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University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination, Spring 2025
Program: B.Sc. in Civil Engineering
3rd Year 2nd Semester

Course Title: Structural Engineering I
 Time: 1 hour

Credit Hour: 3.00

Course Code: CE 313 (Old)
 Full Marks: 40

Answer all the questions
 (Roll=Last two digits of your registration number)

PART-A

QUESTION 1 [8 MARKS]

Analyze the beam shown in Figure 1 and calculate the vertical deflection of **D** and rotation of **C** (For ODD roll $P=13^k$ and $L=5$ ft, for Even roll $P=18^k$ and $L=8$ ft and $EI=\text{constant}$) using Virtual work Method CO1/PO2/C4 [08]

QUESTION 2 [12 MARKS]

Analyze the frame shown in Figure 2 and calculate the horizontal deflection at **A** (For ODD roll $P=22$ kN, for Even roll $P=28$ kN and $EI=\text{constant}$) using Virtual work Method. CO1/PO2/C4 [12]

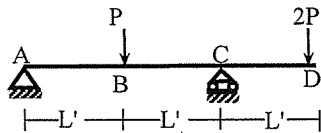


Figure 1

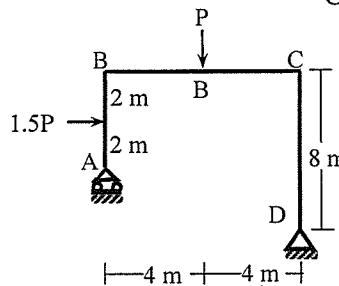


Figure 2

Part-B

QUESTION 3 [13 MARKS]

Analyze the frame shown in Figure 3 to draw Shear force, Bending Moment, and Axial force Diagram using the Portal Method. CO1/PO2/C4 [13]

QUESTION 4 [07 MARKS]

Analyze the truss and determine the member forces (**BC** and **AB**) of the statically indeterminate truss shown in Figure 4 assuming, diagonal members take an equal share of the sectional shear force. CO1/PO2/C4 [07]

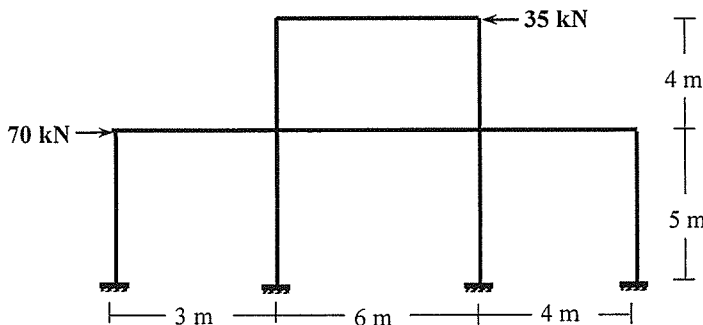


Figure 3

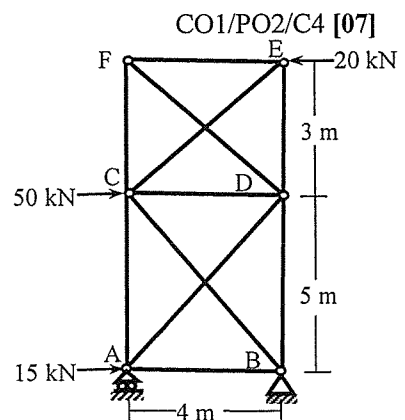


Figure 4

able for Evaluating $\int_0^L m m' dx$

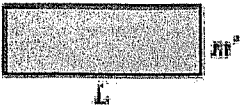

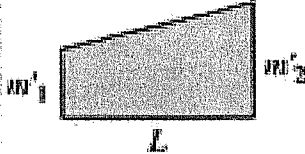
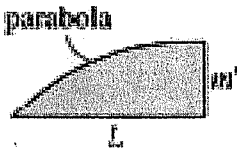

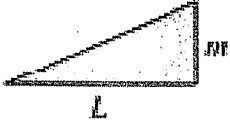
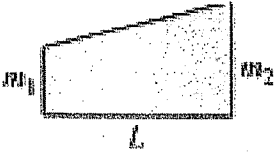
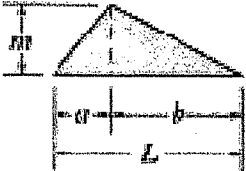

$\int_0^L m m' dx$				
	$m m' L$	$\frac{1}{2} m m' L$	$\frac{1}{2} m (m'_1 + m'_2) L$	$\frac{2}{3} m m' L$
	$\frac{1}{2} m m' L$	$\frac{1}{3} m m' L$	$\frac{1}{6} m (m'_1 + 2m'_2) L$	$\frac{5}{12} m m' L$
	$\frac{1}{2} m' (m_1 + m_2) L$	$\frac{1}{6} m' (m_1 + 2m_2) L$	$\frac{1}{6} [m'_1 (2m_1 + m_2)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

Figure 3

Figure 4

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Spring 2025
Program: B.Sc. in Civil Engineering
3rd Year 2nd Semester

Course Title: Design of Concrete Structures II
 Time: 1 hour

Credit Hour: 3.00

Course Code: CE 317
 Full Marks: 60

Answer all the questions

QUESTION 1 [30 MARKS]

- a. Interior panel of beam supported slab of an office building (live load is 2.4 kN/m^2) is shown in **Figure 1**. Thickness of the slab is 175 mm. Apply the design concept to obtain the reinforcement of slab for **short direction mid-span moment** (positive) only. Assume required data to design the slab. The coefficients of moment are shown in **Table 1**. [15]
- b. A 10-storeyed office building is constructed with **flat slab** as shown in **Figure 2**, live load of the office is 2.4 kN/m^2 . Thickness of slab could be considered as 225 mm. The concrete strength (f_c') is 25 N/mm^2 . Positive and negative moment coefficients of the panel are 0.35 and 0.65, respectively. Design the **Slab S5** for **mid-span moment** of **long direction middle strip** only. [15]

Table 1. Moment coefficients for slab.

Span Ratio		0.9
Positive Moment	Live load	0.034
	Dead Load	0.022

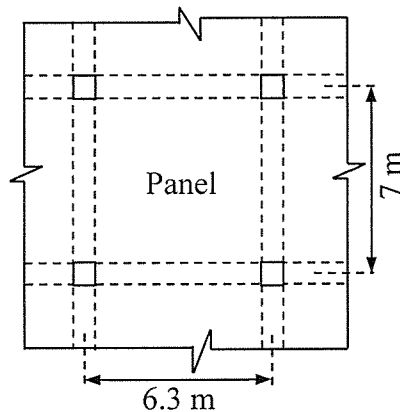


Figure 1. Interior slab panel.

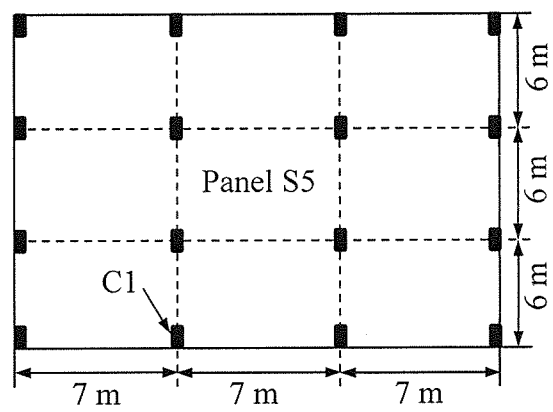


Figure 2. Flat slab floor plan.

QUESTION 2 [18 MARKS]

Design the ground floor column of “C1” (shown in **Figure 2**) of the 10-storeyed office building stated in **Question 1 (b)** as tie column. The structure is constructed as **flat slab**. The column is subjected to 600 kN-m uni-axial moment due to lateral load. Design the column considering safety, environment and societal requirements of BNBC 2020. Show the reinforcement details. The column design chart is shown in Appendix (**Figure A1**). [18]

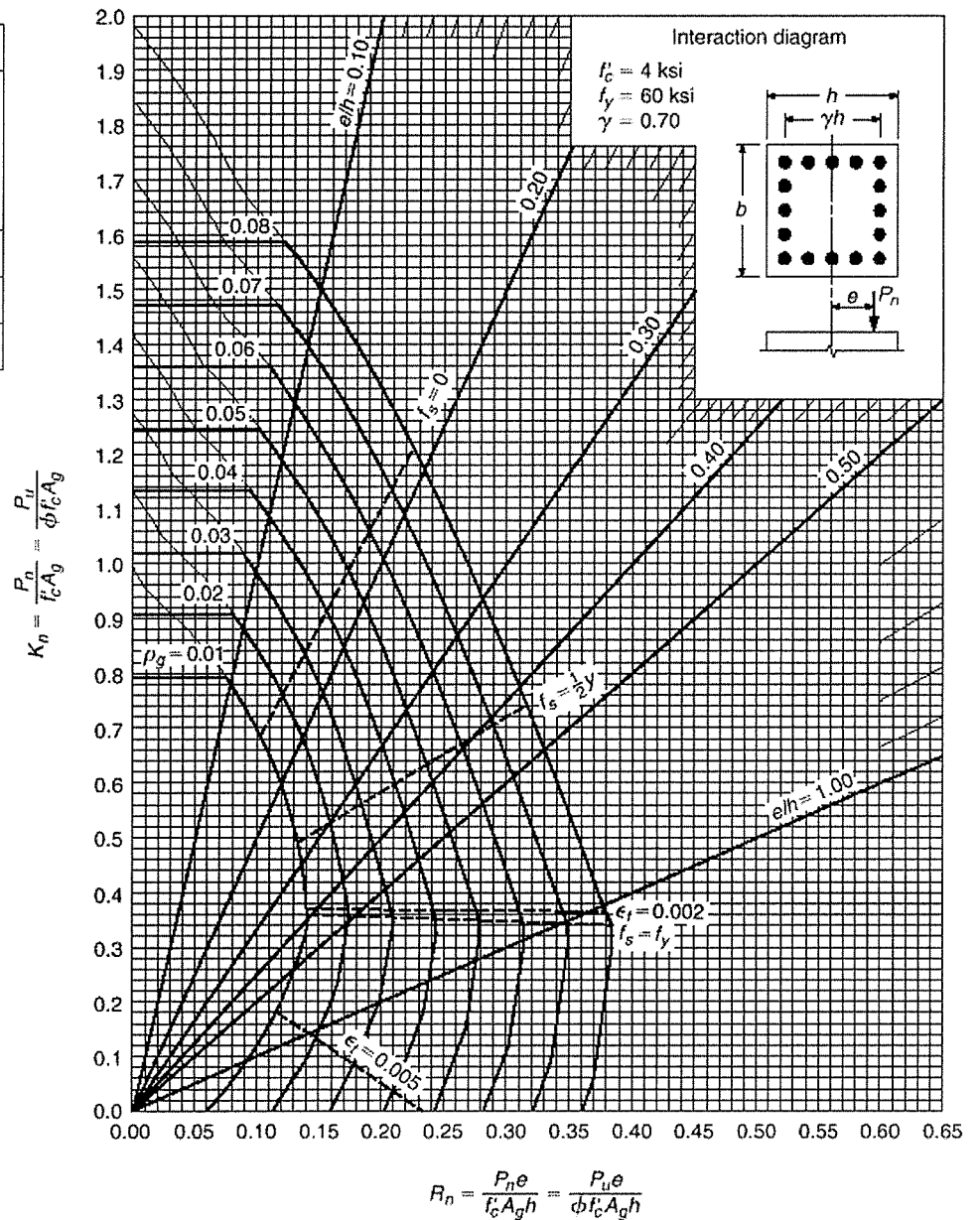
QUESTION 3 [12 MARKS]

The minimum thickness of flat slab of **Question 1(b)** has to be maintained for the whole floor as shown in **Figure 2**. Develop formulation for checking punching shear of flat slab based on first principle approach (with figures). Propose a solution for minimum thickness of the slab considering deflection and punching shear requirements in accordance to BNBC 2020. Check the punching shear for column C1 (only). Dimension of column could be based on design / assumption. [12]

Table A1. Minimum thickness of slabs without interior beams.

f_y MPa	Without drop panels		
	Exterior panels		Interior panels
	Without edge beams	With edge beams	
280	$l_n/33$	$l_n/36$	$l_n/36$
420	$l_n/30$	$l_n/33$	$l_n/33$
520	$l_n/28$	$l_n/31$	$l_n/31$

APPENDIX



University of Asia Pacific
Department of Civil Engineering
Mid Term Examination: Spring 2025
Program: B. Sc. Engineering (Civil)
3rd Year 2nd Semester

Course Title: Environment Engineering II Credit hour:3.00 Course Code: CE 333
Time-1hour Full marks: 40

PART A

There are two questions. Answer all the questions. (10*2 = 20)
[Assume reasonable data if any]

QUESTION 1 [10 Marks]

[10]

In a coastal fishing village, the majority of households are located close to the shoreline, where high groundwater tables make pit latrines and septic tanks unsuitable. During high tide, wastewater often seeps into the surrounding environment, contaminating wells and fish-drying areas. This contamination not only poses severe public health risks but also threatens the community's main source of livelihood, as polluted coastal waters reduce fish quality and market value. At the same time, villagers depend heavily on external supply of expensive fertilizers for small-scale crop cultivation.

To improve both sanitation and livelihood security, the local authority is exploring the adoption of ecological sanitation systems.

Select a suitable Ecosan technology for this coastal village and explain how it can prevent water contamination and safeguard public health.

QUESTION 2 [10 Marks]

[10]

A 25 inches sewer with $n = 0.013$ is laid on a grade of 0.016.

Determine the velocity when depth of flow is 5 inches and the capacity when pipe is flowing half full.

Necessary formula:

$$\theta = 2 \cos^{-1} \left(1 - \frac{2d}{D} \right) \quad Q = \frac{D^{5/2} \times \sqrt{S}}{2.16n}$$

$$A = \frac{D^2}{4} \left(\frac{\pi\theta}{360} - \frac{\sin\theta}{2} \right)$$

$$P = \frac{\pi D \theta}{360}$$

PART B

There are two questions. Answer all the questions. (10*2 = 20)

[Assume reasonable data if any]

QUESTION 3 [10 Marks]

[10]

Calculate the velocity through a rack, when approach velocity is 0.80 m/s, flow open area through clean bar rack is 0.25 m² and headloss across the rack is 40 mm. Also estimate the headloss, when 50% area of the flow area is blocked off due to coarse solids accumulation.

Use the following formula: $h = h_1 - h_2 = \frac{V^2 - v^2}{2gC^2}$

QUESTION 4 [10 Marks]

[10]

Explain the COD removal mechanisms in a biological wastewater treatment system.

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Spring 2025
Program: B.Sc. in Civil Engineering
3rd Year 2nd Semester

Course Title: Transportation Engineering I (Self-study)
Time: 1 hour

Credit Hour: 3.00

Course Code: CE 351
Full Marks: 60

Answer all the questions

PART A

QUESTION 1 [20 MARKS]

- a. Tariq lives in Narayanganj and works at a government office in Motijheel, Dhaka. Every Sunday to Thursday, he leaves from his home by rickshaw to the railway station and takes an early morning train to Dhaka. After arriving at the Kamalapur Railway Station, he catches a city bus to his office in Motijheel. While it's usually efficient, during some busy days if the train is delayed, he misses the bus and ends up late. During hartals or strikes, both train and bus services may be disrupted, forcing him to find expensive alternatives. Based on the story:
- i) Define the multimodal transportation system.
 - ii) List two advantages of using multimodal transportation system.
 - iii) List two challenges Tariq faces with this system.
 - iv) Explain the importance of coordination between different modes of transport in a multimodal system. [8]
- b. Discuss the concept of Road Hierarchy in transportation system by showing a detailed schematic diagram. [6]
- c. Using the Roadway Classification System, identify the classification of 'Elephant Road' in Dhaka across all applicable categories. [6]

QUESTION 2 [20 MARKS]

- a. Design the superelevation for a horizontal curve length of 720 m where the back tangent bearing is $Az\ 58^{\circ}$ and forward tangent bearing is $Az\ 130^{\circ}$. The design speed is 85 kmph. [10]
- b. A -2.00% grade intersects a +3.50% grade at station 50+30 and at a PVI elevation of 350 ft. Given the length of the vertical curve is 650-ft, determine the station and elevation of the curve low point. [10]

PART B

QUESTION 3 [20 MARKS]

- a. A city authority in a developed country is redesigning a commercial street that experiences heavy traffic during peak hours. The street is 12m wide, and planners must decide whether to adopt Angular Parking or Parallel Parking along one side of the road. As a transportation engineer, recommend which parking system would be more suitable for this street and justify your answer. [4]
- b. State the name of the grade-separated interchange commonly used for a three-legged intersection. Additionally, illustrate the layout with a neat diagram, clearly indicating the directions of traffic flow. [6]
- c. Determine the lighting layout a road lined with markets, educational institutions, offices, hospitals, and malls. The road is a two-way road and has 2 lanes on each direction having lane width of 12m and 0.5m shoulder on both side of road. Assume the surface reflectance to 8% and a maintenance factor of 0.85. Consider, the expected life of the light is 200 days. Given, Night-time vehicle flow (both direction) = 1000 vph and Day-time vehicle flow (both direction) = 1500 vph. Refer to the annexure for necessary data. [10]

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Spring 2025
Program: B.Sc. in Civil Engineering
3rd year 2nd Semester

Course Title: Engineering Hydrology
 Time: 1 hour

Credit Hour: 2

Course Code: CE 363
 Full Marks: 40

Answer all the questions

QUESTION 1 [10 MARKS]

- a. Discuss the factors that affect watershed behavior. [5]
 b. Explain why evaporation rate is greater in windy weather than clam weather? [5]

QUESTION 2 [15 MARKS]

- a. In a given year, a 15,000 Km² watershed received 35 cm of precipitation. The annual rate of flow measured in the river draining the area is 60 m³/sec. Estimate the annual evapotranspiration. Assume negligible change of storage and net groundwater flow. [5]
 b. The following rainfall record is found for the stations in a basin for the month of September. Estimate the missing rainfall for September 2024 for Station E. [5]

Station	All years' average for September (ft)	Measured in September 2024 (in)
A	0.30	3.8
B	0.33	4.1
C	0.25	2.2
D	0.28	2.5
E	0.35	??
F	0.33	4.3
G	0.19	1.9

- c. The depths of 45-minutes rainfall event are given below. Estimate maximum 25 minutes rainfall intensity in in/hr. [5]

Storm time (minutes)	5	10	15	20	25	30	35	40	45
Rainfall depth (in)	0.1	0.15	0.2	0.25	0.2	0.25	0.2	0.15	0.05

QUESTION 4 [15 MARKS]

For the data given below, construct the IDF curves for return periods of 10 and 5-years.

[15]

Year	Rainfall depth (mm)			
	1 Hour	2 Hour	4 Hour	6 Hour
2000	2	2.1	2.8	4.1
2001	1.8	2.7	2.8	2.8
2002	1.5	2.6	2.8	3.1
2003	1.4	2.5	3.1	3.7
2004	1.6	1.8	2.2	2.6
2005	1.2	1.7	2.4	2.7
2006	1.4	1.5	1.5	2.3
2007	1.7	1.8	2.4	2.7
2008	1.9	2.6	4.1	5.1
2009	1.8	3.2	3.8	3.9
2010	1.3	1.6	1.7	1.7
2011	1.8	2.1	3.3	3.4
2012	1.6	2	2.3	2.6
2013	1.9	2.8	2.8	2.9
2014	3.1	3.4	3.6	3.6
2015	1.5	1.6	2.1	2.9
2016	2.9	3.4	4	4.1
2017	1.4	2.5	2.8	2.8
2018	1.6	2.1	2.2	2.2
2019	2.2	2.3	4.5	5.2
2020	2.5	3	3.2	3.2
2021	2.1	3	3.1	3.1
2022	1.6	2.3	2.8	3.2
2023	1.2	1.8	2.1	2.5
2024	1.5	4.2	4.2	4.2

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Spring 2025
Program: B.Sc. in Civil Engineering
3rd year 2nd Semester

Course Title: Engineering Hydrology (Old)
 Time: 1 hour

Credit Hour: 3

Course Code: CE 363
 Full Marks: 40

Answer all the questions

QUESTION 1 [10 MARKS]

- a. Discuss the factors that affect watershed behavior. [5]
 b. Explain why evaporation rate is greater in windy weather than clam weather? [5]

QUESTION 2 [15 MARKS]

- a. In a given year, a 15,000 Km² watershed received 35 cm of precipitation. The annual rate of flow measured in the river draining the area is 60 m³/sec. Estimate the annual evapotranspiration. Assume negligible change of storage and net groundwater flow. [5]
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F	0.33	4.3
G	0.19	1.9

- c. The depths of 45-minutes rainfall event are given below. Estimate maximum 25 minutes rainfall intensity in in/hr. [5]

Storm time (minutes)	5	10	15	20	25	30	35	40	45
Rainfall depth (in)	0.1	0.15	0.2	0.25	0.2	0.25	0.2	0.15	0.05

QUESTION 4 [15 MARKS]

For the data given below, construct the IDF curves for return periods of 10 and 5-years.

[15]

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2002	1.5	2.6	2.8	3.1
2003	1.4	2.5	3.1	3.7
2004	1.6	1.8	2.2	2.6
2005	1.2	1.7	2.4	2.7
2006	1.4	1.5	1.5	2.3
2007	1.7	1.8	2.4	2.7
2008	1.9	2.6	4.1	5.1
2009	1.8	3.2	3.8	3.9
2010	1.3	1.6	1.7	1.7
2011	1.8	2.1	3.3	3.4
2012	1.6	2	2.3	2.6
2013	1.9	2.8	2.8	2.9
2014	3.1	3.4	3.6	3.6
2015	1.5	1.6	2.1	2.9
2016	2.9	3.4	4	4.1
2017	1.4	2.5	2.8	2.8
2018	1.6	2.1	2.2	2.2
2019	2.2	2.3	4.5	5.2
2020	2.5	3	3.2	3.2
2021	2.1	3	3.1	3.1
2022	1.6	2.3	2.8	3.2
2023	1.2	1.8	2.1	2.5
2024	1.5	4.2	4.2	4.2