3-2

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2019
Program: B.Sc in Civil Engineering

Course Title: Principles of Management Course Code: IMG 301 Credit: 2.00
Time: 2 hours Full Marks:50

(Answer any five)

1. Some laptops are needed for sales representative. How will a manager choose the laptop brand? (10)

Weighted Criteria:

Memory and storage	35
Battery life	25
Carrying weight	20
Warranty	15
Display quality	5

Possible Alternatives:

Brand	Memory and storage	Battery life	Carrying weight	Warranty	Display quality
HP	30	20	20	12	4
Acer	25	17	15	10	3
Sony	20	15	12	10	2
Lenovo	22	13	10	9	5
Dell	15	11	8	13	4

2. Explain five alternatives of job specialization with examples. (10)

3. Briefly discuss the contingency theories of leadership with examples. (10)

4. a) Explain the control process of an organization with examples. (5)
   b) Briefly discuss the purposes of an effective control system. (5)

5. a) Illustrate how a manager can motivate his or her subordinates from the understanding of the Herzberg two factor theories. (5)
   b) Explain Maslow's hierarchy of needs theory with examples. (5)

(Continued in the next page)

6. Write short notes on any two (2) of the followings: (10)

Customer Departmentalization, Charismatic Leadership, Program Decision Making, Job Enlargement

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2019
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. Any missing data can be assumed reasonably.

1. Column bending moments (kN-m) of a two-storied frame are shown in ***Fig.1***. Use the Portal Method to calculate the corresponding
(i) applied loads P1 and P2, (ii) column shear forces, (iii) beam axial forces. **[10]**

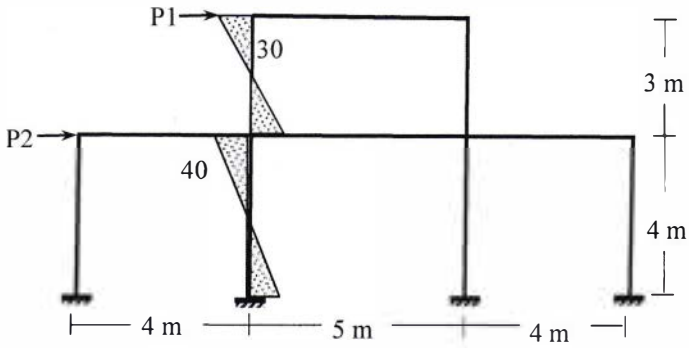


Fig.1

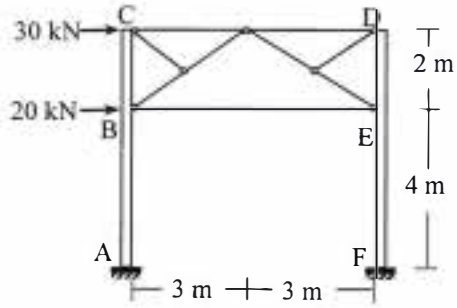


Fig.2

2. Use Portal Method to draw the bending moment diagrams of columns ABC and DEF of the mill bent shown in ***Fig.2***. **[05]**

3. Use Method of Virtual Work to determine the horizontal deflection of joint **C** of the frame shown in ***Fig. 3***
[Given: E=200 GPa, I = 100×10^6 mm^4]. **[10]**

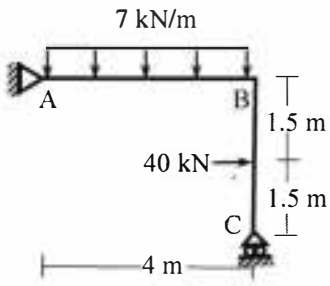


Fig.3

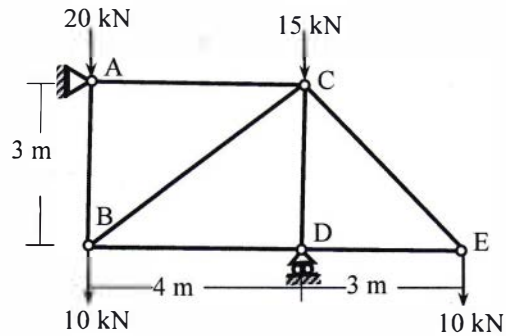


Fig.4

4. Use Method of Virtual Work to determine the vertical deflection of joint **E** of the truss shown in ***Fig. 4*** . Each member has same cross-sectional area (400 mm^2).
[Given: E=200 GPa] . **[10]**

5. Use the (i) Flexibility Method and (ii) Moment Distribution Method to draw the shear force and bending moment diagrams of the beam shown in ***Fig.5***.
[Given:E=200 GPa , I = 90×10^6 mm^4]. **[20]**

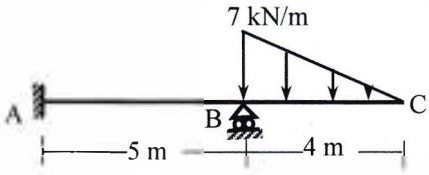


Fig.5

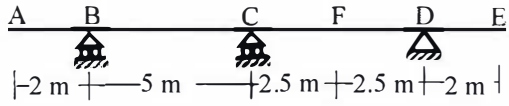


Fig.6

6. (i) Draw the qualitative influence lines of the beam shown in ***Fig.6***,
(a) Bending moments M_C, M_F
(b) Support reactions R_C, R_D and
(c) Shear forces $V_D^{(L)}$, $V_C^{(R)}$,

(ii) Calculate the maximum value of $\mathbf{M_F}$ (Positive), if the beam (***Fig.6***) is subjected to a uniformly distributed dead load is 30 kN/m and moving live load is 15 kN/m (uniformly distributed) and 35 kN (concentrated) [Given: EI = constant]. **[15]**

7. Use Moment Distribution Method to draw bending moment diagram of the frame shown in ***Fig.7*** [Given: EI = constant]. **[15]**

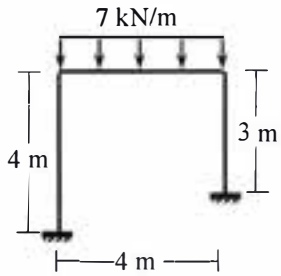


Fig.7

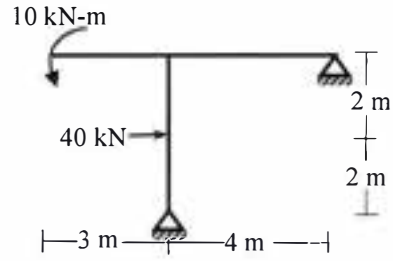


Fig.8

8. Use Force Method to draw shear force and bending moment diagrams of the frame shown in ***Fig.8*** [Given: E=200 GPa , I = 80×10^6 mm^4]. **[15]**

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2019
Program: B.Sc. in Civil Engineering

Course Title: Design of Concrete Structures II | Course Code: CE 317
Time: 3 (Three) hours | Full Marks: 100

Assume reasonable values for any missing data. Symbols used have their usual meanings.
[Use $f_c' = 30\ N/mm^2$ and $f_y = 410\ N/mm^2$ for all design]

QUESTION 1 [20 MARKS]

a. An interior panel of beam supported reinforced concrete slab of office building as shown in **Figure 1** is to be designed. The slab is subjected to 7.2 kN/m^2 dead load (including self-weight, random wall and finishes) and 2.4 kN/m^2 live load. The thickness of slab could be assumed as 125 mm. Apply the concept to design the short span of slab for moment at mid-span and support. The co-efficient of moments are listed in **Table 1**. [10]

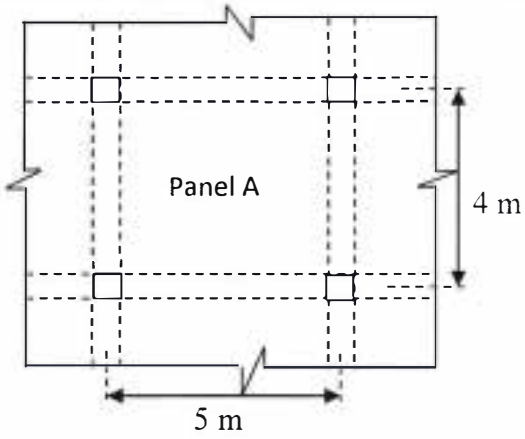


Figure 1. Interior slab panel

Table 1: Moment coefficients of interior slab (short span)

Span Ratio	Positive Moment		Negative Moment
	Live load	Dead Load	
0.85	0.037	0.024	0.06
0.8	0.041	0.026	0.065

b. A simply supported 8 meter span post-tensioned pre-stress concrete beam is carrying 10 kN/m live load and 20 kN/m dead load (including self-weight of beam). The section of the rectangular beam is 200 mm x 600 mm. A tendon could be provided as (i) straight at the centroid of the section or, (ii) 100 mm below the centre at mid span of the beam. Apply the concepts to analyse the section to obtain minimum pre-stressing forces in both cases. [10]

QUESTION 2 [20 MARKS]

a. A reinforced concrete column is required to design for 1500 kN dead load and 600 kN live load. Apply the concept to design the column as tied and spiral columns and show reinforcement details. The size of tied and spiral columns could be assumed as 400 mm x 400 mm and 400 mm diameter respectively. Assumed required data to design. [10]

b. The tied column (400 mm x 400 mm) of **Question 2(a)** is supported by pad footing. The bearing capacity of soil is 150 kN/m^2. Apply the concept to design the footing for only one span. The depth (h) of footing could be assumed as 900 mm. [10]

QUESTION 3 [20 MARKS]

a. The floor of 6 storeyed office building (live load 2.4 kN/m^2) is constructed with reinforced concrete flat slab as shown in **Figure 2**. The dead load of the slab due to random wall (excluding self-weight) is 2 kN/m^2 . Design **long span middle strip** of the slab **Panel A (6 m x 5 m)** of the floor as shown in **Figure 2.** Assume required data to design. The column size could be assumed as 400 mm x 400 mm. [10]

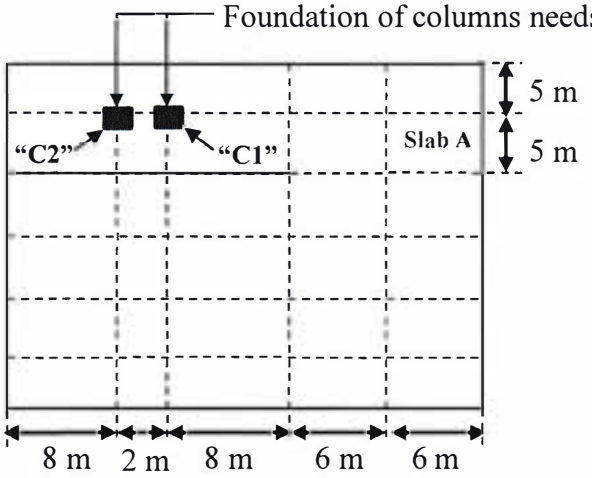


Figure 2: Layout plan of flat slab

Table 2: Distribution of total factored static moment (M_0) for flat slab of end span

Factored Moment (slab without edge beam)		
Interior Negative	Positive	Exterior Negative
0.7	0.52	0.26

b. Columns (400 mm x 400 mm) C1 and C2 stated in **Questions 3(a)** as shown in **Figure 2** are supported by combined footing. The loads on both columns are same. Design the footing for **short span moment** only. The safe bearing capacity of soil is 150 kN/m^2. [10]

QUESTION 4 [20 MARKS]

a. A column of reinforced concrete structure as shown in **Figure 3** needs to be checked for 2000 kN axial load and 200 kN.m bending moment in longer direction. Evaluate and justify (through analysis of column) whether it could sustain the load and moment at balanced failure condition. Assumed required information for analysis of column. [10]

b. A reinforced concrete cantilever retaining wall of an artificial lake as shown in **Figure 4** is subjected to lateral load due to soil and pore water pressure. Design the wall (only) and check overturning of the whole retaining wall. The density of soil and water is 1800 kg/m^3 and 1000 kg/m^3 respectively, coefficient of active soil pressure is 0.33. Assume required data to design. [10]

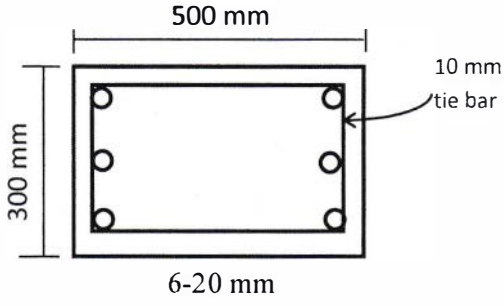


Figure 3: Sections of column

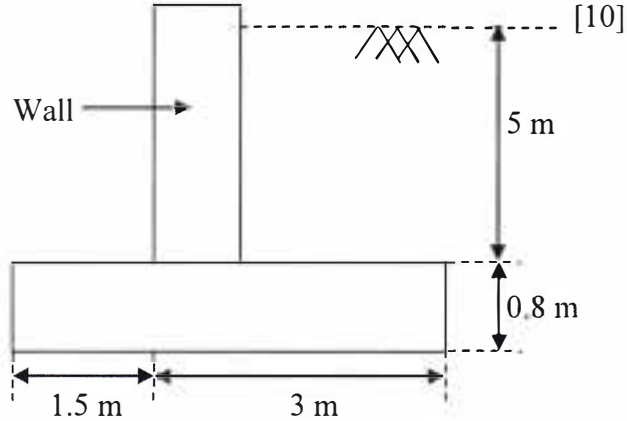


Figure 4: Retaining wall of an artificial lake

QUESTION 5 [20 MARKS]

a. The interior column **C1 (Figure 2)** of 6 storeyed office building stated in **Question 3(a)** is required to design for axial load and 200 kN.m uniaxial bending moment. The column could be designed as rectangular or square shapes. Evaluate which shape would be the economical choice and justify through comparative design of both shapes of column using column design chart. Assumed required data to design. [10]

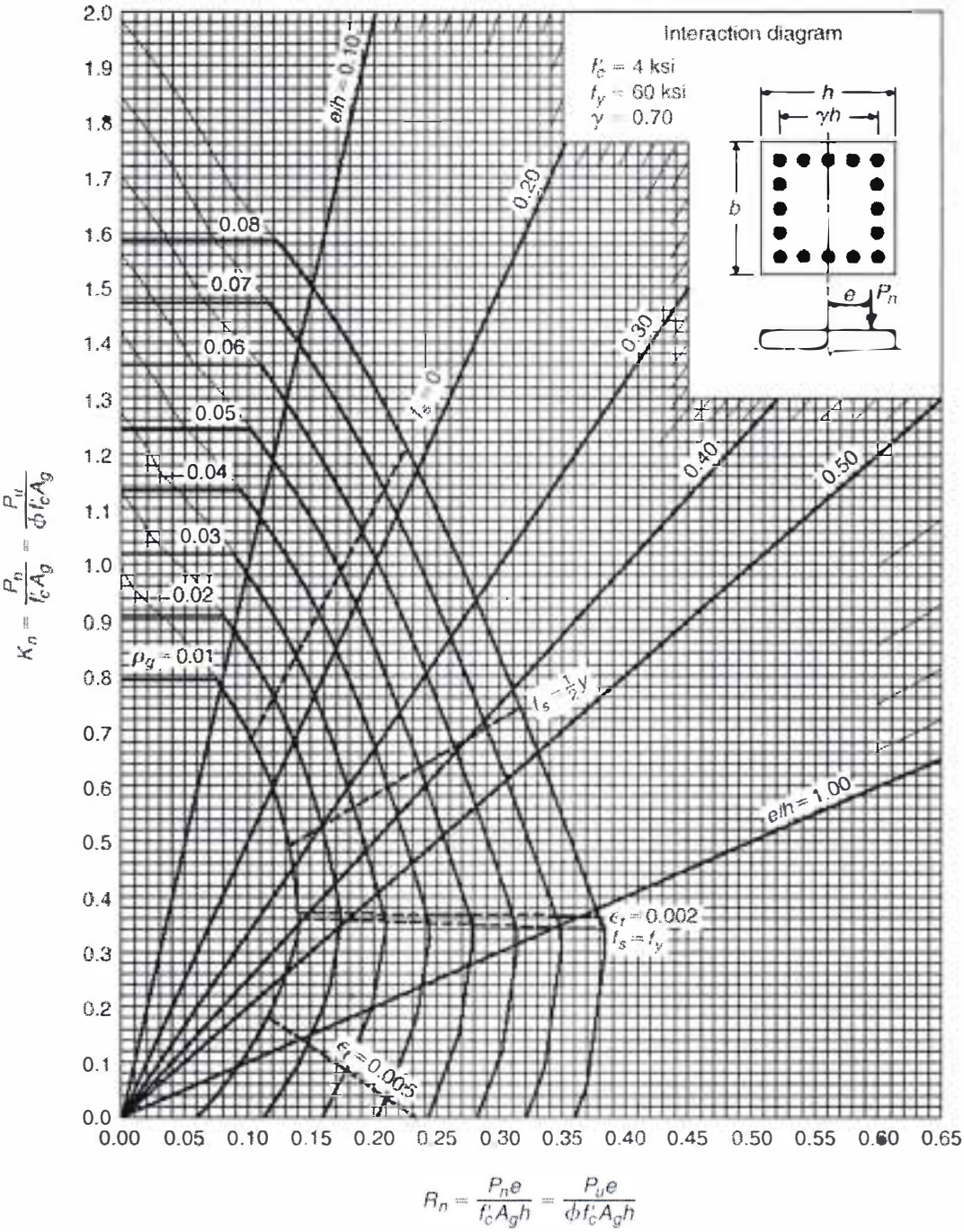
b. A column (400 mm x 500 mm) of a 9 storeyed academic building is supported by bore pile foundation. The dead and live loads of the foundation are 1800 kN and 600 kN respectively. The capacity of 500 mm diameter bore pile is 700 kN. Evaluate whether 600 mm depth (h) of pile cap would resist punching and flexural shear, if not, propose suitable solution for optimal design of the pile cap. The normal concrete strength (f_c') is 30 N/mm^2, however, in critical situation 40 N/mm^2 compressive strength of concrete could be used in pile cap. Assume required data to design. [10]

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 2019
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II | Course Code: CE 333
Time: 3 hours | Full Marks: 100

There are Six (6) questions. **Answer any Five (5).** Assume any missing data.

1. (a) Explain the main objectives of ecological sanitation. **[5]**
   (b) What are the advantages and disadvantages of SBS systems? **[5]**
   (c) Briefly explain DAF system with recycle-flow mode. **[5]**
   (d) With schematic diagram describe operational principles of different zones in a rectangular sedimentation tank. **[5]**

2. (a) "BOD concentration of wastewater is always greater than COD concentration"- justify the statement. **[5]**
   (b) Explain the operational mechanism of step aeration process. **[5]**
   (c) What is the principle of sequential aerobic-anaerobic environment formation in a RBC reactor? **[5]**
   (d) How mass balance of organics removal across an activated sludge system is calculated? **[5]**

3. (a) What is the functional difference between Pre D and Post D systems employed for nitrogen removal from wastewater? **[5]**
   (b) Explain the basic principle of biological phosphorus removal. **[5]**
   (c) "Knowledge on process flow diagram is not required for designing an industrial wastewater treatment plant"- justify the statement. **[5]**
   (d) With schematic diagram explain the working principle of continuous belt filter presses for sludge dewatering. **[5]**

4. (a) How can organic media improve nitrogen removal from wastewater in vertical flow wetlands? **[5]**
   (b) What is the benefit of providing aeration in a horizontal flow wetland? **[5]**
   (c) How facultative zone is formed in stabilization ponds? **[5]**
   (d) Why floating treatment wetland could be an attractive wastewater treatment technology in Bangladesh? **[5]**

5. Wastewater flow from an area averages 5000 m^3/d during November (winter) and 8000 m^3/d during June (summer). The average temperature of November is 5^0C, and in June (summer) average temperature is 35^0C. The mean concentration of influent BOD_5 is 500mg/L. Reaction coefficient K is 0.23 d^{-1} at 20^0C, and θ is 1.06. Prepare a facultative pond treatment system for the area to remove 90% of the incoming BOD. Use the graph if required. **[20]**

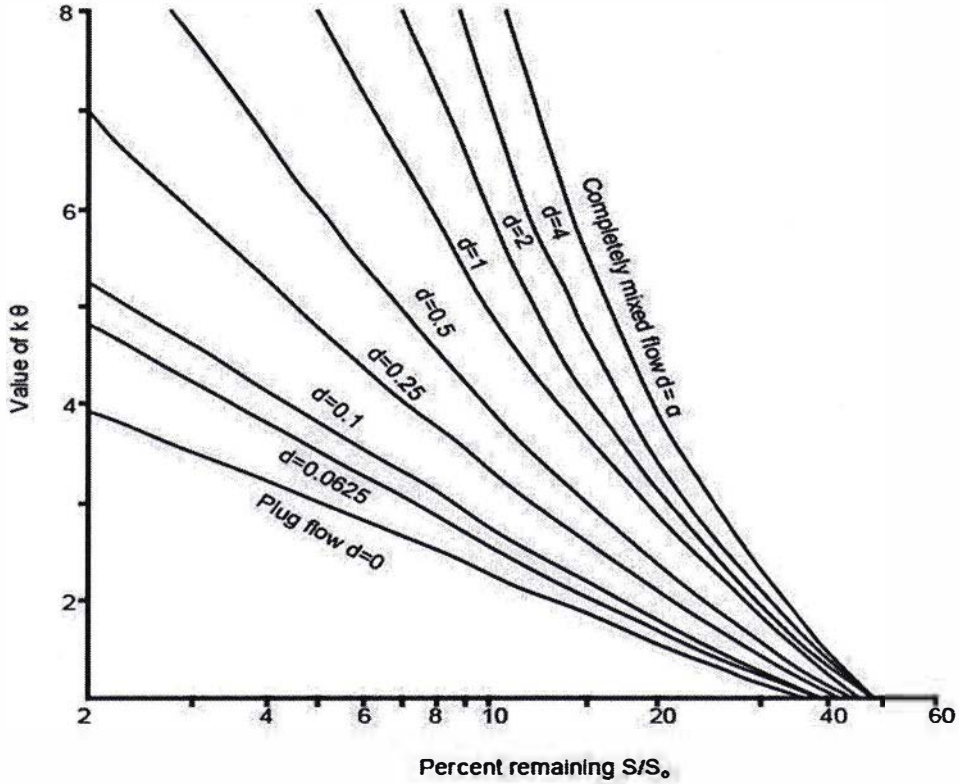


Figure. Graphical plot of the Thirumurthi equation.

6. As an environmental engineer, you have been assigned to propose wastewater treatment plants for a domestic area and an industry. Pollutant concentration values of wastewater generated from the domestic area and industry is given in the following table. Propose treatment flow diagram of: (a) combined activated sludge process and constructed wetlands for domestic wastewater treatment; and (b) combined constructed wetland and stabilization pond systems for industrial wastewater treatment. **[20]**

	Unit	Domestic wastewater	Industrial wastewater
pH		6.9	6.1
DO	mg/L	0.7	0.4
NH_4-N		50	---
NO_3-N		---	20
TN		52	25
BOD		200	890
COD		310	1100
TSS		250	980
TP		8	---

University of Asia pacific
Department of Civil Engineering
Final Examination Spring 2019
Program: B.Sc. Engineering (Civil)

Course Title: Transportation Engineering I (Transport and Traffic Design) Course Code: CE 351
Time: 3 Hours Full Marks: 150

There are **six** questions. Answer any **five** of them.

1. a) A vehicle initially traveling at 70 m/h skids to a stop on a 5% downgrade, where the pavement surface provides a coefficient of friction equal to 0.38. Determine the distance of the vehicle travel before coming to a complete stop. 12

   b) A horizontal curve having 1100 ft radius is designed for a two-lane highway having a design speed of 80 mph. If the section of highway is having a 6% upgrade and coefficient of friction is 0.348, estimate the least possible distance of any object can be placed from the centerline of the inside lane of the curve. Assume PR time to be 2.5 sec. 18
   Spot speeds of 8 vehicles traversing 5 km segment of a highway are given below.

2. a) Calculate the AADT for the following data. Data was collected on Wednesday in August. MEF for August is 0.521. Necessary Table is provided enclosed. 10

Hour	Volume
7:00 a.m. - 8:00 a.m.	1400
8:00 a.m. - 9:00 a.m.	1160
9:00 a.m. - 10:00 a.m.	1200
10:00 a.m. - 11:00 a.m.	1350
11:00 a.m. - 12:00 p.m	1280
12:00 p.m. -13:00 p.m	1190

   b) Compile the principle techniques of traffic calming device. Concisely discuss the device which is most suitable for emergency rescue route. 10

   c) Summarize the low cost improvement techniques for locations with inadequate sight distances. 10

3. a) Spot speeds (km/hr) of 50 vehicles traversing a section of an major arterial road are as below: 25
   45, 33, 67, 73, 33, 57, 54, 70, 59, 88, 58, 38, 53, 76, 39, 46, 48, 41, 55, 73, 62, 48, 72, 42, 83, 37, 52, 77, 56, 38, 55, 56, 39, 32, 53, 45, 73, 56, 42, 35, 47, 44, 68, 53, 67, 64, 66, 46, 49, 55. Consider pace as **11-20, 21-30** and so on
   i) **Student ID: odd**
   Estimate the design speed, median speed, and upper limit of speed.
   OR
   ii) **Student ID: even**
   Estimate the average speed, safe speed and lower limit of speed.

   b) Explain 'Time-mean speed' and 'Space-mean speed'. 5

4. a) Explain briefly the different components of Passing Sight Distance for a two-lane highway. 14

   b) Two straight sections of a highway meet at an angle of 170^0. If the radius of simple circular curve is 800 m, determine 16

      i) Long chord
      ii) Tangent distance
      iii) Apex distance
      iv) Mid-ordinate

5. a) A -6% grade vertical curve is followed by a +5% grade at a section of a two-lane highway. Estimate the required length of vertical curve needed to satisfy the design stopping sight distance. Assume height of driver's eye to be 3.0 ft, object height to be 2.5 ft. and stopping sight distance to be 650 ft. 12

   b) An accident evaluator predicts that a bus collided with a tree at a speed of 25mi/hr. ascertained by her estimation of damage. After assessing the accident site she identified skid marks of 90 ft on the concrete pavement (f=0.55) and 60 ft on the soil shoulder (f=0.45). There is -4% grade. Compute the speed of the vehicle at the beginning of skid marks. 18

6. a) Summarize the locations where adequate street lighting is necessary. Illustrate the benefits of street lighting. 10

   b) An urban secondary street with 40 ft pavement width having a reflectance of 13% carries a maximum of 1800 vph at night-time. Design the lighting system considering Fluorescent source with mounting height of 25 ft and a maintenance factor of 0.77. Sketch the lighting layout. 15

   c) Explain the ways walking facilities in Dhaka city may be improved. 5

Necessary equations:

$$S < L: \quad L = \frac{AS^2}{100(\sqrt{2h_1} + \sqrt{2h_2})^2}$$

$$S > L: \quad L = 2S - \frac{200(\sqrt{h_1} + \sqrt{h_2})^2}{A}$$

$$S < L: \quad L = \frac{AS^2}{200[2.0 + S(\tan 1^\circ)]}$$

$$S > L: \quad L = 2S - \frac{200[2.0 + S(\tan 1^\circ)]}{A}$$

Table for Question 2 a)

Table 1 Hourly Expansion Factors for a Rural Primary Road

Hour	Vol.	HEF	Hour	Vol.	HEF
6:00-7:00 a.m.	294	42.01	6:00-7:00 p.m.	743	16.6
7:00-8:00 a.m.	426	28.99	7:00-8:00 p.m.	706	17.5
8:00-9:00 a.m.	560	22.05	8:00-9:00 p.m.	606	20.4
9:00-10:00 a.m.	657	18.8	9:00-10:00 p.m.	489	25.3
10:00-11:00 a.m.	722	17.11	10:00-11:00 p.m.	396	31.2
11:00-12:00 p.m.	667	18.52	11:00-12:00 a.m.	360	34.3
12:00-1:00 p.m.	660	18.71	12:00-1:00 a.m.	241	51.2
1:00-2:00 p.m.	739	16.71	1:00-2:00 a.m.	150	82.3
2:00-3:00 p.m.	832	14.84	2:00-3:00 a.m.	100	124
3:00-4:00 p.m.	836	14.77	3:00-4:00 a.m.	90	137
4:00-5:00 p.m.	961	12.85	4:00-5:00 a.m.	86	144
5:00-6:00 p.m.	892	13.85	5:00-6:00 a.m.	137	90.2
Total daily volume =		12350			

Table 2 Daily Expansion Factors for a Rural Primary Road

Day of Week	Volume	DEF
Sunday	7,895	9.515
Monday	10,714	7.012
Tuesday	9,722	7.727
Wednesday	11,413	6.582
Thusrday	10,714	7.012
Friday	13,125	5.724
Saturday	11,539	6.51
Total weekly volume =		75,122

Table for Question 5 b)

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

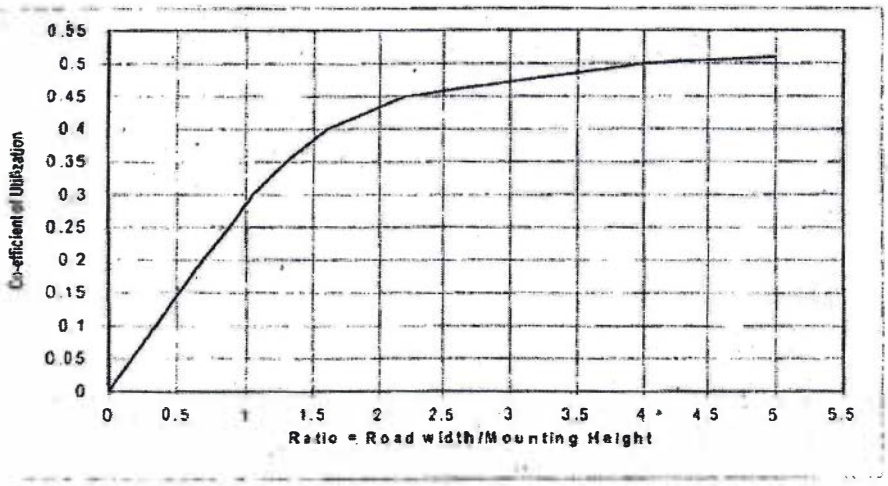
TABLE 3 LIGHTING SOURCE CHARACTERISTICS

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

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

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%).

University of Asia Pacific
Department of Civil Engineering
Semester Final Examination Spring 2019

Course Code: CE 363 Course Title: Engineering Hydrology
Full Marks: 150 Time: 3 hours

Assume any reasonable value, if not given

Part A

Question ONE is compulsory, answer any ONE from the other TWO (35+25=60)

1(a). Compute average rainfall using Thiessen polygon method for the catchment area shown in Fig-1. Use this sheet of having Fig. 1 to solve this problem and attach it with the answer sheet. (15)

1(b). Calculate runoff at the gauging station for a 4 hour rainfall in the catchment area described in Fig-1 by using the following data. (10)

PET is given as 10mm/h
Infiltration varies from 2mm/h to 4mm/h
Interception loss is 10% of the average rainfall
Depression loss is 5% of the average rainfall
Storage in water reservoir is 10% of average rainfall

1(c). Derive a synthetic unit hydrograph when there are no hydrological data available for the same catchment (fig-1). Use Snyder method and assume Ct=1.6 and Cp=0.5. (10)

2(a). Explain the factors that affect the rate of evaporation. (9)

2(b). Compute the average daily evaporation from the reservoir in the figure-2 and volume of water evaporated from the reservoir during one week. Use the following information. (16)

Area of the reservoir = 400 hectares; Water temperature = 21°C
Relative humidity = 40%; Wind velocity at 1.0 m above ground = 18 km/h

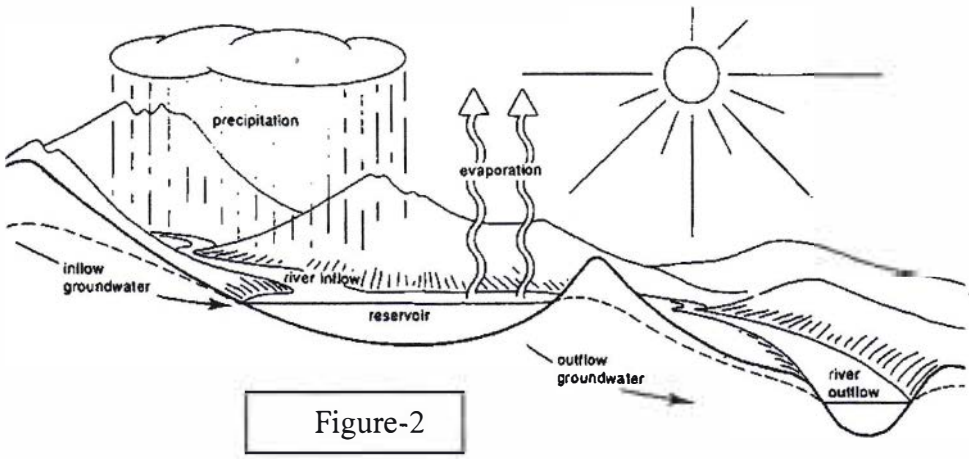


Figure-2

3(a). A catchment area has seven rain gauge stations. In a year the annual rainfall recorded by the gauges are as follows:

Station	A	B	C	D	E	F	G
Rainfall (cm)	141	101	115	182	108	87	98

For a 10% error in the estimation of the mean rainfall, deduce the optimum number of additional stations required to be established in the catchment. (13)

3(b). A catchment area has seven rain gauge stations. Annual rainfall data of 2018 at station E is missing. Annual rainfall data of 2018 and normal annual rainfall recorded by the gauges are as follows. Compute the missing data. (12)

Station	A	B	C	D	E	F	G
Rainfall of 2018(cm)	202	156	140	182	missing	117	132
Normal rainfall (cm)	180	150	170	160	165	150	155

Part B

There are FOUR questions answer any THREE (30x3=90)

4(a). The following are the ordinates of the hydrograph of flow from a catchment area of 560 km^2 due to a 4-hr rainfall. Deduce the ordinates of 4-hr unit hydrograph for the basin. Assume base flow to be uniform at 9 m^3/s. (15)

Time (hr)	0	4	8	12	16	20	24	28
Discharge (cumec)	9.6	32	51.2	172	288	324	280	216

Time (hr)	32	36	40	44	48	52	56
Discharge (cumec)	164	116	80	56	40	33.6	8.8

4(b). Two storms each of 4-h duration and having rainfall excess values of 2.4cm and 1.6cm respectively occur successively. The 1.6 cm ER rain follows the 2.4 cm rain. The 4-h unit hydrograph for the catchment is given below. Calculate the resulting DRH. (15)

Time (hr)	0	2	4	6	8	10	12	14
UH ordinate (cumec)	0	20	40	68	100	128	148	128

Time (hr)	16	18	20	22	24	26	28	32
UH ordinate (cumec)	88	48	29	20	13	6.5	4	0

5(a). The ordinates of 10-hr UH are given below. Derive the ordinates of a 5-hr UH by the S-curve method. (15)

Time (hr)	0	10	20	30	40	50	60	70
10-hr UH ordinates (cumec)	0	50	200	325	375	325	225	130

Time (hr)	80	90	100	110	120
10-hr UH ordinates (cumec)	68	38	25	12	0

5(b). The inflow hydrograph readings for a channel reach are given for which the Muskingum coefficients of k=20 hour and x=0.25. Generate outflow hydrograph through the reach and determine the attenuation and time lag of outflow. Outflow at the beginning of the flood may be taken as the same as inflow.
(15)

Time (hr)	0	12	24	36	48	60	72	84	96
Inflow (cumec)	18	20	24	115	145	122	102	84	69

Time (hr)	108	120	132	144	156	168	180	192	204
Inflow (cumec)	56	47	39	34	29	26	24	23	21

Time (hr)	216	228	240
Inflow (cumec)	20	19	18

6(a). Describe climatic condition of Bangladesh. (10)

6(b). A bridge need to be designed over the river shown in fig-1. Compute the design discharge with recurrence interval of 100 years, also find 95% confidence limits for these estimates. Annual maximum recorded floods in the river for the period 1959 to 1988 is given below. (20)

Year	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
Flood(cumec)	18300	9680	6480	3680	11430	21240	8500	9720	5810	19650

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Flood(cumec)	37300	7220	20860	18700	7650	6090	4390	10340	12880	42450

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988

Flood(cumec)	14570	8440	14000	22620	4820	29300	24200	12450	7270	6230

7(a) Differentiate between: (5+5)

I. Field capacity and Permanent wilting point

II. Recording and Non-Recording gauge

7(b) List atleast three applications of flood routing. (5)

7(b). The data pertaining to a stream-gauging operation at a section of the river shown in fig-1 (Section AA). Calculate the discharge in the stream with the following data. (15)

Distance (m)	0	1	2	2	2	2	2	1
Depth (m)	0	1.1	2	2.5	2	1.7	1	0
Velocity (m/s)	0	0.299	0.326	0.411	0.336	0.260	0.183	0

You may use any of the following equations

$$Q_2 = C_0 I_2 + C_1 I_1 + C_2 Q_1$$

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

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

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

Please attach this sheet with answer script

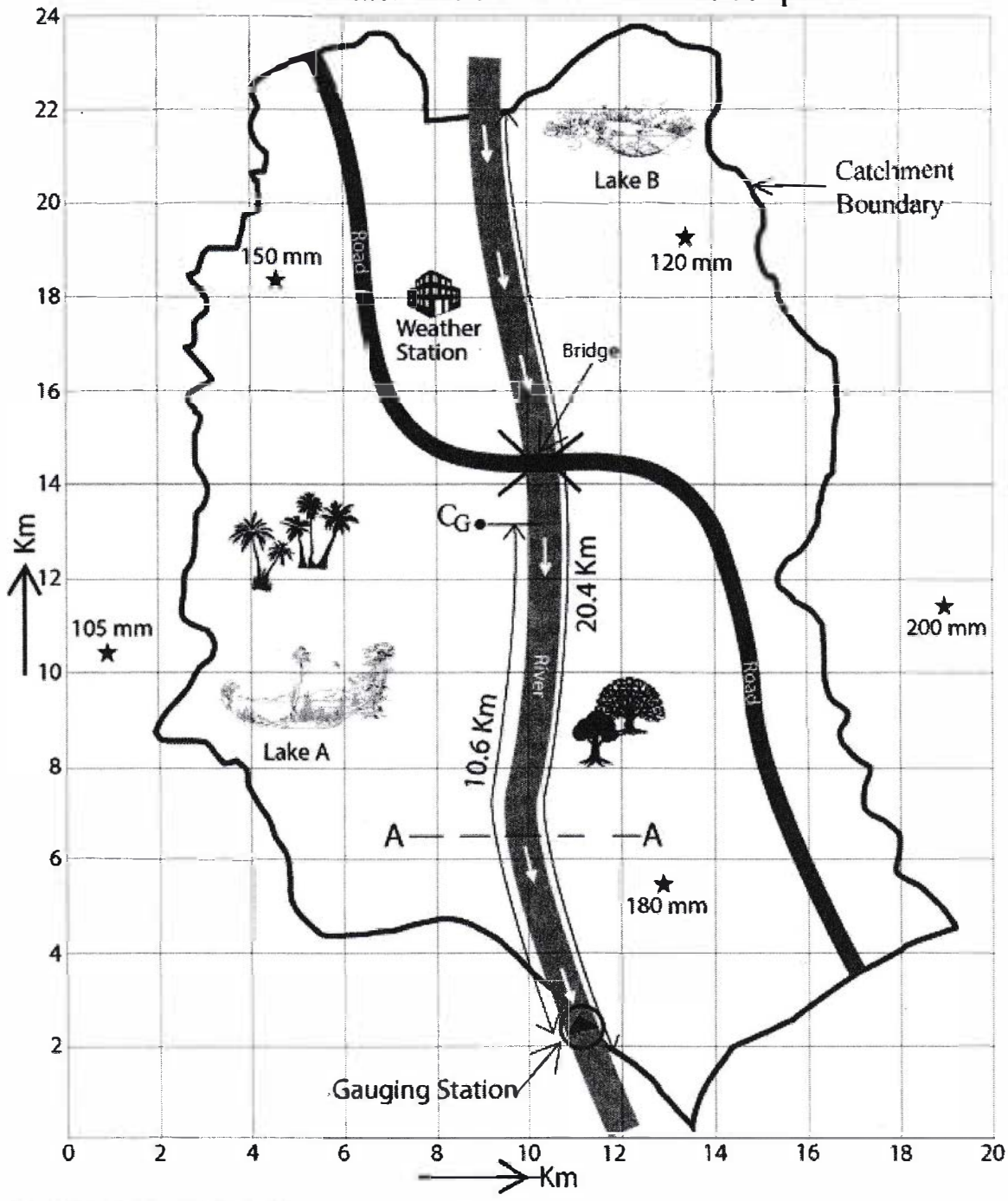


Figure-1

Legend

- ★ Rain Gauge
- River
- Road

This is for Question no. 1, 6 and 7