3-2

University of Asia pacific
Department of Civil Engineering
Final Examination Spring 2016
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 **five** of them

1. a) Define the following terms: i) Design hourly volume, ii) Tidal flow, iii) Saturation flow, and iv) Contra flow. 10
   b) What are the types of delay? Explain them with example. 10
   c) Calculate the AADT for the following data. Data was collected on Tuesday in September. MEF for September is 0.632. Necessary Table is provided herewith. 10

Hour	Volume
7:00 a.m. - 8:00 a.m.	1100
8:00 a.m. - 9:00 a.m.	960
9:00 a.m. - 10:00 a.m.	880
10:00 a.m. - 11:00 a.m.	670
11:00 a.m. - 12:00 p.m	1020

2. a) What are the objectives of traffic speed studies? Name the factors affecting traffic speeds? 10
   b) Following spot speed data was collected during conducting speed studies at certain section of an urban road. Determine: 20
      a) Modal speed
      b) Average speed
      c) Design speed
      d) Median speed
      e) Upper and Lowe values of the speed limits of traffic stream

Speed Range (mph)	No. of Vehicle
0 - 5	0
5 - 10	15
10 - 15	35
15 - 20	45
20 - 25	115
25 - 30	210
30 - 35	270
35 - 40	250
40 - 45	40
45 - 50	20
50 - 55	15
55 - 60	5
60 - 65	3
65 - 70	0

3. a) What are the principle techniques of traffic calming device? 6
   b) Briefly describe any one of the techniques for traffic calming. 10
   c) Concisely discuss the device which is most suitable for emergency rescue route. 6
   d) Discuss on-street and off-street parking facilities. 8

4. a) Draw a neat and clean diagram and show safe stopping sight distance in the design of horizontal curves. 10
   b) What are the low cost improvements techniques for locations with inadequate sight distances? 5
   c) The Mayor of Dhaka wants to erect a sign welcoming visitors as they enter the city. During entering the road has four 13-foot lanes with 6-foot shoulders. The road has a horizontal curve with a radius of 1500 feet. The speed limit is 55 mph. How far from the inside shoulder of the highway must the sign be placed so as to avoid potential stopping sight distance problems? 15

5. a) An expressway has an 80 mph design speed. There is a 2% grade followed by a negative 3% grade (crest vertical curve). Assume height of driver's eye to be 3.5 ft and object height to be 1 ft. What is the required length of vertical curve needed to persuade design stopping sight distance? Assume the stopping sight distance to be 750 ft. 14
   b) What safe stopping sight distance must be provided to an arterial road having a design speed of 70 mi/hr.? The road is a +4% grade. Assume reaction time as 2.5 second and friction factor as 0.40. 12
   c) Name some geometric elements of highways. 4

6. a) Describe the function of transportation in economic development of Bangladesh. 10
   b) Explain various types of transportation related drawbacks in Bangladesh? 10
   c) An urban primary road with 65 ft pavement width having a reflectance of 9% carries a maximum of 1750 vph at night-time. Design the lighting system considering Sodium source with mounting height of 40 ft and a maintenance factor of 0.78. Draw the lighting layout. 10

Necessary equations:

ɜst Vertical Curves

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

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

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

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

Tables for Question 1(c)

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

Tables and Figure for Question 6(c)

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

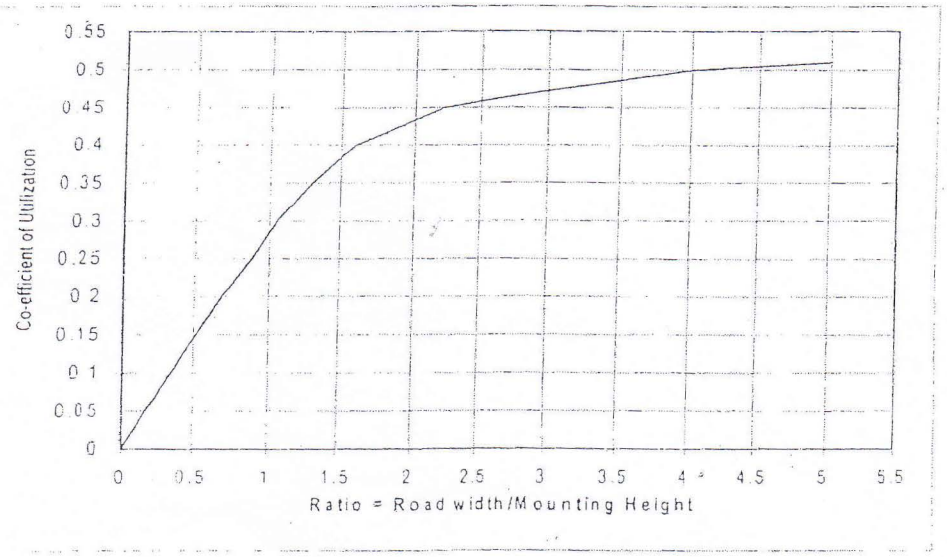
TABLE 3 LIGHTING SOURCE CHARACTERISTICS

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
Final Examination Spring 2016
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering II | Course No: CE 333
Time: 3.0 hours | Full Marks: 150

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*Answer any **three** out of **four** questions from each part (25*6=150)*
Assume reasonable value of missing data (if any)

Part A

1. (a) Briefly discuss the interrelationship between water, sanitation and health education with figure. [5]
   (b) Define sanitation and sanitation development. Discuss different types of sanitation systems in details with example. [20]

2. (a) Write short notes on i) Agricultural Wastewater ii) Stromwater. [10]
   (b) Define plumbing system of a building. Write down the governing principles of plumbing system. [15]

3. (a) What are the important aspects that need to be considered for successful application of SBS systems? [5]
   (b) Define septic tank. Design and sketch a two compartment septic tank to serve two houses of 8 persons each. The production of wastewater is 110 lpcd. The tank is to be desludged every 3 years. [20]

4. (a) Make a comparison in a tabulated form between separate system and combined system for wastewater collection. [10]
   (b) Define wastewater. Write down the composition of wastewater. What are the objectives of wastewater treatment? [15]

Part B

5. (a) What are the common problems that affect the ability and willingness of the community to invest in sanitation facilities? [5]
   (b) Define sludge. What are the objectives of sludge management? Mention the methods that are commonly adopted for sludge treatment and disposal. [15]
   (c) Discuss the food consumption processes of Bacteria. [5]

6. (a) Define i) Latency and ii) Persistence. [5]
   (b) Describe in detail i) Preliminary treatment process ii) Primary treatment process and iii) Advanced primary treatment process of wastewater. [20]

7. (a) Define true pathogens and opportunistic pathogens with example. [5]
   (b) Draw and discuss typical bacterial growth pattern in wastewater indicating different stages. Mention the factors that affect bacterial growth in a biological reactor. [15]
   (c) What are the main reasons of losing the water seal in a trap? [5]

8. (a) What are the common coagulants used in wastewater treatment processes? [5]
   (b) Discuss in detail with sketch i) Centralized ii) Decentralized and iii) Satellite treatment system of wastewater. [20]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2016
Program: B.Sc Engineering (Civil)

Course Title: Principles of Management | Course Code: IMG301

Time: 2 Hours | Full Marks: 50

Answer any 4 Questions from the following: 12.5x4

1. Define Job Enlargement and Job Enrichment. Explain how Job Enlargement and Job Enrichment can be applied to motivate employees with practical examples.

2. Describe Maslow's Hierarchy of Needs, Theory X and Theory Y with examples.

3. Define Team, Group and draw comparison between the two.

4. Write down the steps involved in Strategic Management. Conduct a SWOT(Strength, Weakness, Opportunities and Threats) analysis on Department of Civil Engineering, University of Asia Pacific.

5. Write short notes on:

   a) Competitive Advantage

   b) Mission, Vision and Goals

----------Good Luck----------

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2016

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

There are TWO sections in the question paper namely "Part A" and "Part B". You have to answer from the both sections according to the instruction mentioned on each section.

Part A
There are FOUR questions answer any THREE

1.(a) Distinguish between the following (any Four) (10)

i) Recording and non-recording rain gauges
ii) Cold and warm fronts.
iii) Infiltration capacity and infiltration rate
iv) Evaporation and transpiration
v) Storm hydrograph and direct runoff hydrograph

1.(b) Calculate in one step the precipitable water in a saturated air column of 1000 m high above 1 m^2 of ground surface. The surface pressure is 101.3 kPa, the surface air temperature is 25°C and the lapse rate is 6.0°C/km. (10)

1.(c) Assuming that all the water in the ocean is involved in the hydrological cycle, calculate the average residence time of ocean water using the following data: (5)

Volume of ocean water = 1 401 000 000 km^3
Precipitation rate on ocean = 458 000 km^3/yr
Precipitation rate on land = 119 000 km^3/yr
Evaporation from ocean = 505 000 km^3/yr
Evaporation from land = 72 000 km^3/yr

2.(a) Explain the following (any three): (9)

i) Consistency test for rainfall records
ii) Estimating the missing rainfall data
iii) Pan coefficient
iv) Dalton's law of evaporation

2.(b) A storm with 15 cm precipitation produced a direct runoff of 8.7 cm. The time distribution of the storm is as follows. Estimate Φ-index of the storm. (8)

Time from start (hr)	1	2	3	4	5	6	7	8
Incremental rainfall (cm)	0.6	1.35	2.25	3.45	2.7	2.4	1.5	0.75

2.(c) Estimate the daily potential Evapotranspiration from the following data, using Penman's formulae. (8)

Slope of the saturation vs temperature at the mean air temperature = 1.4 mm/°C
Net radiation = 5 mm of water per day
Relative humidity = 80%
Saturated vapor pressure, e_w= 23.76 mm of Hg
Wind velocity at 2 m height = 90 km/day
Psychometric constant = 0.49 mm of Hg

3.(a) Write the list of factors that affect the process of evaporation. (5)

3.(b) Five rain gauges located within a catchment whose shape can be approximately described by smooth lines joining the following coordinates: (5,2), (12,3), (20,9), (17,16), (9,15), (4,7). In this catchment there are five gauges named A, B, C, D and E. (20)

Rain gauge	Co-ordinates (km)	Annual rainfall (cm)
A	(10,12)	142
B	(16,4)	136
C	(15,10)	95
D	(8,7)	81
E	(13,8)	131

All coordinates are expressed in km. Compute the average rainfall in the area using Thiessen polygon method.

4.(a) Describe Horton's equation. How to quantify other losses while calculating runoff? (10)

4.(b) The following data are collected for a 30 m wide stream at a gauging station. Compute the discharge. (10)

Distance from left water edge (m)	Depth, d (m)	Revolutions of current meter kept at		Duration of observation
		0.2 d	0.8 d	
0	0	0	0	0
3	0.8	30	17	50
6	1.0	36	24	50
9	1.3	45	35	50
12	1.7	62	51	50
15	2.2	102	87	50
18	2.8	120	103	50
21	2.3	67	53	50
24	1.9	35	22	50
27	1.2	24	15	50
30	0	0	0	50

Calibration equation of current meter: v = 0.3N + 0.05; N = revolutions per seconds, v = velocity, m/s.

4.(c) How to find stream velocity using current meter? Also mention how to calculate average velocity. (5)

Part B

There are FOUR questions answer any THREE

5.(a) What are the climatic factors affecting flood hydrograph? (5)

5.(b) Using the 12-hr unit hydrograph given below, compute the ordinates of a 6-hr unit hydrograph using S-curve method: (12)

Time	0	6	12	18	24	30	36	42	48
Discharge (cumec)	0	10	37	76	111	136	150	153	146

Time	54	60	66	72
Discharge (cumec)	130	114	70	30

5.(c) Discuss the role of drainage basin characteristics on the shape of the flood hydrograph. What data are required for reservoir routing? (8)

6.(a) Describe Superposition method. (5)

6.(b) Describe rational method of estimating the magnitude of a flood peak. (5)

6.(c) The following inflow and outflow hydrographs were observed in a river reach. Estimate the values of K and x applicable to this reach for use in the Muskingum equation. (15)

Time	0	6	12	18	24	30	36	42	48	54	60	66	78
Inflow	6	22	49	55	58	45	32	23	16	12	10	7	6
Outflow	6	8	15	28	42	47	36	27	20	15	13	9	7

7.(a) The inflow hydrograph readings for a channel reach are given below for which the Muskingum coefficients of k=28 hr and x= 0.35. Route the flood 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. (12)

Time (hr)	0	6	12	18	24	30	36	42	48
Inflow (cumec)	15	16	31	96	121	102	85	70	57

Time (hr)	54	60	66	72	78
Inflow (cumec)	47	35	26	22	17

7.(b) Derive the required expression and different steps for reservoir routing. (8)

7.(c) Define unit hydrograph. What are the basic assumptions of unit hydrograph? (5)

8.(a) Write the procedure of deriving a synthetic unit hydrograph for a catchment by using Snyder's method. (7)

8.(b) Annual maximum recorded floods in a tributary of the river Brahmaputra for the period 1979 to 2008 is given below which fits well the Gumbel extreme value distribution. Estimate the flood discharge with recurrence interval of 100 years and also find 95% confidence limits for these estimates. (18)

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Flood (cumec)	14570	8440	14000	22620	4820	29300	24200	12450	7270	6230

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Flood (cumec)	18300	9680	6480	3680	11430	21240	8500	9720	5810	19650

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Flood (cumec)	37300	7220	20860	18700	7650	6090	4390	10340	12880	42450

$$PET = \frac{AH_n + E_a\gamma}{A+\gamma}$$

c in per cent	50	68	80	90	95	99
$f(c)$	0.674	1.00	1.282	1.645	1.96	2.58

TABLE REDUCED MEAN $\bar{y}_n$ IN GUMBEL'S EXTREME VALUE DISTRIBUTION

N = sample size

N	0	1	2	3	4	5	6	7	8	9
10	0.4952	0.4996	0.5035	0.5070	0.5100	0.5128	0.5157	0.5181	0.5202	0.5220
20	0.5236	0.5252	0.5268	0.5283	0.5296	0.5309	0.5320	0.5332	0.5343	0.5353
30	0.5362	0.5371	0.5380	0.5388	0.5396	0.5402	0.5410	0.5418	0.5424	0.5430
40	0.5436	0.5442	0.5448	0.5453	0.5458	0.5463	0.5468	0.5473	0.5477	0.5481
50	0.5485	0.5489	0.5493	0.5497	0.5501	0.5504	0.5508	0.5511	0.5515	0.5518
60	0.5521	0.5524	0.5527	0.5530	0.5533	0.5535	0.5538	0.5540	0.5543	0.5545
70	0.5548	0.5550	0.5552	0.5555	0.5557	0.5559	0.5561	0.5563	0.5565	0.5567
80	0.5569	0.5570	0.5572	0.5574	0.5576	0.5578	0.5580	0.5581	0.5583	0.5585
90	0.5586	0.5587	0.5589	0.5591	0.5592	0.5593	0.5595	0.5596	0.5598	0.5599
100	0.5600									

TABLE 7.4 REDUCED STANDARD DEVIATION S_n IN GUMBEL'S EXTREME VALUE DISTRIBUTION

N = sample size

N	0	1	2	3	4	5	6	7	8	9
10	0.9496	0.9676	0.9833	0.9971	1.0095	1.0206	1.0316	1.0411	1.0493	1.0565
20	1.0628	1.0696	1.0754	1.0811	1.0864	1.0915	1.0961	1.1004	1.1047	1.1086
30	1.1124	1.1159	1.1193	1.1226	1.1255	1.1285	1.1313	1.1339	1.1363	1.1388
40	1.1413	1.1436	1.1458	1.1480	1.1499	1.1519	1.1538	1.1557	1.1574	1.1590
50	1.1607	1.1623	1.1638	1.1658	1.1667	1.1681	1.1696	1.1708	1.1721	1.1734
60	1.1747	1.1759	1.1770	1.1782	1.1793	1.1803	1.1814	1.1824	1.1834	1.1844
70	1.1854	1.1863	1.1873	1.1881	1.1890	1.1898	1.1906	1.1915	1.1923	1.1930
80	1.1938	1.1945	1.1953	1.1959	1.1967	1.1973	1.1980	1.1987	1.1994	1.2001
90	1.2007	1.2013	1.2020	1.2026	1.2032	1.2038	1.2044	1.2049	1.2055	1.2060
100	1.2065									

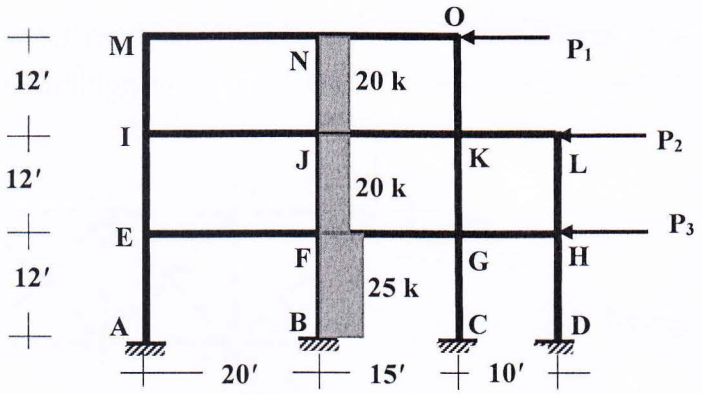
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2016
Program: B.Sc. Engineering (Civil)
Section: A & B

Course Code: CE 313 | **Time: 180 Minutes**
Course Title: Structural Engineering II | **Full Marks: 20x10 = 200**

Answer any 10 of the following 14 Questions. *The figures are not drawn to scale.* Any missing data can be assumed reasonably.

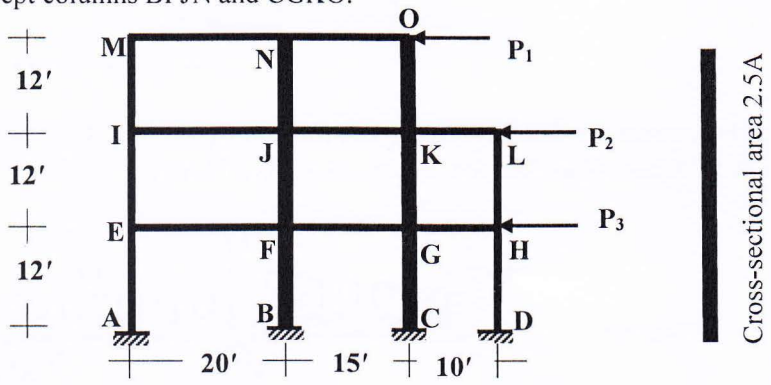
[1] Figure 1 shows the SFD of columns BFJN in the frame. Use the Portal Method to determine the values of P_1, P_2 and P_3 and draw the BMD of columns AEIM, CGKO and DHL. **(20)**

Figure 1



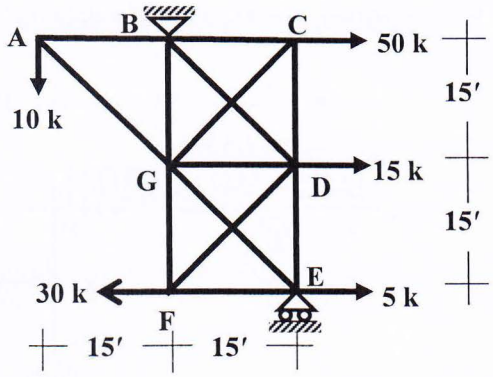
[2] Draw the AFD of columns EIM, FJN, GKO and HL by using the Cantilever Method of the frame shown in Figure 2. Use the values of P_1, P_2 and P_3 obtained in Question 1. The corss-sectional area of the columns are A, except columns BFJN and CGKO. **(20)**

Figure 2



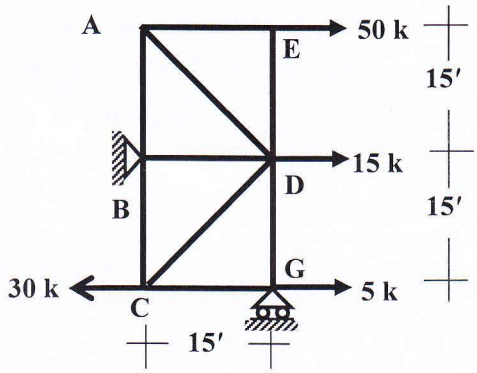
[3] Determine the member forces of the statically indeterminate truss shown in Figure 3. The diagonals can carry both tensile and compressive forces, and are assumed to carry half the panel shear. **(20)**

Figure 3



[4] Use the Virtual Work Method to determine the deflection $\Delta_{C(\downarrow)}$ and $\Delta_{E(\rightarrow)}$ of the truss shown in Figure 4. Given, EA = 75 x 10^3 k. **(20)**

Figure 4

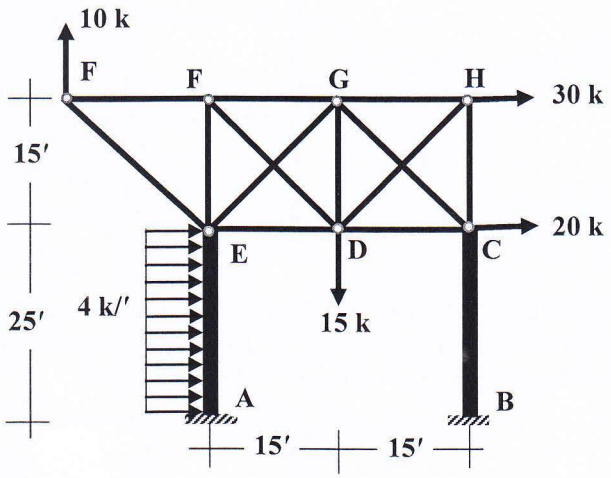


[5] A portal frame is connected with statically indeterminate truss as shown in Figure 5.

(a) Use the Portal Method to calculate the support reactions A, B and draw the BMD of BC and AE. **(8)**

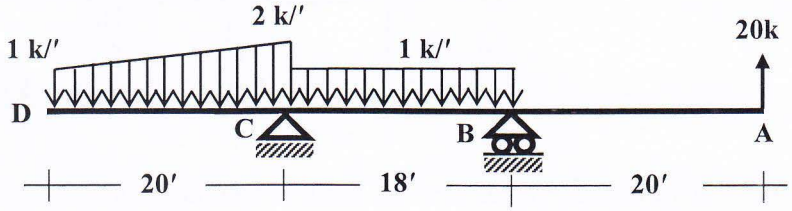
(b) Calculate member forces in FD, GD, FG by assuming diagonal members can take tension only. **(12)**

Figure 5



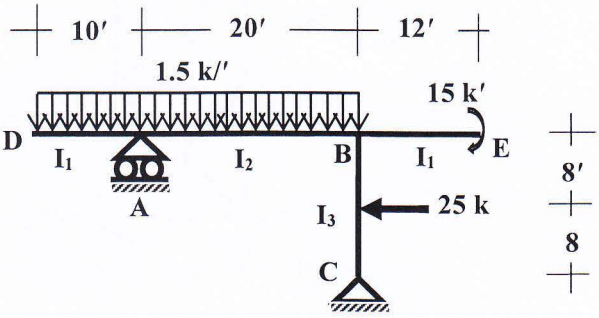
[6] Determine the deflection $\Delta_{A(\downarrow)}$ and rotation θ_A at point A of the beam shown in Figure 6 by using the Virtual Work Method. Given, EI = 29x10^6 k-in^2. **(20)**

Figure 6



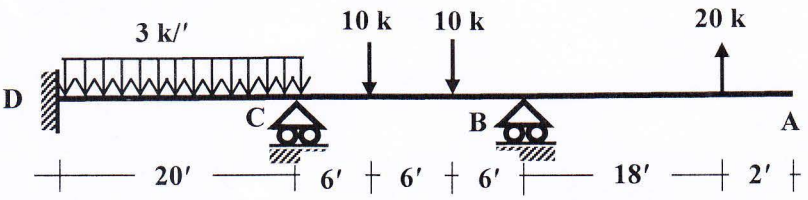
[7] Determine the deflection $\Delta_{E(\downarrow)}$ at point E of the frame shown in Figure 7 by using the Virtual Work Method. Given, E = 29x10^3 ksi, I_1 = 1500 in^4, I_2 = 2000 in^4, I_3 = 1800 in^4. **(20)**

Figure 7



[8] Determine the support reactions and draw the BMD of the beam shown in Figure 8 by using the Flexibility Method. In addition to the external load assume that the support C has settled 2″. Given, $EI = 40x10^6$ k-in^2. **(20)**

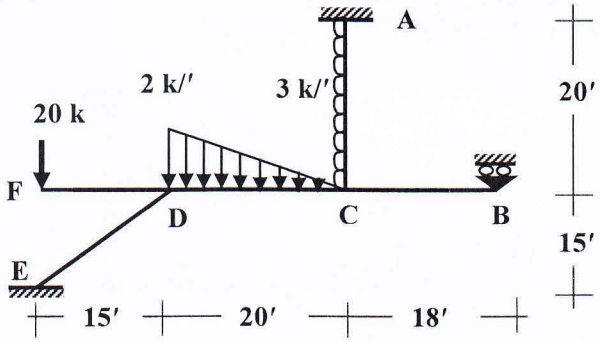
Figure 8



[9] Prove that the moment carryover factor is 0.5. Draw the BMD of the beam shown in Figure 8 by using the Moment-Distribution Method. **(20)**

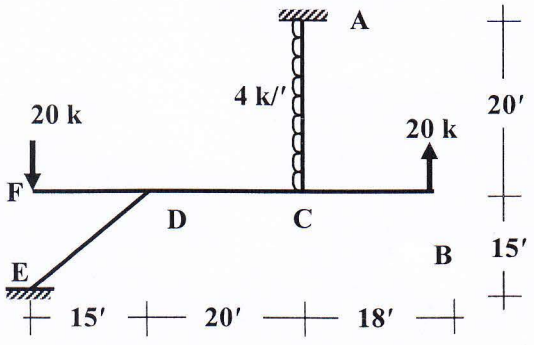
[10] Draw the BMD of the frame shown in Figure 9 by employing the Moment-Distribution Method. Given, $E = 20x10^3$ ksi, $I = 400$ in^4. **(20)**

Figure 9



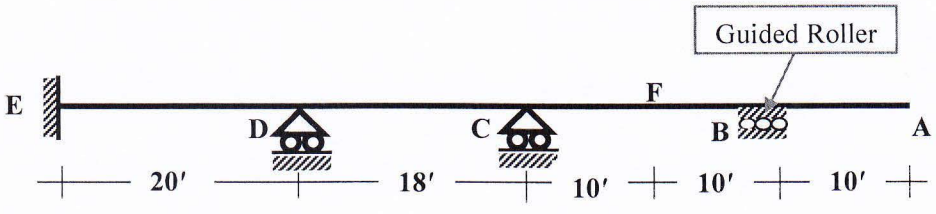
[11] Draw the BMD of the frame shown in Figure 10 by using the Moment-Distribution Method. Assume the support E has settled 2″. Given, $E = 29x10^3$ ksi, $I = 1400$ in^4. **(20)**

Figure 10



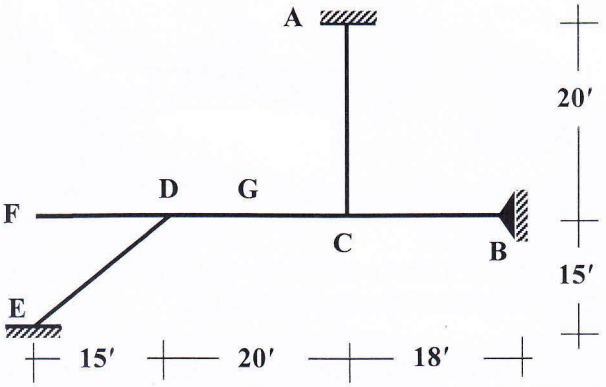
[12] Draw the influence line for moment at F of the beam shown in Figure 11 and place a uniformly distributed live load 5 k/′ and a point moving load of 20 kips for maximum positive moment. Given, $E = 30x10^3$ ksi, $I = 4000$ in^4. **(20)**

Figure 11



[13] Draw the influence line of moment at G of the frame shown in Figure 12 and place a uniformly distributed live load 1.5 k/′ and a point moving load of 10 kips for maximum positive moment. Given, $E = 30x10^3$ ksi, $I = 4000$ in^4. **(20)**

Figure 12



[14] Draw the BMD of the frame shown in Figure 13 by using the Flexibility Method. Given, $E = 29x10^3$ ksi, $I_1 = 2000$ in^4, $I_2 = 2300$ in^4, $I_3 = 1550$ in^4. **(20)**

Figure 13