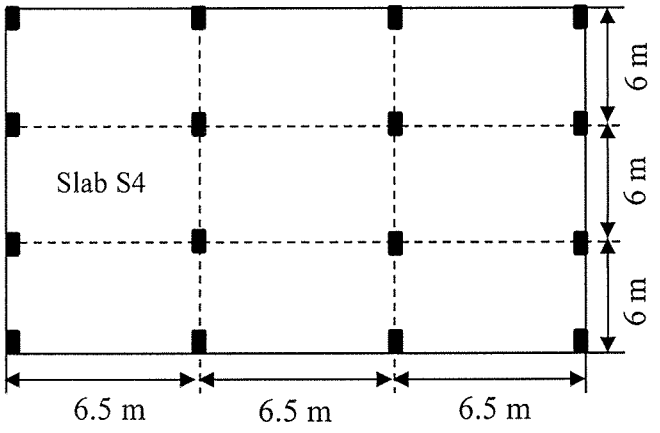


Figure 1. Flat slab floor plan

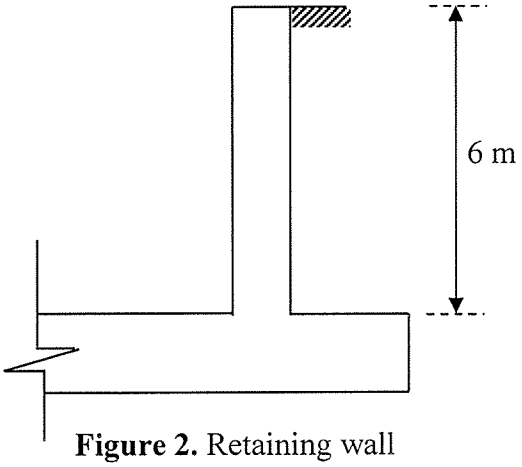


Figure 2. Retaining wall

b. A cantilever retaining wall of an open tunnel is shown in **Figure 2**. Density of soil beside the wall is 1800 kg/m^3, active soil pressure coefficient is 0.3, soil is saturated with water (void ratio of the soil is 30%). 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 25 N/mm^2. [6 Marks]

QUESTION 2 [20 MARKS]

a. A column of multi-storeyed building is supported by **pad footing** foundation. The foundation is subjected to 1200 kN dead load and 450 kN live load, respectively. Bearing capacity of the soil is 180 kN/m^2. Design the **isolated pad footing** with minimum thickness as per punching requirement. Concrete strength could be considered as 25 N/mm^2. Assume required data to design the foundation. Column size is 500 mm x 500 mm. [14 Marks]

b. A simply supported post-tensioned girder of 12 m span is subjected to uniformly distributed dead load (including self weight) of 40 kN/m and live load of 15 kN/m. Section of the girder is 1200 mm x 300 mm. Eccentricity of the tendon is 200 mm from bottom of the girder. Analyze the pre-stressing girder to obtain required minimum pre-stressing force and stresses at mid-span of the girder. [6 Marks]

QUESTION 3 [20 MARKS]

The floor plan of a 10-storeyed RC frame structure of a residential building (live load 2 kN/m^2) is shown in **Figure 3**. Slabs of the floor are supported by beams (300 mm x 600 mm). Random wall load of the slab is 2 kN/m^2. Design the slab panel **"S1"** with the minimum thickness considering safety and environmental issues of BNBC 2020. Required data has to be assumed in design. Shear force co-efficient of the slab is 0.5. Coefficients of moments of slabs are shown in **Appendix**.

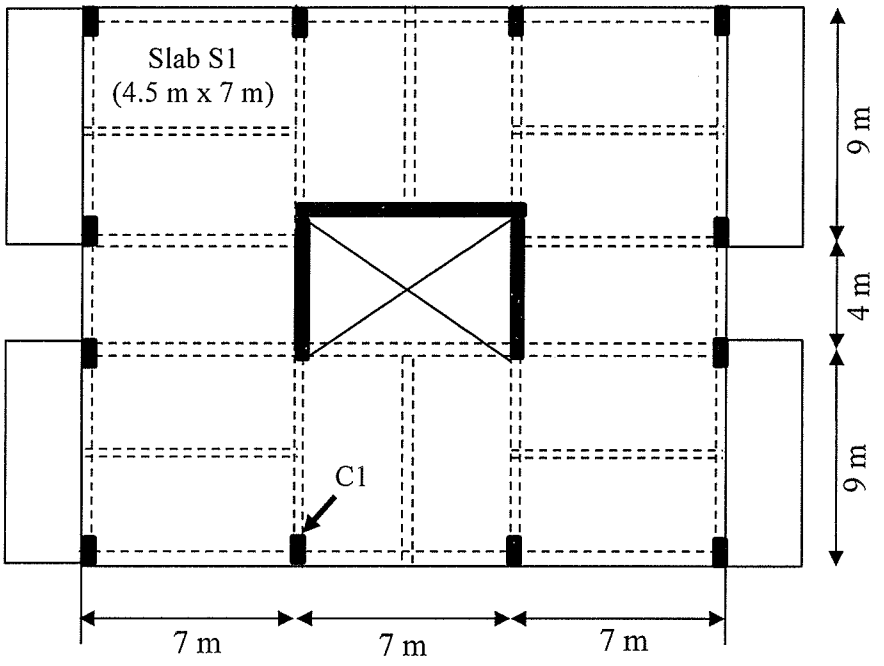


Figure 3. Floor plan of 10 storeyed apartment

QUESTION 4 [20 MARKS]

Design the ground floor **column of "C1"** (shown in **Figure 3**) of the project stated in **Question 3**. The maximum width of the column is 400 mm. The column is subjected to 600 kN-m moment on its critical axis (400 mm) due to lateral load. **Design** the column considering safety, environment and societal requirements. Dimension of the column is required to be minimized as much as possible considering all the provisions of BNBC 2020. Approximate method could be used to calculate the design load of the column. The column design chart is shown in **Appendix**.

QUESTION 5 [20 MARKS]

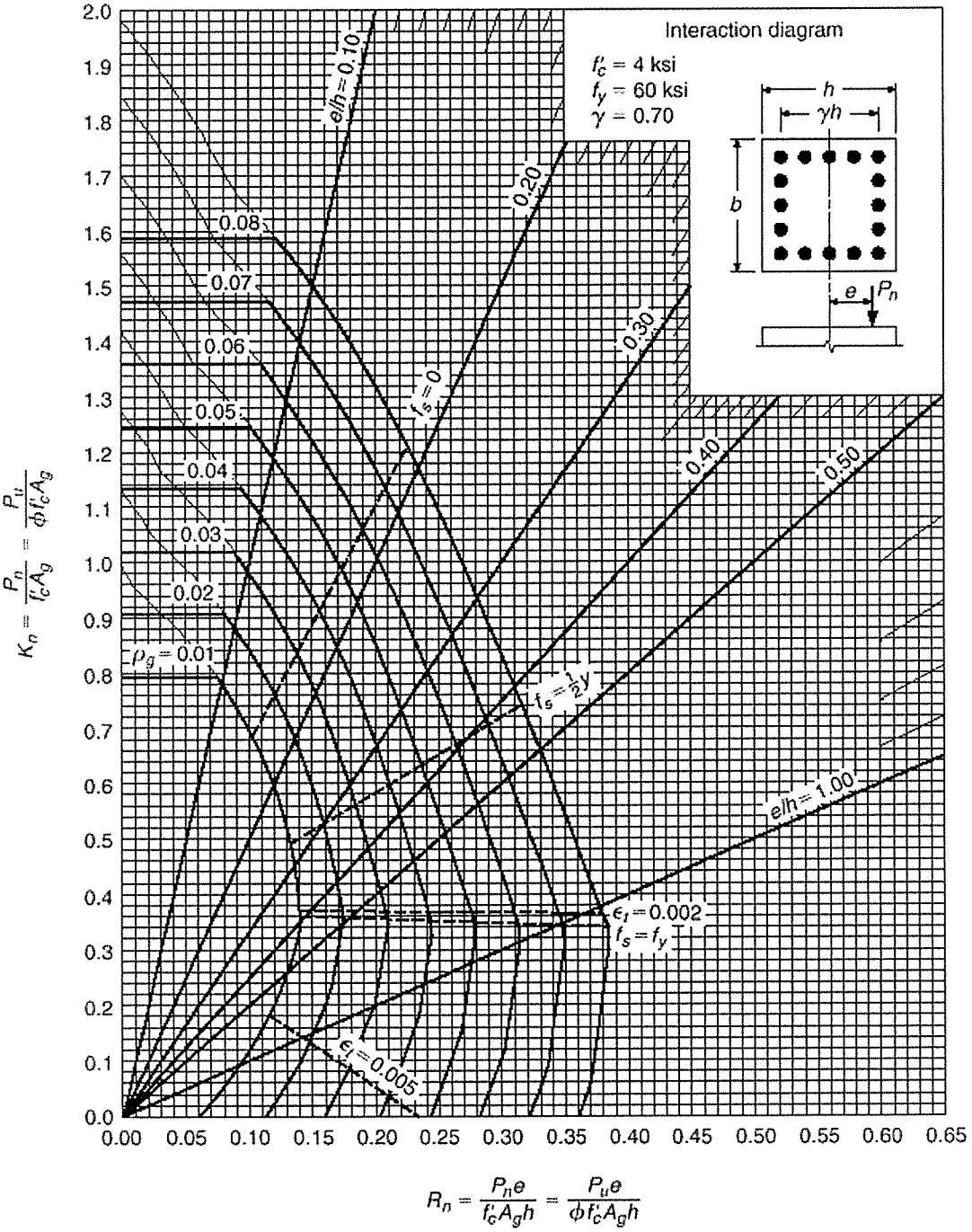
The **column "C1"** of the project (**Question 3**) is supported by pile foundation. The capacity of 600 mm diameter bore pile can be consider within the range of 1000 kN-1200 kN. **Propose a solution for optimal design** of the pile cap considering all options (flexure, shear, punching shear, number of piles) of code (BNBC 2020). **Design the pile cap** with minimum depth and steel considering safety and environmental issues of BNBC 2020.

APPENDIX

Direct Design Method:

Minimum thickness of Flat Slab

Exterior Panels without Edge Beams	Exterior Panels with Edge Beams	Interior Panels
$L_n/33$	$L_n/36$	$L_n/36$



6.2.5.3.3 The minimum thickness, h for slabs with beams spanning between the supports on all sides, shall be as follows:

(a) For α_{fm} equal to or less than 0.2, the provisions of Sec 6.2.5.3.2 shall apply;

(b) For α_{fm} greater than 0.2 but not greater than 2.0, h shall not be less than

$$h = \frac{l_n\left(0.8+\frac{f_y}{1400}\right)}{36+5\beta(\alpha_{fm}-0.2)} \quad \geq 125 \text{ mm} \qquad (6.6.5)$$

(c) For α_{fm} greater than 2.0, h shall not be less than

$$h = \frac{l_n\left(0.8+\frac{f_y}{1400}\right)}{36+9\beta} \quad \geq 90 \text{ mm} \qquad (6.6.6)$$

Table 6.6.8: Coefficients for Negative Moments in Slabs †

$M_{a,neg} = C_{a,neg} w l_a^2$

$M_{b,neg} = C_{b,neg} w l_b^2$

Where, w = total uniform dead plus live load per unit area

Span Ratio, $m = \frac{l_a}{l_b}$	Moment Coefficient	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
										
0.65	$C_{a,neg}$		0.077		0.085	0.087	0.093		0.074	0.083
	$C_{b,neg}$		0.014	0.043	0.015			0.031	0.024	0.008
0.60	$C_{a,neg}$		0.081		0.089	0.088	0.095		0.080	0.085
	$C_{b,neg}$		0.010	0.035	0.011			0.024	0.018	0.006

Table 6.6.9: Coefficients for Dead Load Positive Moments in Slabs †

Span Ratio $m = \frac{l_a}{l_b}$	Moment Coefficient	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
										
1.00	$C_{a,dl}$	0.036	0.018	0.018	0.027	0.027	0.033	0.027	0.020	0.023
	$C_{b,dl}$	0.036	0.018	0.027	0.027	0.018	0.027	0.033	0.023	0.020
0.65	$C_{a,dl}$	0.074	0.032	0.054	0.050	0.036	0.054	0.065	0.044	0.034
	$C_{b,dl}$	0.013	0.006	0.014	0.009	0.004	0.007	0.014	0.009	0.005

Table 6.6.10: Coefficients for Live Load Positive Moments in Slabs †

0.65	$C_{a,ll}$	0.074	0.053	0.064	0.062	0.055	0.064	0.070	0.059	0.054
	$C_{b,ll}$	0.013	0.010	0.014	0.011	0.009	0.010	0.014	0.011	0.009

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2024
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. In a rural riverside village, the absence of adequate sanitation facilities has entrenched open defecation as a common practice. The scarce pit latrines, poorly built and prone to overflowing, force villagers to discharge waste into nearby water bodies. Consequently, the once-clear pond and river have darkened, emitting foul odors and becoming breeding grounds for dangerous pathogens, triggering a rise in waterborne diseases. **[5+5]**

In this case, select an appropriate type of human waste management to provide a sustainable environmental solution for that particular community using engineered diagram and also, explain the challenges you may encounter with your proposed technology within that rural community.

2. Explain how small-bore sewerage system achieves better performance in terms of water treatment and cost. **[14]**

3.(a) Discuss anaerobic digestion process of sludge treatment and also, describe why high-rate anaerobic digester performs better than slow rate digester. **[8+8]**

(b) Describe the pollutant removal mechanisms of a facultative pond. **[10]**

(c) Explain the advantages and disadvantages of Central Effluent Treatment Plant (CETP). **[10]**

Section B

4.(a) Calculate the volume of the aeration tank of high purity oxygen activated sludge system for municipal wastewater treatment employing the following data set, and check with design parameters. Also, calculate the expected effluent BOD_5 concentration of the system. The required formulas are provided below. **[15]**

Parameter	Value
Design average flow, Q	5000 m^3/d
Influent BOD	500 mg/L
Influent TSS	250 mg/L
F/M	0.6 lb BOD applied/lb MLVSS.d
MLSS	6000 mg/L
VSS/TSS	0.7
Maximum volumetric BOD load	5 $kg/(m^3.d)$

Minimum aeration time	1h
Minimum cell residence time	4d
K_S	60 mg/L of BOD
k_d	0.06/d
Y	0.6VSS/mg BOD
k	$6d^{-1}$

Formulas:

$$F/M = \frac{S_0}{\theta X} = \frac{QS_0}{VX} \qquad \theta_c = \frac{VX}{QX_i} \qquad S = \frac{K_s(1+\theta_c k_d)}{\theta_c(Yk - k_d) - 1}$$

(b) Identify the COD fractions that are commonly available in wastewater and indicate the removal mechanisms of these components in a biological wastewater treatment unit. **[10]**

(c) "A trickling filter is not required to be integrated with a secondary clarifier"-explain the relevance of the statement. **[5]**

5. (a) Identify the differences between the three sludge and Post D systems in terms of organic carbon availability to support denitrification. **[10]**

(b) You have been assigned to propose wastewater treatment plants for two small towns. The wastewater produced from Town 1 will be treated by activated sludge processes. The treatment system of Town 2 will include natural approaches. The chemical properties of the wastewater produced from the two towns are summarized below:

Table. Pollutant concentration of the wastewater produced from the two towns.

		Town 1	Town 2
	Unit	Concentration	
pH	---	5.1	8.1
DO		0.2	0.5
NH_4-N		60	6
NO_3-N	mg/L	5	95
TN		80	130
BOD_5		3000	800
COD		7000	2100
TP		13	---

(i) Recommend a flow diagram of the activated sludge process to treat the wastewater produced from Town 1. **[7.5]**

(ii) Recommend a natural treatment process flow diagram to treat the wastewater produced from Town 2. **[7.5]**

(iii) Justify how your proposed natural treatment system will encounter the infrequent NH_4-N concentration increase in wastewater produced from Town 2. **[5]**

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

Course Title: Transportation Engineering I | Course Code: CE 351
Time: 3 hours | Credit Hour: 3:00 | Full Marks: 120

Answer all the questions

1. a) Explain the driver's reaction or PIEV time and identify the factors that affect them. Illustrate with clear sketches the minimum passing sight distance for a two-lane, two-way highway designed for right-hand driving vehicles. **[5+10]**

b) Identify the disadvantages of traffic signals. Discuss the conditions under which all red periods need to be included in designing traffic signals. **[5+5]**

2. a) Which is preferable for use on roads: traffic signs or traffic markings? Briefly outline the latest trends in their application. **[5+5]**

b) Briefly discuss the classifications of traffic signs and explain their implementation in the context of Bangladesh. **[10]**

3. The Bijoy Sarani intersection is to be converted into a two-phase signalized intersection for which the data are obtained as follows: **[10+6+4]**

Amber: 3 sec
Red-Amber: 2 sec

	N-S	E-W
Inter-Green:	8	6
Lost Time:	2	3

	North	South	East	West
Flow, pcu/hr	620	790	875	710
Saturation flow, pcu/hr	1910	2380	2700	2130

i) Design the signal
ii) Draw the concerned bar diagram
iii) Draw the phase diagram

4. The cycle length (C) to effective green time (g) ratio at a signalized intersection is 2.5. The number of vehicles passing through the intersection during one cycle's saturation flow interval is provided as follows: **[6+5+4]**

Interval	Duration	Avg PCU
First	6 sec	4
Second	6 sec	12
Third	6 sec	10
Fourth	6 sec	10
Fifth	6 sec	11
Last	6 sec	5

i) Draw the saturation flow diagram and determine the Saturation flow level.
ii) Calculate initial and final loss times.
iii) Determine the approach capacity of the intersection.

5. a) What factors affect the travel demand of road users? **[6]**

b) A survey was conducted on five vehicles traveling along a 15 km stretch of road to determine spot speeds. The collected data are as follows: **[3+3+8]**

Vehicle No.	Travel Time (hr)	Spot Speed (kmph)
1	2.56	A
2	3.19	B
3	3.21	C
4	1.09	D
5	4.33	E

i) Determine time-mean speed.
ii) Determine the average speed of the traffic stream.
iii) Determine design speed and safe speed for the road (use graph paper).

6. a) Explain the disadvantages of unregulated street parking. **[5]**

b) A newly appointed traffic engineer studied a minor road. The annual average daily traffic (AADT) for the road is 75,000. To estimate traffic variation over time, he back-calculated traffic volume for 9 AM to 10 AM, 2 PM to 3 PM and 8 PM to 9 PM. The study was done on Thursday, December 31. [See Annexure for necessary data] **[5+4+6]**

i) Determine the AWT for the month mentioned.
ii) Determine ADT for Wednesday.
iii) Determine when he will get the maximum traffic volume for the specified three time periods.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2024
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. The numbers inside the brackets indicate marks.

1. (a) State the factors on which rainfall intensity depends while using rational formula. (5)
   (b) What are the applications of flow routing? (5)

2. (a) Discuss the differences between and applicability of Horton's model and Phi Index model for estimating infiltration. (10)
   (b) Briefly discuss the advantages of using remote sensing in hydrology. (10)

3. A well penetrates an unconfined aquifer. Prior to pumping, the water level is 30 m. After a long period of pumping at a constant rate of 0.08 m^3/s, the drawdown at a distance 55 and 145 m from the well were observed to be 3.2 and 1.8 m, respectively. Determine (i) the transmissivity of the aquifer, (ii) drawdown in the pumped well and (iii) radius of influence of the well. (10)

4. The recent 20-year annual maximum flood measured at a local river is given below. (25)

No.	Max. Flood (cfs)	No.	Max. Flood (cfs)
1	4200	11	4100
2	2000	12	3800
3	5000	13	3200
4	4400	14	4000
5	3800	15	3300
6	3000	16	7200
7	2500	17	5200
8	2200	18	1000
9	3200	19	650
10	2400	20	2700

Plot the data using the Weibull plotting position formula. Based on the frequency curve and the mathematical equation, estimate the 15-year annual maximum and the exceedance probability and return period for an event of 4000 ft^3/s using (i) lognormal and (ii) normal distribution. The standard deviation of normally and lognormally distributed data are 1492.46 and 0.24, respectively.

Based on the statistical analysis used in (i) and (ii), is it possible to investigate whether the data follows lognormal or normal distribution? If not, what will you suggest to find a suitable distribution? Justify your suggestions. Use the frequency factor table (Table 11.6).

5. For the data given below, construct the IDF curves for return periods of 20 and 15 years. (15)
The rainfall depths for 1-hr, 2-hr, 4-hr, 6-hr, 10-hr, 12-hr and 24-hr are given in mm.

No.	**Year**	**1-hr**	**2-hr**	**4-hr**	**6-hr**	**10-hr**	**12-hr**	**24-hr**
1	1986	1.7	2.9	4.6	4.8	4.8	4.8	5.1
2	1987	1.9	2.6	2.6	3	3.7	3.7	4.8
3	1988	1.9	2.3	2.7	2.9	3.1	3.1	3.2
4	1989	1.9	2.4	2.8	4	4.7	4.9	5.7
5	1990	1.9	1.9	2.2	2.5	2.5	2.5	3
6	1991	2.1	2.4	3	3.5	4	4.2	5.1
7	1992	1.7	2.5	2.7	2.8	3	3	4
8	1993	1.7	3.6	3.6	3.6	4.3	4.3	4.7
9	1994	1.9	2.1	2.8	3	3.8	3.8	3.8
10	1995	2.4	3.7	4.5	4.5	4.6	4.6	5.4
11	1996	1	1.3	1.6	1.7	1.7	1.7	1.8
12	1997	2.7	2.8	3.2	3.7	3.7	3.8	4.4
13	1998	1.3	1.5	2	2.6	3.5	3.8	4.1
14	1999	2.8	3.2	3.4	4.1	5.2	5.7	6
15	2000	2	2.1	2.8	4.1	5.6	6	7.9
16	2001	1.8	2.7	2.8	2.8	2.8	2.8	2.8
17	2002	1.5	2.6	2.8	3.1	3.8	4.5	6.4
18	2003	1.4	2.5	3.1	3.7	4.2	4.3	4.5
19	2004	1.6	1.8	2.2	2.6	3.6	3.6	4.1
20	2005	1.2	1.7	2.4	2.7	3	3.1	3.3
21	2006	1.4	1.5	1.5	2.3	2.5	2.7	2.8
22	2007	1.7	1.8	2.4	2.7	2.9	2.9	4.4
23	2008	1.9	2.6	4.1	5.1	5.1	5.2	5.4
24	2009	1.8	3.2	3.8	3.9	3.9	3.9	3.9
25	2010	1.3	1.6	1.7	1.7	1.7	1.7	2.7
26	2011	1.8	2.1	3.3	3.4	3.7	4.2	4.9
27	2012	1.6	2	2.3	2.6	2.7	2.7	2.7
28	2013	1.9	2.8	2.8	2.9	2.9	2.9	2.9

6. Route the following hydrograph through a river for which K = 6 hours, x= 0.20. At the beginning, the outflow is 15 m^3/s. (20)

Time (h)	0	6	12	18	24	30	36	42	48
Inflow (m^3/s)	5	10	15	20	30	40	35	25	15

Appendix

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

Table 11.6 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