Set-A

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2022
Program: Bachelor of Civil Engineering

Course Title: Principles of Management Course Code: IMG 301 Credit(s):2
Time:2 hours Full Marks:50

Instructions:

1. Answer any four questions from Section-A and any three questions from Section-B
2. Number the questions properly.

Section-A Broad questions (Answer any four questions: 4x8=32)

1. Discuss one group decision making technique and state 3 advantages of group decision making over individual decision making.
2. Explain the Rational Decisional Making Model with an example and state 2 conditions for its proper application.
3. Suppose you wish to open your Civil Engineering firm. How will you design the structure and management process to ensure proper function of the firm? How can you ensure effective control at the firm?
4. Outline in light of Equity theory as to how you can ensure organizational justice to your subordinates.
5. Write in detail how contingency theory of leadership differ from Behavioral Theories and explain one of the Leadership theories in detail.
6. Explain which leadership styles are appropriate when: a) followers have poor orientation and readiness but higher level of enthusiasm b) when followers have higher readiness but lower level of enthusiasm.

Section-B Brief questions (Answer any three:3x6=18)

1. Job Enlargement and Job Enrichment
2. Bounded rationality and its impact on decision making
3. Chain of Command Vs Span of Control
4. Herzberg two factor theory
5. MBO
6. Departmentalization and Matrix Structure

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

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

ANSWER ALL QUESTIONS. Assume any missing data reasonably.

PART-A

1. Analyze the Beam in ***Fig.1*** using Force Method and find the reactions, where P is 20 kN, if the Roll is even or P is 30 kN, if the Roll is odd. Consider the Reaction at C as Redundant. **[12]**

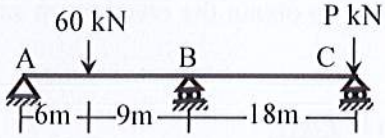


Fig.1

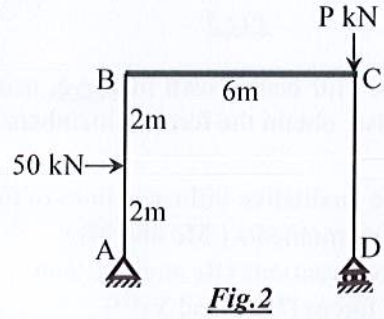


Fig.2

2. Apply the Virtual Work Method to calculate the horizontal deflection of the roller support at D for the frame shown in ***Fig.2***, where P is 20 kN, if the Roll is even or P is 30 kN, if the Roll is odd. [E and I are constant, Consider $I_{AB}=I_{CD}=I$ and $I_{BC}=2I$] **[12]**

3. Analyze the frame in ***Fig.3*** using Force Method and find the Reactions, where P is 20kN, if the Roll is even or P is 30kN, if the Roll is odd. Consider the horizontal reaction at D as redundant. [E and I are constant]

[12]

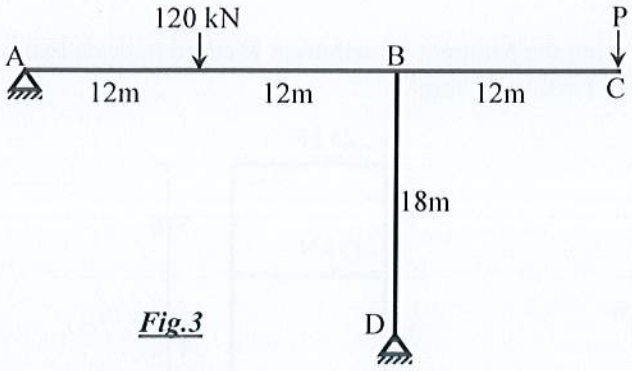


Fig.3

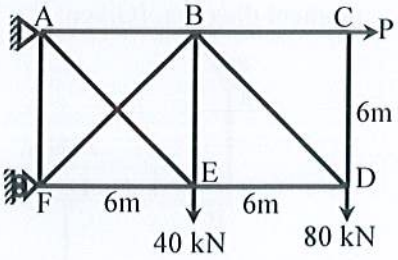


Fig.4

4. Analyze the Truss in ***Fig.4*** using Force Method and find all member forces, where P is 20kN if the roll is even or P is 30kN, if the Roll is odd. Consider the Force in BE as redundant. [E and A are constant] **[14]**

PART-B

5. Analyze the frame as shown in ***Fig.5***, using Portal Method to draw the axial force and bending moment diagram of columns of the frame **[10]**

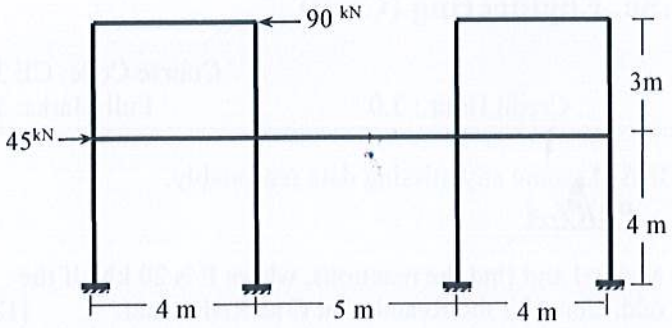


Fig.5

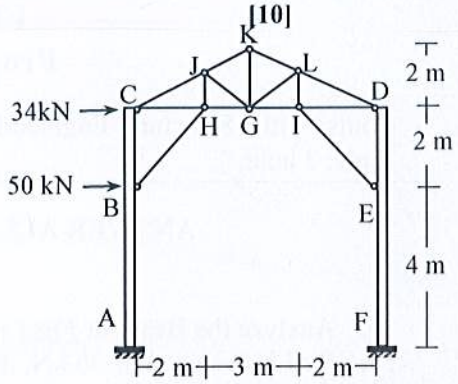


Fig.6

6. Analyze the mill bent shown in ***Fig.6,*** using Portal Method to obtain the reactions at support **A** and **F** of Also, obtain the force in members **BH** and **CJ**. **[05]**

7. (i) Draw the qualitative influence lines of the beam shown in ***Fig.7***, **[15]**

(a) Bending moments ($\mathbf{M_C}$ and $\mathbf{M_F}$)

(b) Support reactions ($\mathbf{R_B}$ and $\mathbf{R_D}$)and

(c) Shear forces ($\mathbf{V_D^{(L)}}$ and $\mathbf{V_F^{(L)}}$)

(ii) Calculate the maximum value of M_F (Positive), if the beam ***(Fig.7)*** is subjected to a uniformly distributed dead load of 40 kN/m and moving a live load of 14 kN/m (uniformly distributed) and a moving load of 44 kN (concentrated) [Given: EI = constant].

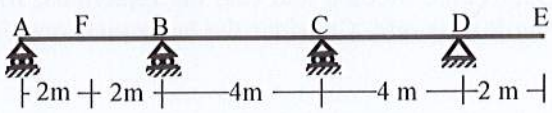


Fig.7

8. Analyze the frame as shown in ***Fig.8,*** using the Moment Distribution Method to draw bending moment diagram. [Given: E = 200 GPa , I = 90×10^6 mm^4] **[15]**

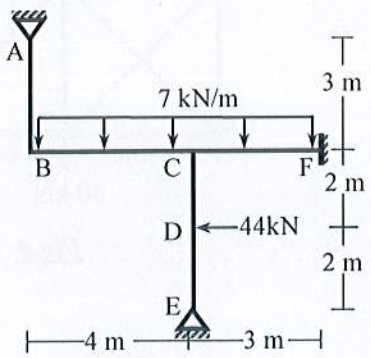


Fig.8

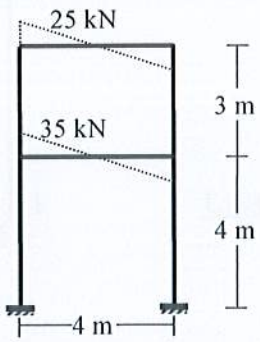


Fig.9

9. The shear force diagram of a frame is shown in ***Fig.9,*** Apply the Vertical Load (Approximate) Method to calculate gravity load and draw the bending moment diagram of the frame. **[05]**

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2022
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. The corner slab panel of an office building (live load 2.4 kN/m^2) is shown in **Figure 1**. The floor will be constructed with beam supported slab and it carries 3 kN/m^2 dead load due to random wall and floor finishes. The negative moment coefficient (at continuous support) of the slab is 0.05, thickness is 160 mm. Apply the concept to design the slab for support moment only. Assume required data for design, concrete strength (f_c') could be used as 15 N/mm^2. [10 Marks]

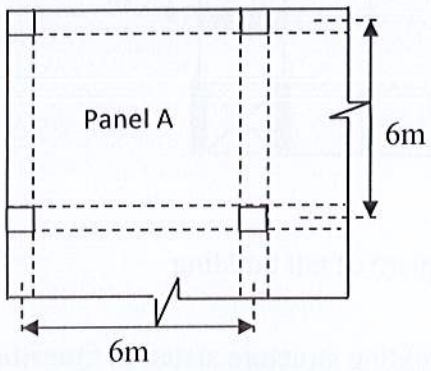


Figure 1. Panel of beam supported slab

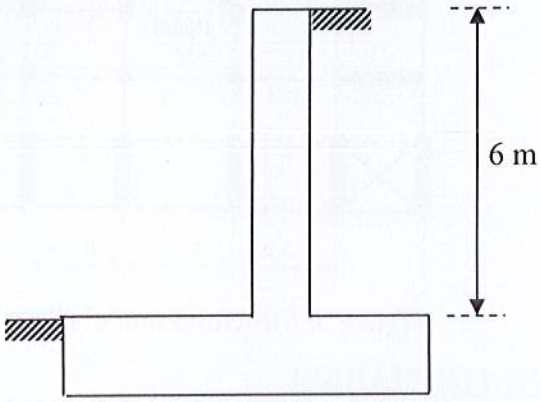


Figure 2. Retaining wall

b. A cantilever retaining wall of a riverbank is shown in **Figure 2**. The density of soil beside the wall is 1800 kg/m^3, active soil pressure coefficient is 0.33, soil is saturated with water (void ratio of the soil is 70%). Apply the concept to design the wall with **optimal thickness** as per requirements of BNBC 2020. Assume required data for design, concrete strength (fc') could be used as 15 N/mm^2. [10 Marks]

QUESTION 2 [20 MARKS]

a. An interior column of a multi-storeyed academic building is subjected to dead and live loads of 1500 kN and 450 kN respectively. The column is supported by isolated footing and bearing capacity of soil under the footing is 170 kN/m^2. The depth of the footing could be used as 600 mm. Apply the concept to design the footing. Assume required data to design the footing. [10 Marks]

b. A 12 m span simply supported post-tensioned slab of car park is subjected to uniformly distributed 8 kN/m dead load (including self-weight) and 2.4 kN/m live load. The cross section of each panel is 250 mm (thickness) x 1000 mm (width). Justify "***eccentric post-tensioning tendon is economical as compared to straight tendon***" through comparative analysis of the panel in terms of prestressing force and stresses. Maximum eccentricity of the tendon is 50 mm, assume required data to analyse the slab. [10 Marks]

QUESTION 3[20 MARKS]

The floor slab layout plan of a 15-storeyed office building is shown in **Figure 3**. The floor of the structure will be constructed with a **flat slab system** and it carries 3 kN/m^2 dead load due to random wall and floor finishes. Design the **long span column strip of Panel A (Figure 3)**. Synthesis (optimize) the thickness of the slab considering deflection and punching requirements of ACI / BNBC code. Assume required data to design the slab. [20 Marks]

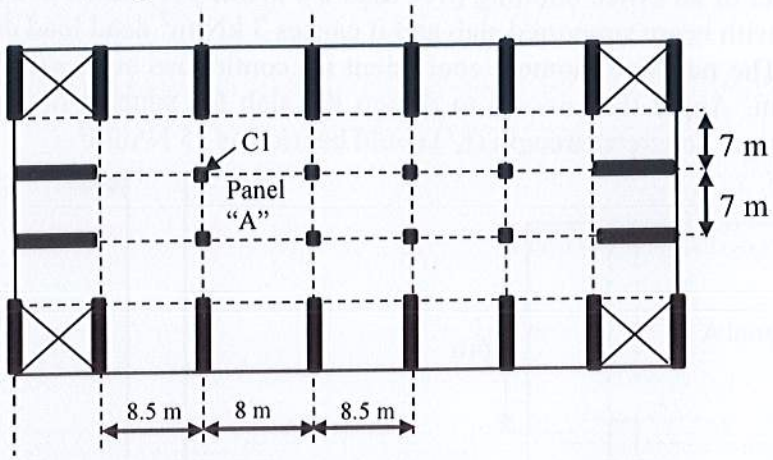


Figure 3. Structural model (floor plan) of tall building

QUESTION 4 [20 MARKS]

The column "C1" as shown in **Figure 3** of the tall building structure stated in **Question 3** is required to design as tie column. The uni-axial design moment of the column at ground floor could be considered as 600 kN-m, use approximate method to obtain design load of the column. The column has to be designed for the lowest minimal dimension considering all possible options of BNBC 2020. Propose a solution to design the column with structural details. [20 Marks]

QUESTION 5 [20 MARKS]

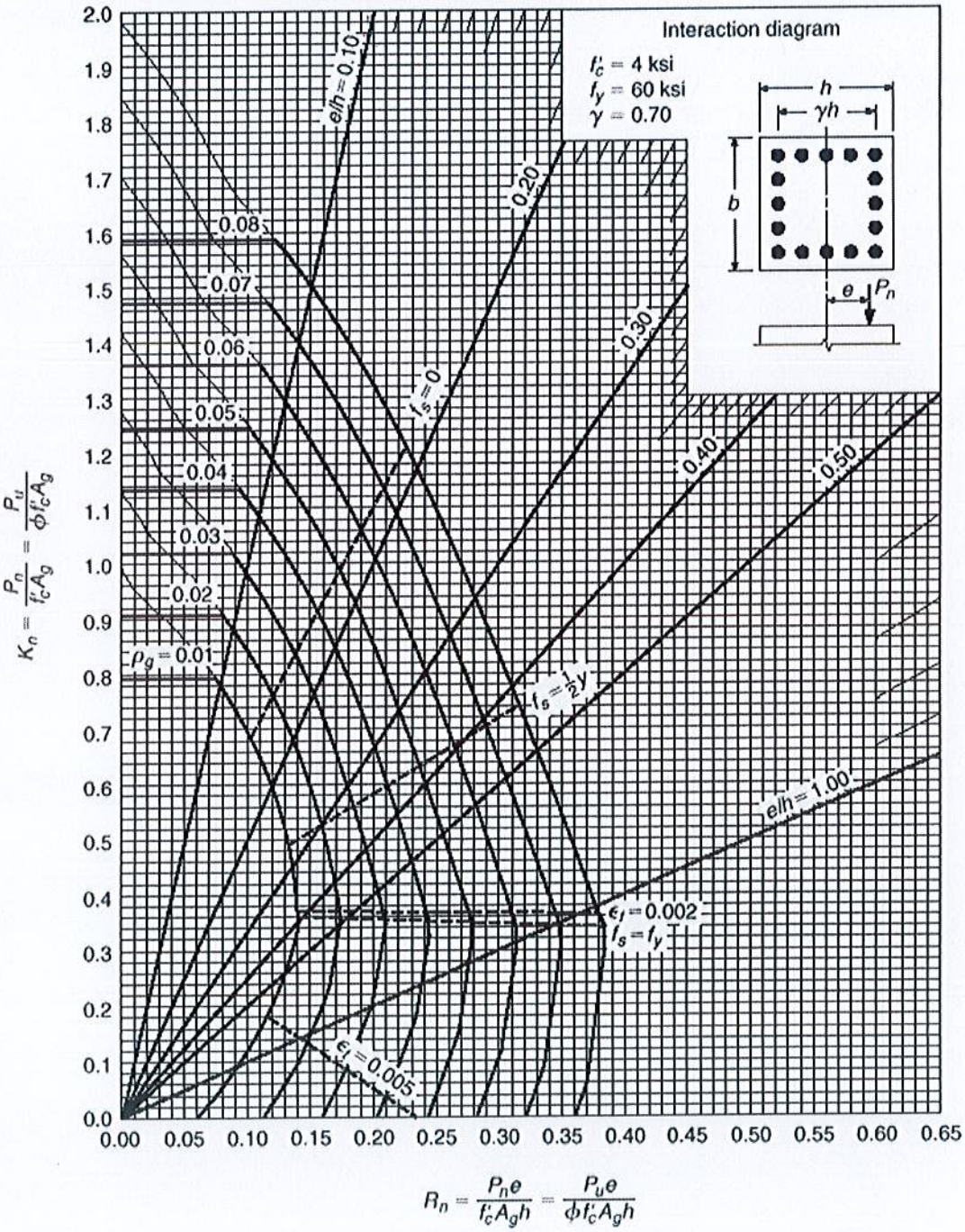
The column "C1" as shown in **Figure 3** of the tall building structure stated in **Question 3** is supported by pile foundation. The capacity of 600 mm diameter bore pile could be considered with the maximum value of 1000 kN. Thickness of the pile cap is required to be minimal in design considering all possible options in accordance to BNBC 2020 / ACI 318. Propose a solution to design the pile cap with the minimum thickness. Assume required data to design the pile cap. [20 Marks]

APPENDIX

Direct Design Method:

Minimum thickness of Flat Slab

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



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

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

There are five (5) questions. Answer all the questions. Assume any missing data. All questions bear equal marks [5×24=120]

1. (a) With schematic diagrams show the transmission routes of the following water and waste-related diseases: (i) Diarrhea causing infections and enteric fevers; (ii) Worm infection with the animal host. **[4]**

   (b) A clarifier is designed to have a surface overflow rate of 40.0 $m^3/m^2.d$. Compute the overall removal efficiencies with settling analysis data, illustrated in the following table. The water temperature is 15°C, and particle specific gravity is 1.20. At 15°C the kinematic viscosity of water, μ is 0.00113kg/(s.m) and the specific gravity of water is 0.9990. Use the equation if required which is provided below. **[20]**

Particle size mm	Weight fraction <size, %
0.10	12
0.08	25
0.07	40
0.06	75
0.05	86
0.04	95
0.02	99
0.01	100

Equation: $V_a = \frac{g(\rho_s - \rho)d^2}{18\mu}$

2. (a) Explain the role of bacteria in removing wastewater pollutants. **[4]**

   (b) The domestic wastewater generated from a community is discharged to open water bodies, without any treatment. Due to the severe quality degradation of such water bodies, the local authority has proposed a combination of primary and secondary treatment processes, for domestic wastewater treatment. The authority has selected trickling filters, as a secondary treatment process. Under such circumstances design two-stage trickling filters (for the community) using the NRC formula from the following dataset: **[20]**

   - Water temperature= 25°C
   - Incoming wastewater= 3000 m^3/d
   - Influent BOD=200 mg/L
   - Estimated effluent BOD=20 mg/L

- Depth of each filter=2 m
- Recirculation for filter 1 and 2 (r_1=r_2)=1.5
- Assume both filters will have equal BOD removal efficacy

NRC formula:

$$E_1 + E_2(1 - E_1) = E \qquad F = \frac{1+r}{(1+0.1r)^2} \qquad E_1 = \frac{100}{1+0.532\sqrt{\frac{W}{VF}}} \qquad E_2 = \frac{100}{1+\frac{0.532}{1-E_1}\sqrt{\frac{W'}{VF}}}$$

3. (a) "External carbon addition is not required in three sludge systems designed for wastewater nitrogen removal"-justify the statement. **[12]**

   (b) What is the advantage of the three-stage Phoredox (A^2/O) system over Phoredox (A/O) to achieve biological phosphorus removal from wastewater? **[12]**

4. (a) Explain the mechanisms of facultative ponds that are associated with wastewater pollutants removal. **[12]**

   (b) How can you achieve simultaneous removal of organic compounds, nitrogen, and phosphorus from wastewater employing horizontal flow constructed wetlands? **[12]**

5. Propose nature-based stabilization pond systems to treat wastewater from an urban area and constructed wetlands to treat wastewater from an industry using the following dataset. **[24]**

	Unit	Urban wastewater	Industrial wastewater
pH		6.9	7.8
DO	mg/L	0.9	0.4
NH_4-N		4	--
NO_3-N		2	100
TN		10	110
BOD_5		500	2000
COD		700	3000
TSS		800	3200
TP		6	18

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

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

Assume any necessary data

1. Compile five factors in transportation development. 10

2. The parking survey data collected from a parking lot by license plate method is shown in the table. Find the **average occupancy, average turnover, parking load, parking capacity and efficiency** of the parking lot. 20

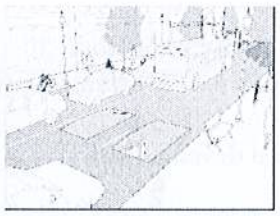
Bay	Time			
	0-15	15-30	30-45	45-60
1	1456	9813	-	5678
2	1945	1945	1945	1945
3	3473	5463	5463	5463
4	3741	3741	9758	4825
5	1884	1884	-	7594
6	-	7357	-	7893
7	-	4895	4895	4895
8	8932	8932	8932	-
9	7653	7653	8998	4821
10	7321	-	2789	2789
11	1213	1213	3212	4778
12	5678	6678	7778	8888
13	3213	3213	2212	1778
14	4678	4678	2778	6888
15	5213	5213	4212	9778

3. A major road with four lane running E-W direction meets a minor road having two lanes running in N-S direction. The E-W flow is 1670, W-E flow is 1550, N-S flow is 720, and S-N flow is 680 vehicles per hour. The intersection of the two roads is controlled by a traffic signal with a cycle time of 60 seconds. Assume for all the phases the yellow time is 3 seconds, the lost time is 4 seconds, and saturation headway is 2.1 seconds. Ignore turning movements and pedestrian traffic. **Design the traffic signal** for the road. 15

4. A person standing at a stop line of signalized intersection found that the vehicles arrive at 3.7, 6.9, 9.7, 12, 14.1, 16, 17.9, and 19.8 seconds after the start of the green. Find the lost time and saturation headway. 10

5. Evaluate following figure: 15

(a)



(b)

(c)

6. Compile different types of Kerb. 10

7. Compare rotaries and roundabout. 10

8. Explain following terms: 10

a) Average annual daily traffic (AADT)
b) Average daily traffic (ADT)
c) Vehicle-mile of travel (VMT)
d) Peak hour volume (PHV)

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

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

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

1 (a) Define flow routing. What are the types of flow routing? (5)
(b) What are the methods of estimating peak flood flow? (5)

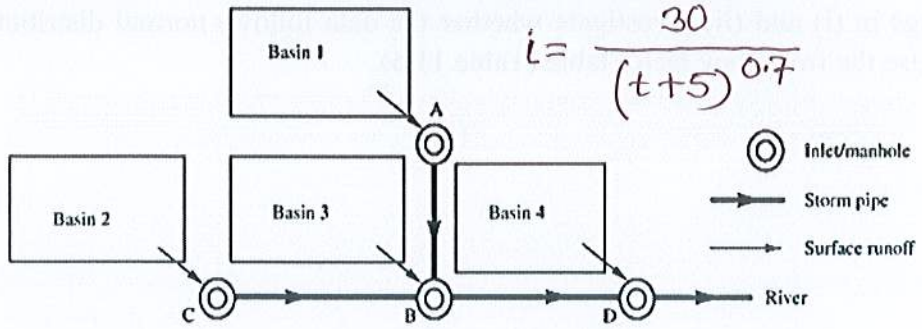
2 (a) Briefly discuss the assumptions and limitations of rational method (10)
(b) Discuss the deterministic and stochastic approaches used in hydrology. Discuss the applicability of these approaches. (10)

3 Route the following hydrograph through a river for which K = 10 hours, x= 0.30. 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)	10	15	20	30	40	35	27	20	15

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

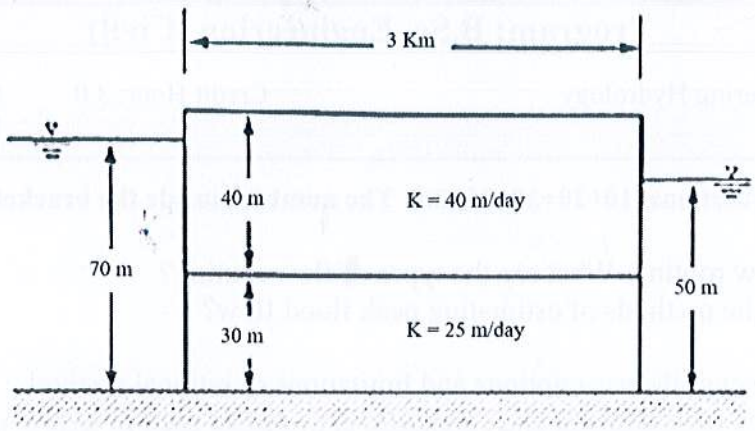
4 (a) A schematic of the stormwater drainage system is shown below. Using the rational method, determine the peak flow rates to be used in the sizing of pipes and inlets. Assume the flow velocity through the pipes is 3 ft/s. (15)



Basin	Area (Acres)	t_i (min)	C
1	2.2	12	0.3
2	1.8	10	0.4
3	2.2	13	0.3
4	1.2	10	0.5

Stormwater Pipe	Length (ft)
AB	200
CB	300
BD	300

(b) A confined aquifer underlies an unconfined aquifer shown in the figure below. The width of the aquifer is 200 m. Determine the flow rate from one stream to another. (10)



5 Assuming normal distribution, make a frequency analysis of the annual maximum flood measured at a local valley. (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		

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 cfs. Based on your findings in (i) and (ii) investigate whether the data follows normal distribution or not? Use the frequency factor table (Table 11.6).

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