3-2

University of Asia Pacific

Department of Civil Engineering

Final Examination, Spring- 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) Distinguish Management and Leadership.	4
	b) Critically explain Charismatic Leadership Theory.	8.5
2.	a) What is Matrix Organization ?	4
	b) Delineate the advantages of Matrix Organization.	8.5
3.	a) Mention the key Characteristics of Teams.	4
	b) Critically 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.	Write short notes on:	12.5
	a) Power	
	b) Delegation of Authority	

Best of Luck

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 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. An interior panel of flat slab of an office building (live load 2.4 kN/m^2) is shown in **Figure 1**. The floor carries 2 kN/m^2 dead load due to random wall and floor finishes. **Minimum thickness** of slab should be based on defection and punching requirements of code. The concrete strength (f_c') could be used as 24 N/mm^2. Assume column size as 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]

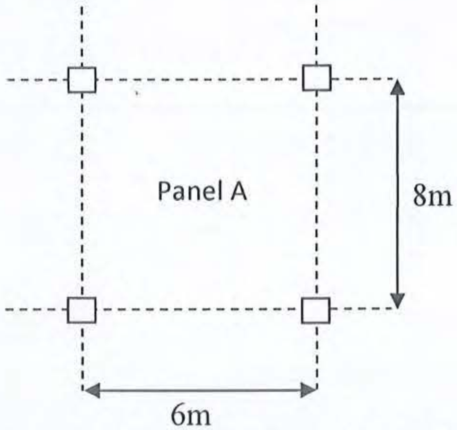


Figure 1. Panel of beam supported slab

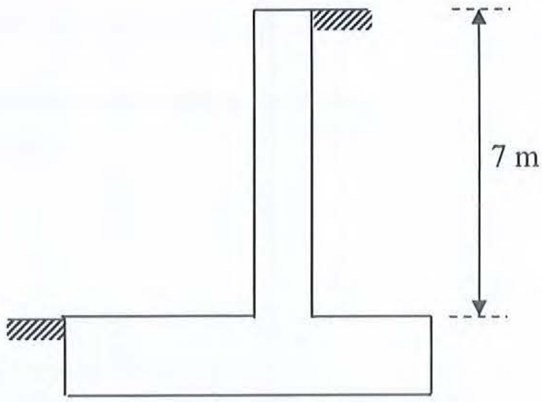


Figure 2. Retaining wall

b. A cantilever retaining wall of an open underpass is shown in **Figure 2**. The 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 60%). Apply the concept to design the wall with minimum thickness as per requirements of BNBC 2020. Assume required data for design, concrete strength (fc') could be used as 21 N/mm^2. [6 Marks]

QUESTION 2 [20 MARKS]

a. An interior column of a multi-storeyed academic building is subjected to dead and live loads of 2000 kN and 600 kN, respectively. The column is supported by an isolated pad footing, and the bearing capacity of soil under the footing is 200 kN/m^2. Depth of the footing should be based on punching shear. Size of the column is 600 mm x 600 mm. Assume required concrete strength for optimal design (minimum thickness and steel) of square pad footing. Design the pad footing considering safety and environmental issues of design. [14 Marks]

b. A 20 m span simply supported post-tensioned girder of an elevated express way is subjected to uniformly distributed 60 kN/m of dead load (including self-weight) and 30 kN/m live load. Eccentric tendon has to be used for economical design. The width of the girder could be assumed as 300 mm. The maximum allowable concrete compressive stress is 40 N/mm^2. Apply the concept of pre-stressing to obtain required depth of girder for full prestressing. Assume eccentricity of tendon as 250 mm. [6 Marks]

QUESTION 3[20 MARKS]

The floor slab layout plan of a 9-storeyed Nurse Institute (Live load 2.4 kN/m^2) is shown in **Figure 3**. The structure is constructed with frame structure, the slabs are supported by beams. The floor carries 3 kN/m^2 dead load due to random wall and floor finishes. Design the **short span of slab S1 (Figure 3)**. The moment of interior support is based on the consideration of continuous slab. **Synthesis** (optimize thickness and reinforcement) the design in accordance to deflection and shear requirements of ACI / BNBC code considering safety and environmental issues. Concrete compressive strength of the slab is 24 N/mm^2. Shear force co-efficient is 0.5. [20 Marks]

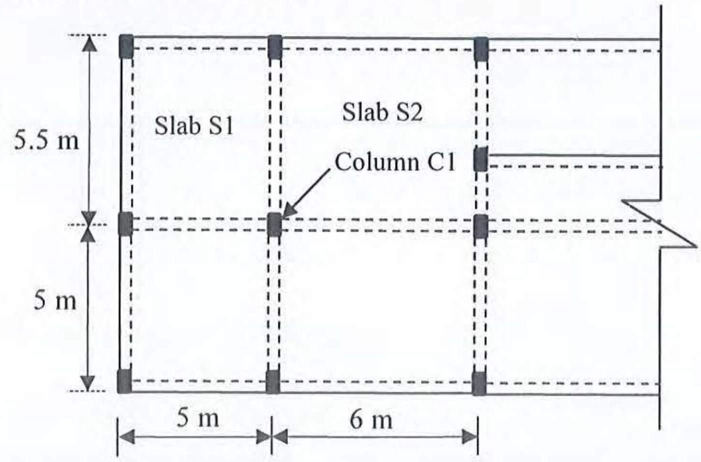


Figure 3: Floor Layout Plan of 9-Storeyed Nurse Institute

QUESTION 4 [20 MARKS]

Design the **column C1 (ground floor, Figure 3)** of the structure stated in **Question 3.** The uni-axial design moment of the column at ground floor could be considered as 550 kN-m, use approximate method to obtain design load of the column. Size of the column should be as minimal as possible applying all possible options of code (shape, concrete strength and steel ratio) with the consideration of safety and environmental issues of design. Propose a solution to design the column (tie column) with structural details. [20 Marks]

QUESTION 5 [20 MARKS]

The column **"C1"** as shown in **Figure 3** of the 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. High strength concrete could be used to minimize the depth of pile cap. All possible options of code (BNBC) should be applied to minimize the depth and steel ratio in design. **Provide a solution for economical (minimum depth, minimum steel) design of pile cap** considering safety and environmental issues of design. Design equations of flexural and punching shear have to be formulated for high strength concrete to design the pile cap. [20 Marks]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2023
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) Identify the problem of the presence of a tubewell closer to a common pit-latrine and your potential approaches to solve the adverse impacts. How could you solve the odor problems of such a common pit latrine? [4+4=8]

(b) Calculate the maximum hourly, average daily, and minimum hourly residential sewage flows from an area occupied by 2000 people. The average per capita sewage flow is 50 gpcd. Consider the sewer length and house connections to be 2 miles and infiltration to be 40,000 gpd. [16]

2. (a) Describe the factors that induce microbial sloughing in attached growth-based wastewater treatment reactors. [8]

(b) Explain the operational mechanisms of an aeration tank and secondary clarifier of a typical activated sludge process. [16]

3. Wastewater flow from an area averages 5000 m^3/d during November (winter) and 8000 m^3/d during June (summer). The average temperature in November is 8^0C, and the average in June (summer) is 32^0C. The mean concentration of influent BOD_5 is 400 mg/L. Reaction coefficient K is 0.23 d^{-1} at 20^0C, and θ is 1.06. Select a facultative pond treatment system for the area to remove 90% of the incoming BOD. Use the following graphical plot of the Thirumurthi equation if required. [24]

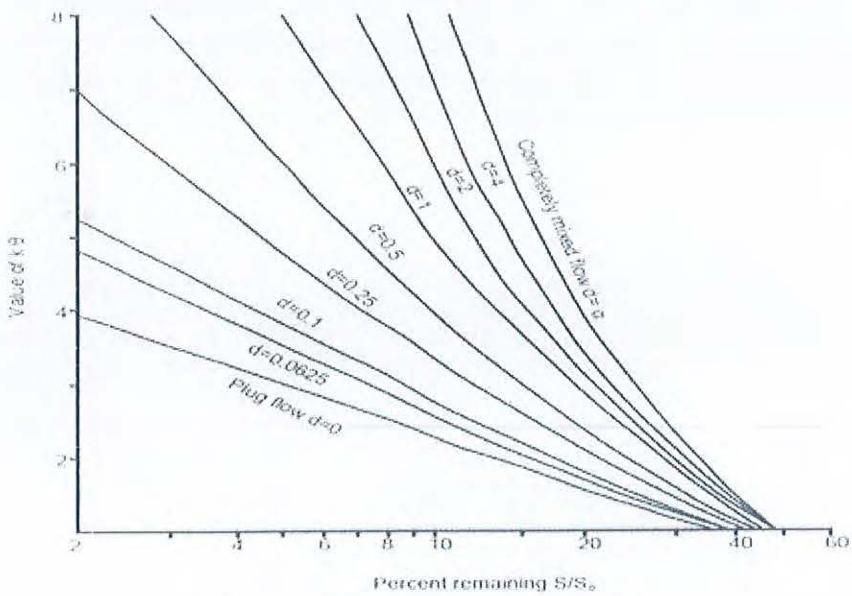


Figure. Graphical plot of the Thirumurthi equation

4. (a) Identify the factors that allow the Bardenpho system to achieve better nitrogen removal from wastewater than the Pre D and Post D systems. [8]

(b) Explain the role of external aeration in improving pollutant removal in vertical and horizontal flow wetlands with schematic diagrams. [16]

5. You have been appointed to propose technology to treat tannery industry effluent. The concentration of the common parameters in the tannery effluent is given in the following table.

Table. Concentration of the common parameters

	Unit	Concentration
pH	---	11.5
DO		0.1
NH_4-N		110
NO_3-N		80
TN		240
BOD_5	mg/L	2500
COD		10000
TSS		12000

Answer the following questions:

(i) Calculate the BOD_5/COD ratio of the tannery effluent from the following table and report on the biodegradability of the wastewater. [4]

(ii) Propose a natural-based treatment technology for treating such tannery effluent. Please note that there is limited land availability to construct wastewater treatment systems. [10]

(iii) After 10 years of operation, a phosphorus concentration of 15 mg/L was detected in the same tannery effluent due to the use of phosphorus-based chemicals to process raw hides. Modify the existing treatment system for the removal of phosphorus. You cannot propose a new system as the limited land availability was completely utilized by the technology that was implemented according to your design 10 years ago. [10]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 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) Draw the configuration of an arterial road and identify its essential components. **[5]**

   b) Write down the name of grade separated interchange for three-legged interchange and draw the diagram with indicating the directions of traffic flow. **[6]**

   c) Discuss in brief the provisions of designing the following

   i. Cul de sac
   ii. Staggered Intersection
   iii. Roundabout **[9]**

2. a) Explain the disadvantages of traffic signal. Discuss the two methods of designing linked/ coordinated traffic signal. **[10]**

   b) Define all red period of a signal phase and describe where you should apply all red signal. **[5]**

3. a) Between traffic signs and traffic markings, which one will you recommend to use in roads? Demonstrate why. **[6]**

   b) Write down the names of two types of special mandatory sign and explain where the traffic signs should be implied. **[5]**

   c) Explain peak hourly volume and design hourly volume. **[4]**

4. Cherry intersection is to be converted into a two-phase signalized intersection for which the data are obtained as follows-

	North-South	East-West
Inter green period (s)	9	10
Starting lost time (s)	2	1
End lost time (s)	1	1

If saturation rate (y) is 40% in both north and east(individually), while 20% in both south and west(individually) then

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

5. The ratio of the cycle length and the effective green time at a signalized intersection is 2.5.

The number of vehicles passing the intersection during the intervals of the saturation flow count is given as follows.

Interval	Duration	PCU
First	6 sec	4
Second	6 sec	12
Third	6 sec	10
Fourth	6 sec	10
Fifth	6 sec	11
Last	3 sec	2

i) Draw the saturation flow diagram and determine Saturation flow level.
ii) Calculate initial and final loss times.
iii) Determine approach capacity of the intersection. **[6+5+4]**

6. A newly appointed traffic engineer studied a rural primary road. The annual average daily traffic (AADT) for the road is reported as 90,500. To get an estimation on traffic variation over time, he back calculated traffic volume for 8 AM to 9 AM, 11 AM to 12 PM and 6 PM to 7 PM. The study was done on Friday, December 01. [See Annexure for necessary data]

i) Determine AWT for the mentioned month.
ii) Determine ADT for Wednesday.
iii) Determine when he will get the maximum traffic volume for the specified three time periods. **[5+4+6]**

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

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

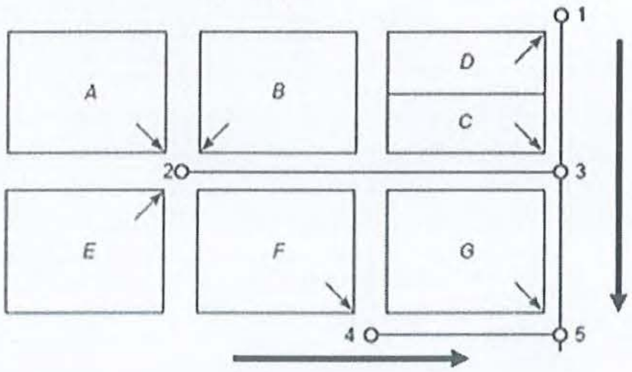
Answer all the questions (10+20+25+20+25). The numbers inside the brackets indicate marks.

1 (a) Which factors should be considered in determining rainfall intensity using rational formula? (5)
(b) Define aquifer, aquitard and aquiclude. (5)

2 (a) Discuss the hydrologic models and application of probability in hydrology. (10)
(b) Discuss the suitability of lagging and S-curve method in determining unit hydrograph. (10)

3 (a) A schematic diagram 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 2.5 ft/s. The flow direction is given by the arrows. (15)

Assume, Rainfall intensity, $i = \frac{100}{(t+15)^{0.3}}$



Basin	Area (Acres)	t_i (min)	Runoff Coefficient, C
A	2.2	11	0.3
B	2.2	12	0.4
C	1.1	13	0.3
D	1.1	10	0.5
E	2.2	14	0.4
F	2.2	12	0.3
G	2.2	11	0.5

Stormwater Pipe	Length (ft)
1-3	200
2-3	600
3-5	200
4-5	300

(b) A well penetrates an unconfined aquifer. Prior to pumping the water level, head is 30 m. After a long period of pumping at a constant rate of 0.04 m^3/s, the drawdown at a distance of 30 m and 75 m from the well were observed to be 3.2 m and 1 m, respectively. Estimate the hydraulic conductivity of the aquifer and radius of influence of the pumping well. (10)

4 Find the first five values of outflow using level pool methodology. Area of the reservoir is 1 acre. (20)

Time (min)	Inflow (ft^3/s)
0	0
10	50
20	100
30	180
40	220
50	300
60	340
70	370
80	360
90	340
100	300
110	220
120	160
130	100
140	70
150	40
160	20
170	0
180	0
190	0
200	0

Elevation (ft)	Discharge (ft^3/s)
0	0
0.5	5
1	9
1.5	18
2	35
2.5	50
3	65
3.5	75
4	95
4.5	120
5	140
5.5	165
6	185
6.5	205
7	215
7.5	230
8	245
8.5	255
9	265
9.5	270
10	275

5 The annual maximum flood measured at a local valley for 19 years are given below. (25)

Year	Max. Flood (ft^3/s)	Year	Max. Flood (ft^3/s)
2001	4200	2011	4100
2002	2000	2012	3800
2003	5000	2013	3200
2004	4400	2014	4000
2005	3800	2015	3300
2006	3000	2016	7200
2007	2500	2017	5200
2008	2200	2018	1000
2009	3200	2019	650
2010	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 ft^3/s using (i) lognormal and (ii) normal distribution. The standard deviation of normally and lognormally distributed data are 1524.19 and 0.25, 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 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 Spring 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. Any missing data can be assumed reasonably.

Part A

QUESTION 1 [20 MARKS]

a. Analyze the frame shown in **Figure 1** to calculate the horizontal deflection at **D** by the Unit Load Method [P= 35-kN for Even Rolls or P= 45-kN for Odd Rolls and EI=Constant]. [10 Marks]

b. Analyze the truss shown in **Figure 2** to obtain vertical deflection of **joint 4** by the Unit Load Method [P= 20 kN and Q=100 kN for Even Rolls or P= 28 kN and Q= 140 kN for Odd Rolls and EA=Constant]. [10 Marks]

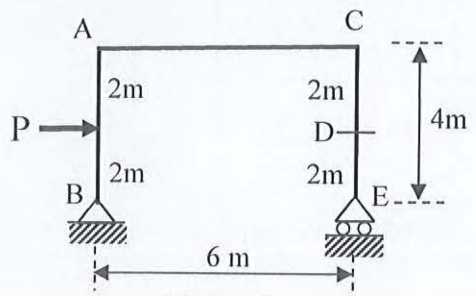


Figure 1

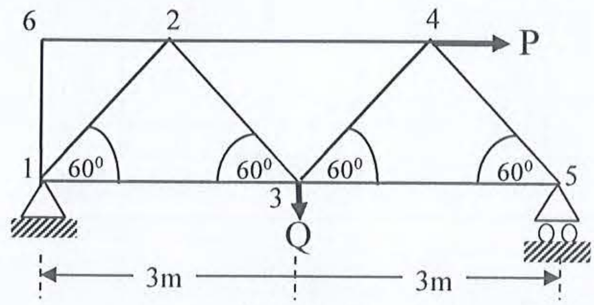


Figure 2

QUESTION 2 [20 MARKS]

a. Analyze the beam in **Figure 3** by Force Method and determine the reactions. Consider the vertical reaction at A or at C as the redundant [P= 40 kN for Even Rolls or P= 50 kN for Odd Rolls and EI=Constant] [10 Marks]

b. Analyze the frame in **Figure 4** by Force Method and determine the support reactions. Consider the vertical reaction at D as redundant [P= 20 kN for Even Rolls or P= 25 kN for Odd Rolls and EI=Constant]. [10 Marks]

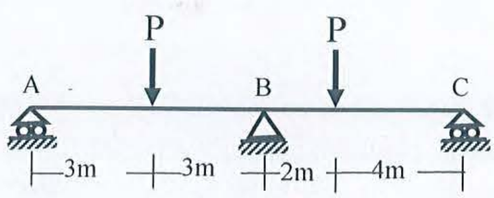


Figure 3

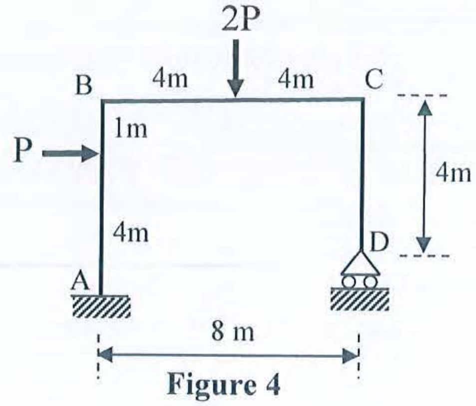


Figure 4

Part B

QUESTION 3 [20 MARKS]

a. A frame of 10-storeyed medical institute is subjected to lateral (wind) load as shown in **Figure 5**. **Analyze** the structure for lateral load using portal method to obtain shear force and bending moment of **ground floor columns (C1, C2 and C3)**; shear force and bending moments of **roof floor beams (B1, B2)** using cantilever method. [Assume size of roof floor columns as C1: 500 mm x 500 mm; C2: 500 mm x 750 mm; C3: 500 mm x 1000 mm] [10 Marks]

b. **Analyze the portal frame and truss** of the industry building as shown in **Figure 6** to obtain shear force and bending moment of columns (C1 and C2); member forces of **ab, af, bf, bc, be and cf** of the truss. Assume that the diagonal members of truss could sustain compression force. [10 Marks]

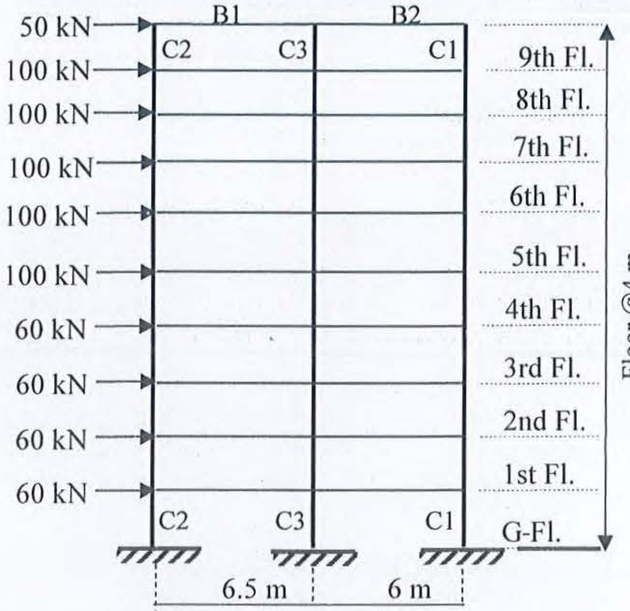


Figure 5: Frame of Medical Institute

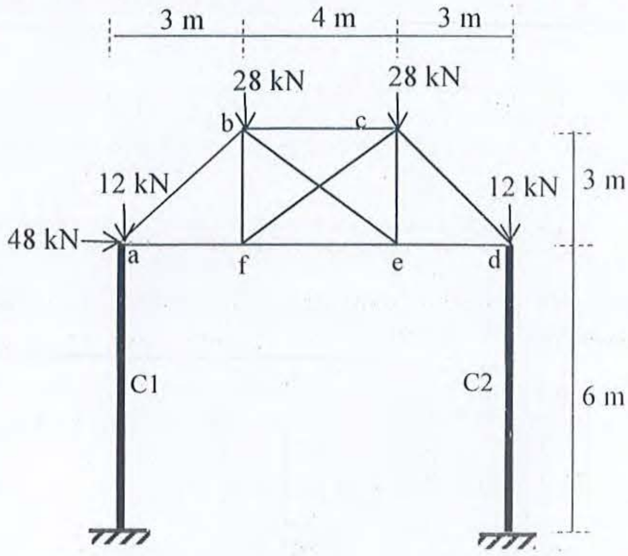


Figure 6: Truss of portal frame

QUESTION 4 [20 MARKS]

a. Draw the qualitative influence lines of the beam shown in **Figure 7** for (I) Bending moments M_C, M_G [G is at mid-span of CD]; (II) Support reactions R_B, R_D and (III) Shear forces $V_B^{(L)}$, $V_C^{(R)}$. [6 Marks]

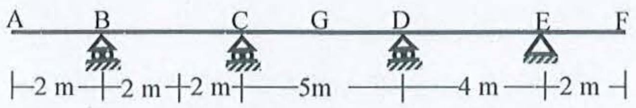


Figure 7

Figure 8

b. The supports and loading conditions of a continuous beam is shown in **Figure 8**. Analyze the structure using Moment Distribution Method to obtain moments (diagram) of beams. All beams have uniform cross- section. [14 Marks]

QUESTION 5 [20 MARKS]

The roof floor of RC frame of a building as shown in **Figure 9** is subjected to design load of 45 kN/m. The columns could be used as 600 mm × 600 mm of normal strength concrete (E is 29000 N/mm^2). Evaluate whether shear walls (300 mm x 1200 mm) of high strength concrete (E is 38000 N/ mm^2) as replacements of three columns would increase or decrease the negative moments (at support) of beam ABC. Justify through comparative analysis of structure using moment distribution method. [Beam size as 300 mm x 600 mm and E is 29000 N/mm^2]. [20 Marks]

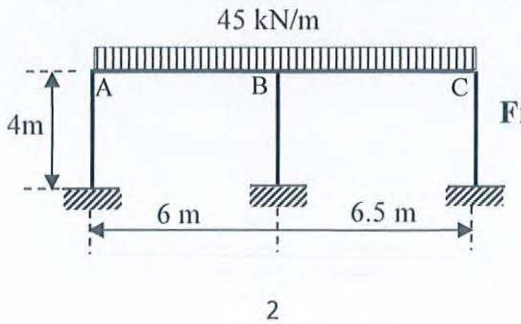
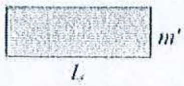
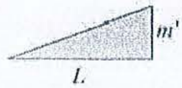
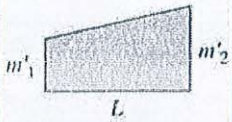
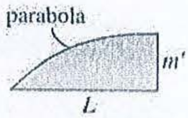
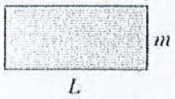
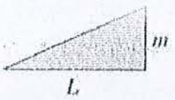
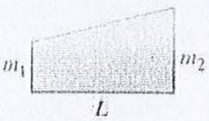
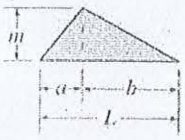
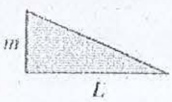
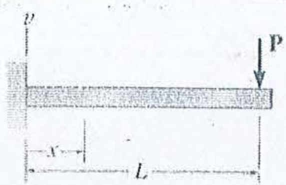
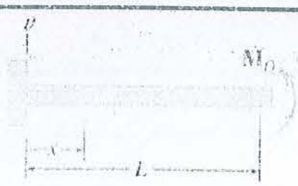


Figure 9

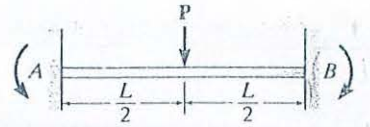
Table for Evaluating $\int_0^L m\, m'\, dx$

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

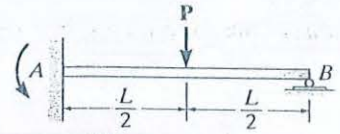
Beam Deflections and Slopes

Loading	$v + \uparrow$	$\theta + \circlearrowleft$	Equation $+\uparrow\ +\circlearrowleft$
	$v_{max} = -\frac{PL^3}{3EI}$ at $x = L$	$\theta_{max} = -\frac{PL^2}{2EI}$ at $x = L$	$v = \frac{P}{6EI}(x^3 - 3Lx^2)$
	$v_{max} = \frac{M_0L^2}{2EI}$ at $x = L$	$\theta_{max} = \frac{M_0L}{EI}$ at $x = L$	$v = \frac{M_0}{2EI}x^2$

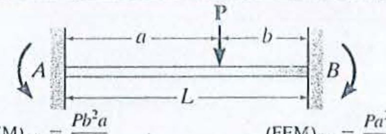
Fixed End Moments



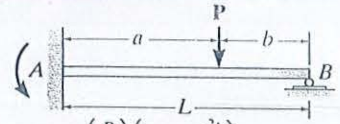
$(FEM)_{AB} = \frac{PL}{8}$ $\quad (FEM)_{BA} = \frac{PL}{8}$



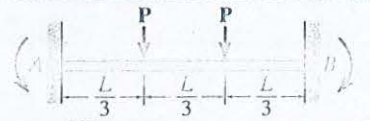
$(FEM)'_{AB} = \frac{3PL}{16}$



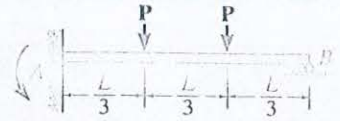
$(FEM)_{AB} = \frac{Pb^2a}{L^2}$ $\quad (FEM)_{BA} = \frac{Pa^2b}{L^2}$



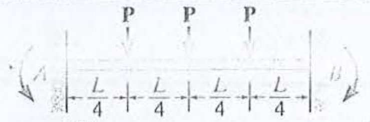
$(FEM)'_{AB} = \left(\frac{P}{L^2}\right)\left(b^2a + \frac{a^2b}{2}\right)$



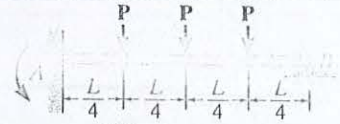
$(FEM)_{AB} = \frac{2PL}{9}$ $\quad (FEM)_{BA} = \frac{2PL}{9}$



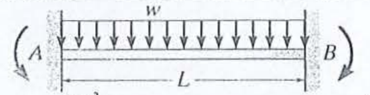
$(FEM)'_{AB} = \frac{PL}{3}$



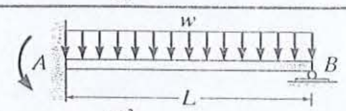
$(FEM)_{AB} = \frac{5PL}{16}$ $\quad (FEM)_{BA} = \frac{5PL}{16}$



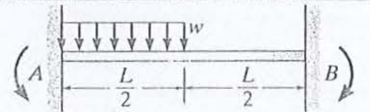
$(FEM)'_{AB} = \frac{15PL}{32}$



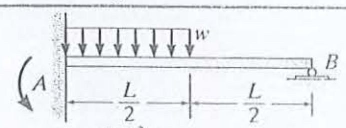
$(FEM)_{AB} = \frac{wL^2}{12}$ $\quad (FEM)_{BA} = \frac{wL^2}{12}$



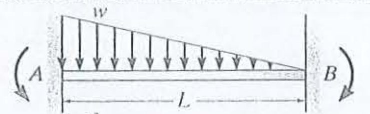
$(FEM)'_{AB} = \frac{wL^2}{8}$



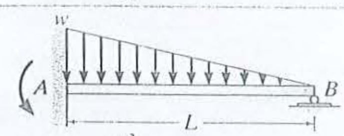
$(FEM)_{AB} = \frac{11wL^2}{192}$ $\quad (FEM)_{BA} = \frac{5wL^2}{192}$



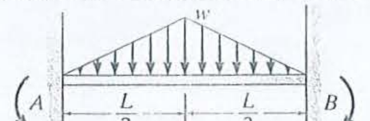
$(FEM)'_{AB} = \frac{9wL^2}{128}$



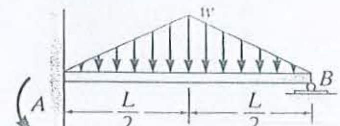
$(FEM)_{AB} = \frac{wL^2}{20}$ $\quad (FEM)_{BA} = \frac{wL^2}{30}$



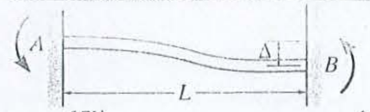
$(FEM)'_{AB} = \frac{wL^2}{15}$



$(FEM)_{AB} = \frac{5wL^2}{96}$ $\quad (FEM)_{BA} = \frac{5wL^2}{96}$



$(FEM)'_{AB} = \frac{5wL^2}{64}$



$(FEM)_{AB} = \frac{6EI\Delta}{L^2}$ $\quad (FEM)_{BA} = \frac{6EI\Delta}{L^2}$

$(FEM)'_{AB} = \frac{3EI\Delta}{L^2}$