University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B.Sc. Engineering (Civil)

Course Title: Professional Practices and Communication | Course Code: CE 403
Time: 2 Hour | Full Marks: 50

Answer all questions.

1 Read the following passage and give answer with explanation from Engineering ethical point of view: 10

Engineer A, a renowned structural engineer, is hired for a nominal sum by a large city newspaper to visit the site of a state bridge construction project, which has had a troubled history of construction delays, cost increases, and litigation primarily as a result of several well-publicized, on-site accidents. Recently the state highway department has announced the date for the opening of the bridge. State engineers have been proceeding with repairs based upon a specific schedule. Engineer A visits the bridge and performs a one-day visual observation. Her report identifies, in very general terms, potential problems and proposes additional testing and other possible engineering solutions.

Thereafter, in a series of feature articles based upon information collected from Engineer A's report, the newspaper alleges that the bridge has major safety problems that jeopardize its successful completion date. Allegations of misconduct and incompetence are made against the project engineers and the contractors as well as the state highway department. During an investigation by the state, Engineer A states that her report was intended merely to identify what she viewed were potential problems with the safety of the bridge and was not intended to be conclusive as to the safety of the bridge.

Was it ethical for Engineer A to agree to perform an investigation for the newspaper in the manner stated?

2(a) What is meant by Dispute? Describe the most common causes of dispute in construction contract. 1+2
(b) Mention the names of the methods (at least 4) of dispute resolution. 2
(c) When Negotiation is a better option for resolving dispute? Briefly describe the method of Negotiation. 2+3

3(a) What is arbitration? Briefly describe the process of arbitration 1+2
(b) What are the merits and demerits of arbitration? 2
(c) What is Litigation? When can this method be applied? 1+2
(d) Write down the disadvantages of litigation. 2

4(a) What are the common components of a thesis? 2
(b) What are the criteria of a good abstract? What should be avoided in abstract writing? 2+2
(c) Describe the points to be considered for a good Title of a proposal/thesis 4

5(a) Describe the 4 characteristics of a good procurement process. 2
(b) Describe the Technical and Financial Evaluation of Bidder Selection Criteria. 2.5
(c) Mention the 5 basic processes of Bid Management 2
(d) What information is typically collected for pre-qualification? 2
(e) What is meant by Winners curse and Lowball bids? Please Explain. 1.5

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B.Sc. Engineering (Civil)

Course No: CE 415 **Course Title: Structural Engineering V**
Time: 2.0 hours **Full Marks: 100**

There are **five** questions. Answer any **four** questions. The figures in the right margin indicate the **marks** of the questions. Assume value for any missing data.

1. (a) Make a preliminary design for section of a prestressed-concrete beam to resist a total moment of 420 KN-m including girder self weight moment 115 kN-m. Assume a trial depth of the section is $42\sqrt{(M_T)}$ in mm (where M_T is in kN-m) . The effective prestress for steel is 750 MPa, and allowable stress for concrete under working load is 12 MPa. (8)

(b) A symmetric I-shaped beam is prestresssed with A_{ps}=2189 mm^2 as prestressing steel with an effective stress f_{se} of 1100 MPa. The c.g.s. of the strands is 115 mm above from the bottom of the beam. Determine the ultimate moment of the section in **Figure: 1** using strain compatibility method. (17)
(Given: f'_c = 48 MPa and β_1=0.7, Start trial of 'c' value with 250 mm)

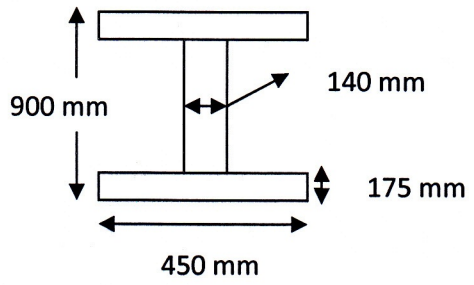


Figure: 1

2. (a) Show the stress distributions in a prestressed concrete beam section for different locations of compressive force (C) according to elastic theory. (10)

(b) Fourteen steel wires of 9 mm diameter with anchorages are used for prestressing of a 15m pretensioned beam. The beam has symmetrical I-section shown in **Figure: 1.** Determine the position for the c.g.s. line. **[Given:** f_o=860MPa, f_{se}= 750 MPa, f'_b= 3 MPa, , f'_t= 3 MPa, M_G= 75 kN-m, M_T=270 kN-m at midspan]. (15)

3. A section of simply supported composite beam is shown in **Figure: 2.** The precast stem is prestressed with an effective force of 400 kips assuming a total loss as 15%. Compute the stresses in the section at different stage of loading and also draw the stress distribution at these stages if the bending moment at the section are as follows: (25)

- Due to precast stem = 250 k-ft
- Due to top slab = 80 k-ft
- Due to live load = 400 k-ft

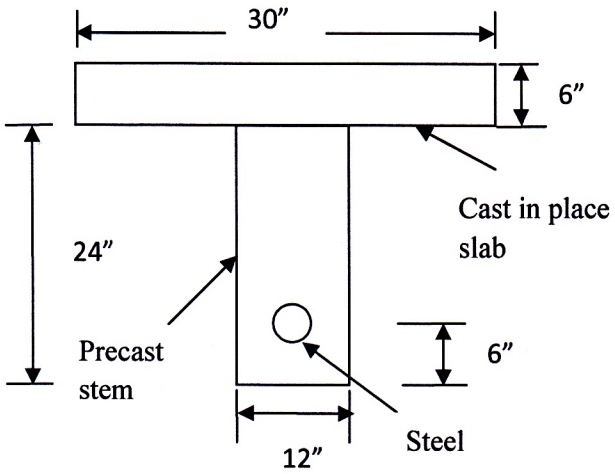


Figure: 2

4. **(a)** Check the shear strength for the beam shown in **Figure: 3** at section 1-1 which is 3 m from support. Given that this section is adequate for w_u= 70 kN/m on the basis of its flexural strength. (**Given:** f'_c=*40* MPa, f_{se} = *1100* MPa, A_{ps} = 1760 mm^2) (15)

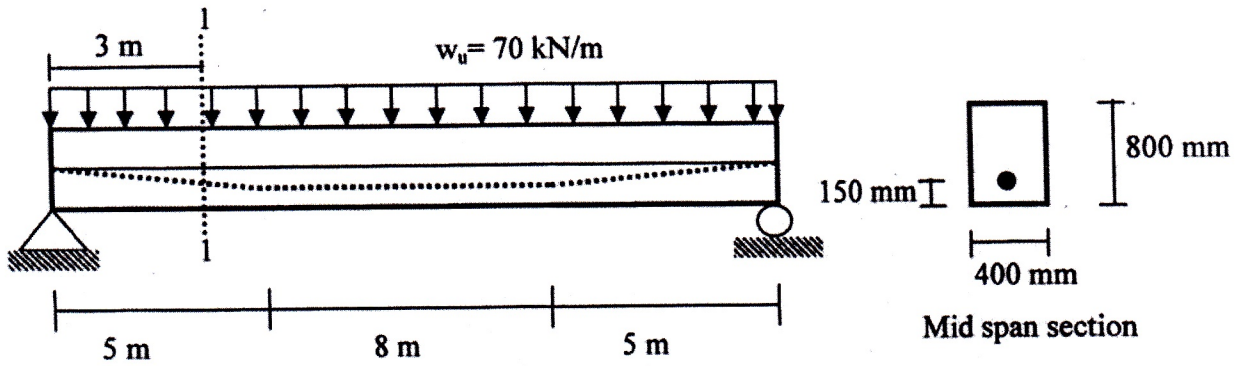


Figure: 3

(b) What are the advantages and disadvantages of partial prestressing? Define "transfer length" and write down the parameters which affect the length of transfer for prestressing steel of pretensioned member. (4+2+4)

5. **(a)** Calculate the mid-span deflection of a 16 m span I-beam as shown in **Figure: 4** (20)
(i) Immediately at transfer of prestress and (ii) after 12 years.
The beam carries a superimposed dead load of 4 kN/m and service load of 6 kN/m in addition to its self weight. It has to carry a concentrated live load of 75 kN at midspan.
Assume that, superimposed dead loads are applied soon after prestress trafnsfer.
Given: A_{ps} = 1760 mm^2, A_c= 240000 mm^2, I=2.408×10^{10} mm^4, f_i=1300 MPa, f_{se}= 1120 MPa, E_c=27400 MPa, C_c=2.3,γ_{con}=24 kN/m^3

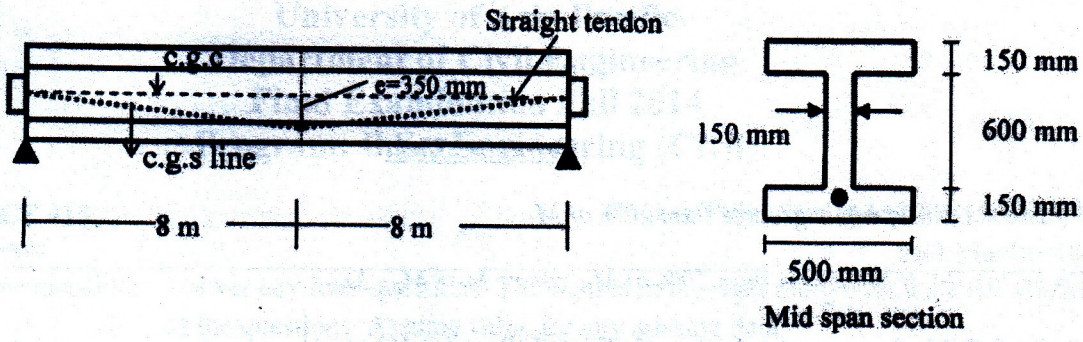


Figure: 4

(b) Draw the load deflection curve of a prestressed beam. (5)

Formulae Sheet

$F = M_T/(0.65h)$, if M_G is greater than 20% of M_T

$F = M_L/(0.5h)$, if M_G is less than 20% of M_T, where $M_L = M_T - M_G$

*$A_c = A_{ps}f_{se}/0.5f_c$ * $\varepsilon_{pu} = \varepsilon_{pu} + \varepsilon_{ce} + \varepsilon_{ct} = (f_{se}/E_s) + (f_c/E_c) + [\varepsilon_{pu}\{(d-c)/c\}]$*

*$K = r^2/c$ * $M_1 = f'_b A_c k_t$*

*$F = -(F/A) \pm (Fey/I) \pm (My/I)$ * $V_{ci} = 0.05\sqrt{f'c}\, b_w d + V_d + V_i M_{cr}/M_{max}$*

* $M_{cr} = (I/y_b)(0.5\sqrt{f'c} + f_{pe} - f_d)$ * $f_{pe} = (F/A) + (Fey_b/I)$ * $a_1 = M_T/F$ * $a_2 = M_G/F_o$*

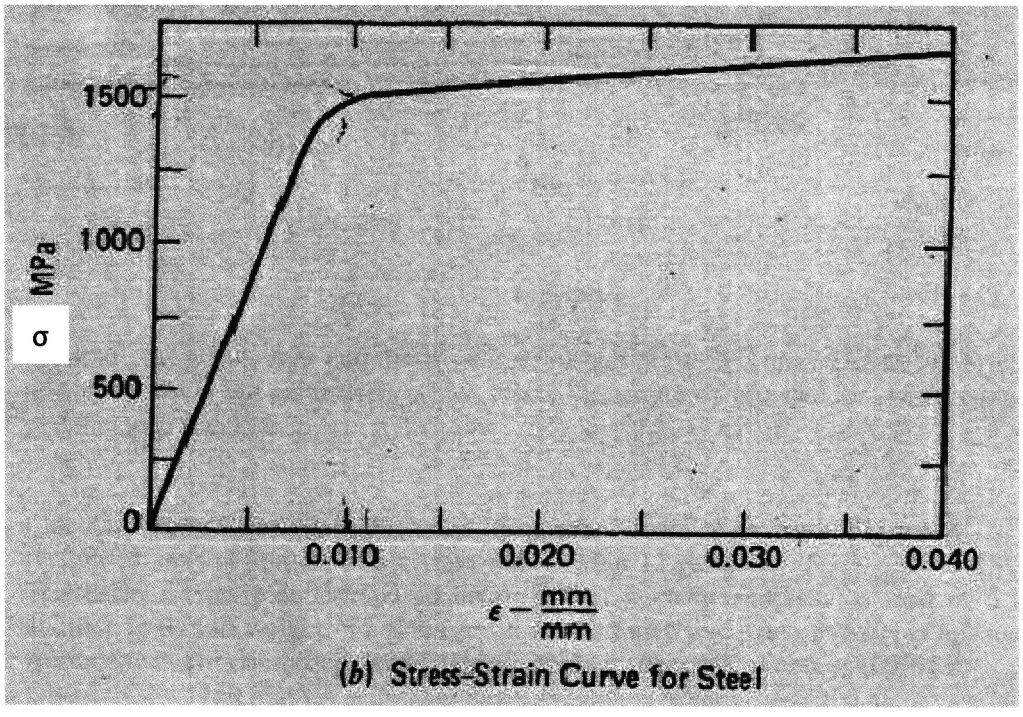
*$e_t = f'_b I/Fc_b$ * $e_b = f'_t I/F_o c_t$*

Δ_p in a simply supported beam $= (5wl^4/384EI)$

* Δ_w in a simply supported beam $= (5wl^4/384EI)$*

* Δ_m in a simply supported beam $= (Ml^2/8EI)$*

* Δ_{pl} in a simply supported beam $= (Pl^3/48EI)$*



(b) Stress-Strain Curve for Steel

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B.Sc. Engineering (Civil)

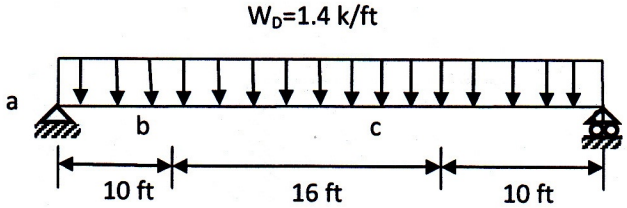
Course Title: Structural Analysis and Design VI | Course Code: CE417
Time: 2 Hours | Full Marks: 120

Section- A :Answer any 3 (Three) of the following 4 (Four) questions

1. (a) Write short notes on the following: (04)

   i. Stiffened and Unstiffened elements
   ii. Elastic and plastic section modulus

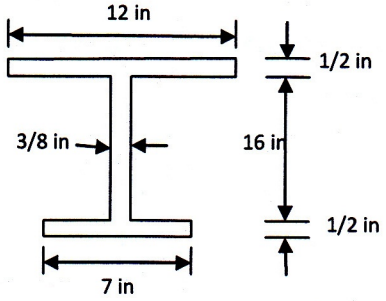
   (b) The beam shown in the following figure has lateral support at locations a, b, c and d. Compute C_b for segment b-c. Use the unfactored service load as shown. (16)



2. (a) Write short notes on compact and non-compact section. (04)

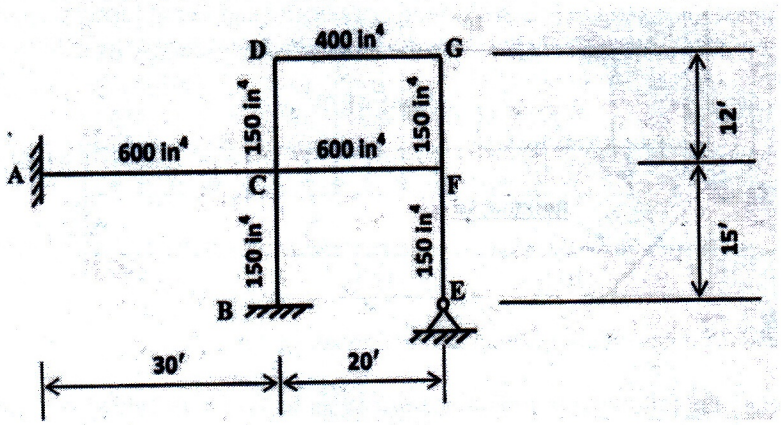
   (b) Compute the following for the cross section shown in figure below. Assume A 992, 50 Grade steel. (16)

   i. Yield moment
   ii. Plastic moment
   iii. Shape factor



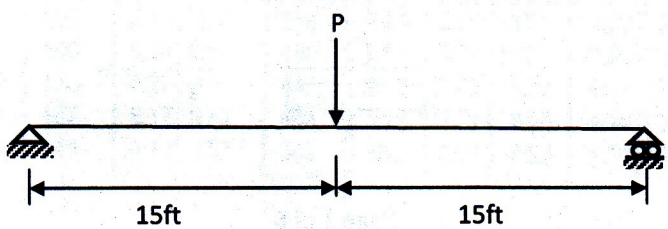
3. (a) Discuss residual stress including its effects. (05)

(b) Define effective length factor. Calculate effective length factors for column BC, EF, CD and FG shown in the following figure. Moment of inertia of columns and beams are shown in figure. (Use Annexure-1). (15)



4. (a) State the typical differences between steel and concrete structures. (04)

(b) The beam shown in the following figure is a W 10×77 and is laterally unsupported except at ends. If F_y=50 ksi, Calculate the maximum permissible value of P. Neglect self-weight of the beam and follow ASD principle. For this beam C_b=1.32. (Use Annexure-2). (16)



Section- B: Answer any 3 (Three) of the following 4 (Four) questions

5. (a) What is meant by C_b and L_c? (04)

(b) Calculate the allowable strength (in ASD) of a W 14 × 90 column section with a strong axis unbraced length of 30 ft and weak axis unbraced length of 15 ft. Assume ends of unbraced lengths as pinned. The materials is ASTM A 992 (Fy=50 ksi and Fu=65 ksi).Annexure 3 is provided to facilitate the design. (16)

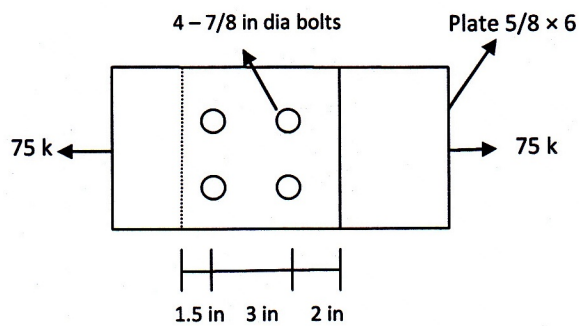
6. (a) Draw a column strength curve and indicate regions of short, intermediate and long column. How does failure of short column differ from that of long column? (05)

(b) Use ASD method to select lightest section of A 36 steel for a 20 feet long column to carry an axial load of 170 kip. Assume Fixed-Pinned ends of 20 ft long column in both axes. Probable column sizes with sectional properties are given below. (15)

Size	A_g (in^2)	r_x (in)	r_y(in)
W 10×39	11.5	4.27	1.98
W 10×45	13.3	4.30	2.01
W 12×40	11.8	5.13	1.93

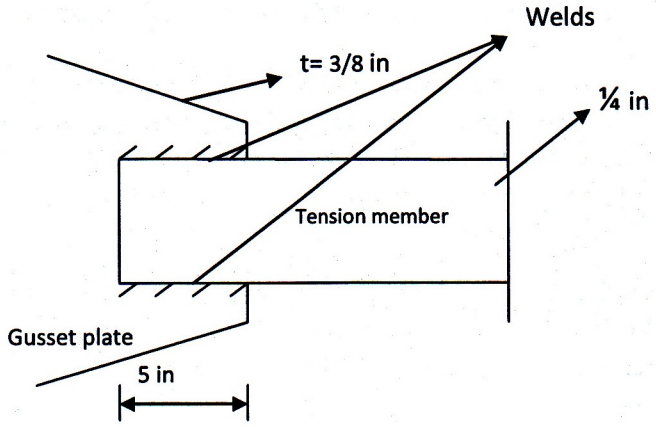
7. (a) What do you understand by shear lag? Describe with figures. (04)

(b) Investigate the adequacy of the connection if the total load applied is 75 k as shown in the figure. It includes 4 -7/8 dia A 325 bolts in standard hole bearing type connection with threads excluded from shear plate. Assume A 572 Grade 50 steel. (16)

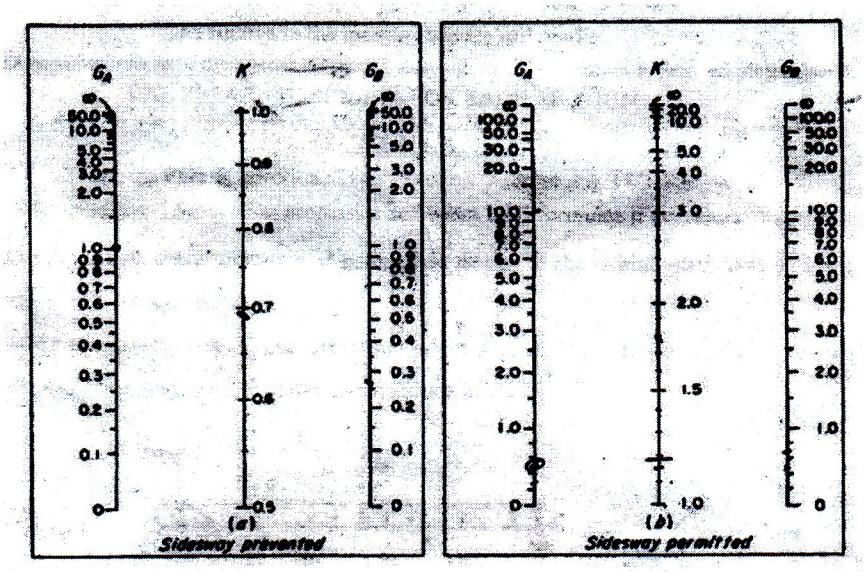


8. (a) What is Lateral Torsional Buckling? How is it prevented? (05)

(b) The following figure shows a flat bar used as a tension member and connected to a gusset plate. The welds are 3/16 in fillet weld made of E 70 XX electrode. The connected parts are A 992 steel. Determine the strength of the connection. (15)

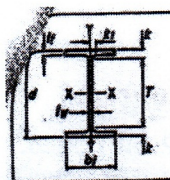


Annexure- 1



Nomograph for effective length of columns.

Annexure- 2

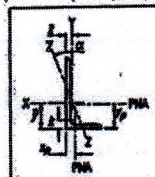


W Shapes
Dimensions

W Shapes
Properties

W14 – W12

Shape	Area, A	Depth, d	Web Thickness, t_w	$\frac{k_{des}}{t}$	Flange Width, b_f	Flange Thickness, t_f	Distance k_{des}	Distance k_{det}	k_1	T	Work-able Gage	Compact Section Criteria $\frac{b_f}{2t_f}$	Compact Section Criteria $\frac{h}{t_w}$	Axis X-X I	Axis X-X S	Axis X-X r	Axis X-X Z	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Axis Y-Y Z	r_{ts}	h_o	Torsional Properties J	Torsional Properties C_w
	in.²	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.			in.⁴	in.³	in.	in.³	in.⁴	in.³	in.	in.³	in.	in.	in.⁴	in.⁶
W14×132	38.8	14.7	14⅝	0.645	⅝	6⅝	14.7	14⅝	1.03	1	1.63	2⅜	1⅝	10	6½	7.15	17.7	1530	209	6.29	234	548	74.6	3.76	113	4.23	13.8	12.3	26500
×120	35.3	14.5	14½	0.590	⅝	6⅛	14.7	14⅝	0.940	⅝	1.54	2⅛	1½			7.80	19.3	1380	190	6.24	212	485	67.5	3.74	102	4.20	13.5	9.37	22700
×109	32.0	14.3	14⅜	0.525	½	6	14.8	14⅛	0.860	⅝	1.46	2⅛	1⅜			8.49	21.7	1240	173	6.22	192	447	61.2	3.73	92.7	4.17	13.5	7.12	20200
×99[f]	29.1	14.2	14⅛	0.485	½	¼	14.8	14⅛	0.780	¾	1.38	2⅛	1⅜			9.34	23.5	1110	157	6.17	173	402	55.2	3.71	83.8	4.14	13.4	5.37	18000
×90[f]	26.5	14.0	14	0.440	7/16	¼	14.5	14⅛	0.710	11/16	1.31	2	1⅜			10.2	25.9	999	143	6.14	157	362	49.9	3.70	75.6	4.11	13.3	4.06	16000
W14×82	24.0	14.3	14⅜	0.510	½	½	10.1	10⅛	0.855	⅞	1.46	1 11/16	1⅛	10⅞	5½	5.92	22.4	881	123	6.05	139	148	29.3	2.48	44.8	2.85	13.6	5.07	6710
×74	21.8	14.2	14⅛	0.450	7/16	¼	10.1	10⅛	0.785	13/16	1.38	1⅝	1⅛			6.41	25.4	795	112	6.04	126	134	26.6	2.48	40.5	2.82	13.4	3.87	5990
×68	20.0	14.0	14	0.415	7/16	¼	10.0	10	0.720	¾	1.31	1 9/16	1⅛			6.97	27.5	722	103	6.01	116	121	24.2	2.46	36.9	2.80	13.3	3.01	5360
×61	17.9	13.9	13⅞	0.375	⅜	5/16	10.0	10	0.645	⅝	1.24	1⅛	1			7.75	30.4	640	92.1	5.98	102	107	21.5	2.45	32.8	2.78	13.2	2.19	4710
W14×53	15.8	13.9	13⅞	0.370	⅜	5/16	8.06	8	0.660	11/16	1.25	1½	1	10⅞	5½	6.11	30.9	541	77.8	5.89	87.1	57.7	14.3	1.92	22.0	2.22	13.3	1.84	2540
×48	14.1	13.8	13¾	0.340	11/16	5/16	8.03	8	0.595	⅝	1.19	1 7/16	1			6.75	33.8	484	70.2	5.85	78.4	51.4	12.8	1.91	19.6	2.20	13.2	1.45	2240
×43[f]	12.8	13.7	13⅝	0.305	5/16	5/16	8.00	8	0.530	½	1.12	1⅜	1			7.54	37.4	428	62.6	5.82	69.6	45.2	11.3	1.89	17.3	2.18	13.1	1.05	1950
W12×58	17.0	12.2	12¼	0.360	⅜	5/16	10.0	10	0.640	⅝	1.24	1½	15/16	9¼	5½	7.82	27.0	475	78.0	5.28	88.4	107	21.4	2.51	32.5	2.82	11.6	2.10	3570
×53	15.6	12.1	12	0.345	⅜	5/16	10.0	10	0.575	9/16	1.18	1⅜	15/16	9¼	5½	8.69	28.1	425	70.6	5.23	77.9	95.8	19.2	2.48	29.1	2.79	11.5	1.58	3160
W12×50	14.6	12.2	12¼	0.370	⅜	5/16	8.08	8⅛	0.640	⅝	1.14	1½	15/16	9¼	5½	6.31	26.8	391	64.2	5.18	71.9	56.3	13.9	1.96	21.3	2.25	11.8	1.71	1880
×45	13.1	12.1	12	0.335	5/16	5/16	8.05	8	0.575	9/16	1.08	1⅜	15/16			7.00	29.8	348	57.7	5.15	64.2	50.0	12.4	1.95	19.0	2.23	11.5	1.26	1650
×40	11.7	11.9	12	0.295	5/16	5/16	8.01	8	0.515	½	1.02	1⅜	⅞			7.77	33.5	307	51.5	5.13	57.0	44.1	11.0	1.94	16.8	2.21	11.4	0.906	1440
W10×112	32.9	11.4	11⅜	0.755	¾	⅜	10.4	10⅜	1.25	1¼	1.75	1 15/16	1	7½	5½	4.17	10.4	716	126	4.66	147	236	45.3	2.68	69.2	3.07	10.1	15.1	6020
×100	29.4	11.1	11⅛	0.680	11/16	⅝	10.3	10⅜	1.12	1⅛	1.62	1 11/16	1			5.18	11.5	623	112	4.60	130	207	40.0	2.65	61.0	3.03	10.0	10.9	5150
×88	25.9	10.8	10⅞	0.605	⅝	5/16	10.3	10¼	0.990	1	1.49	1 11/16	15/16			5.88	13.0	534	98.5	4.54	113	179	34.8	2.63	53.1	2.99	9.85	7.53	4330
×77	22.6	10.6	10⅝	0.530	½	¼	10.2	10¼	0.870	⅞	1.37	1 9/16	⅞			6.58	14.8	455	85.9	4.49	97.6	154	30.1	2.60	45.9	2.95	9.73	5.11	3630
×68	20.0	10.4	10⅜	0.470	½	¼	10.1	10⅛	0.770	¾	1.27	1 7/16	⅞			7.41	16.7	394	75.7	4.44	86.3	134	26.4	2.59	40.1	2.91	9.83	3.56	3100
×60	17.6	10.2	10⅛	0.420	7/16	¼	10.1	10⅛	0.680	11/16	1.18	1⅜	13/16			8.15	18.7	341	66.7	4.39	74.6	116	23.0	2.57	35.0	2.88	9.54	2.48	2840
×54	15.8	10.1	10⅛	0.370	⅜	5/16	10.0	10	0.615	⅝	1.12	1 5/16	13/16			8.93	21.2	303	60.0	4.37	66.6	103	20.6	2.56	31.3	2.86	9.48	1.82	2320
×49	14.4	10.0	10	0.340	5/16	5/16	10.0	10	0.560	9/16	1.06	1¼	13/16			8.93	23.1	272	54.6	4.35	60.4	93.4	18.7	2.54	28.3	2.84	9.42	1.39	2070



Angles
Properties

Angles
Properties

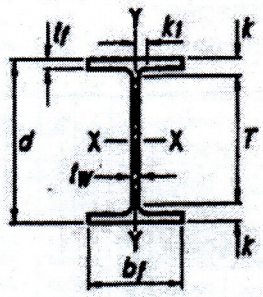
L8-L6

Shape	k	Wt.	Area, A	Axis X-X I	Axis X-X S	Axis X-X r	Axis X-X $\bar{y}$	Axis X-X Z	Axis X-X y_p	Flexural-Torsional Properties J	Flexural-Torsional Properties C_w	Flexural-Torsional Properties $\bar{x}_o$	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Axis Y-Y $\bar{x}$	Axis Y-Y Z	Axis Y-Y x_p	Axis Z-Z I	Axis Z-Z S	Axis Z-Z r	$\tan\alpha$	F_y=36 ksi
	in.	lb/ft	in.²	in.⁴	in.³	in.	in.	in.³	in.	in.⁴	in.⁶	in.	in.⁴	in.³	in.	in.	in.³	in.	in.⁴	in.³	in.		
L7×6×⅞	1⅜	28.2	7.99	37.8	8.39	2.21	2.50	14.8	1.67	1.47	3.97	3.31	9.00	3.01	1.06	1.00	5.60	0.550	5.64	1.71	0.855	0.324	1.00
×⅞	1⅛	22.1	6.48	32.4	7.12	2.23	2.45	12.5	1.80	0.868	2.37	3.34	7.79	2.56	1.10	0.958	4.68	0.464	4.80	1.47	0.860	0.329	1.00
×½	1	17.9	5.25	26.8	5.79	2.25	2.40	10.2	1.74	0.456	1.25	3.37	6.48	2.10	1.11	0.910	3.77	0.376	3.95	1.21	0.866	0.334	0.965
×7/16	15/16	15.7	4.62	23.6	5.11	2.26	2.36	9.03	1.70	0.310	0.851	3.38	5.78	1.86	1.12	0.886	3.31	0.331	3.50	1.08	0.869	0.337	0.912
×⅜	⅞	13.6	3.98	20.5	4.42	2.27	2.35	7.81	1.67	0.196	0.544	3.40	5.06	1.61	1.12	0.861	2.84	0.286	3.05	0.942	0.873	0.339	0.840
L6×6×1	1½	37.4	11.0	35.4	8.55	1.79	1.86	15.4	0.918	3.68	9.24	3.18	35.4	8.55	1.79	1.86	15.4	0.918	15.0	3.53	1.17	1.00	1.00
×⅞	1⅜	33.1	9.75	31.9	7.61	1.81	1.81	13.7	0.813	2.51	6.41	3.21	31.9	7.61	1.81	1.81	13.7	0.813	13.3	3.13	1.17	1.00	1.00
×¾	1⅜	28.7	8.46	28.1	6.84	1.82	1.77	11.9	0.705	1.81	4.17	3.24	28.1	6.84	1.82	1.77	11.9	0.705	11.6	2.73	1.17	1.00	1.00
×⅝	1⅛	24.2	7.13	24.1	5.64	1.84	1.72	10.1	0.594	0.955	2.50	3.28	24.1	5.64	1.84	1.72	10.1	0.594	9.83	2.32	1.17	1.00	1.00
×9/16	1⅛	21.9	6.45	22.0	5.12	1.85	1.70	9.18	0.538	0.704	1.85	3.29	22.0	5.12	1.85	1.70	9.17	0.538	8.94	2.11	1.18	1.00	1.00
×½	1	19.8	5.77	19.9	4.59	1.86	1.67	8.22	0.481	0.501	1.32	3.31	19.9	4.59	1.86	1.67	8.22	0.481	8.04	1.89	1.18	1.00	1.00
×7/16	15/16	17.2	5.08	17.6	4.06	1.86	1.65	7.25	0.423	0.340	0.899	3.32	17.6	4.06	1.86	1.65	7.25	0.423	7.11	1.68	1.18	1.00	0.973
×⅜	⅞	14.9	4.36	15.4	3.51	1.87	1.62	6.27	0.365	0.218	0.575	3.34	15.4	3.51	1.87	1.62	6.26	0.365	6.17	1.45	1.19	1.00	0.912
×5/16	13/16	12.4	3.67	13.0	2.95	1.88	1.60	5.28	0.306	0.129	0.338	3.35	13.0	2.95	1.88	1.60	5.28	0.306	5.20	1.23	1.19	1.00	0.828

Beam LTB formula's

$$\frac{L_p}{r_y} = 1.76\sqrt{\frac{E}{F_y}} = \frac{300}{\sqrt{F_y,\text{ksi}}} \qquad L_r = 1.95 r_{ts}\frac{E}{0.7F_y}\sqrt{\frac{Jc}{S_x h_o}}\sqrt{1+\sqrt{1+6.76\left(\frac{0.7F_y}{E}\frac{S_x h_o}{Jc}\right)^2}} \qquad F_{cr} = \frac{C_b\pi^2 E}{\left(\frac{L_b}{r_{ts}}\right)^2}\sqrt{1+0.078\frac{Jc}{S_x h_o}\left(\frac{L_b}{r_{ts}}\right)^2}$$

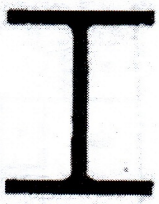
Annexure- 3



W Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance				
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Thickness, t_f		k		k_1	T	Workable Gage
											k_{des}	k_{det}			
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W14×132	38.8	14.7	14 5/8	0.645	5/8	5/16	14.7	14 3/4	1.03	1	1.63	2 5/16	1 9/16	10	5 1/2
×120	35.3	14.5	14 1/2	0.590	9/16	5/16	14.7	14 5/8	0.940	15/16	1.54	2 1/4	1 1/2		
×109	32.0	14.3	14 3/8	0.525	1/2	1/4	14.6	14 5/8	0.860	7/8	1.46	2 3/16	1 1/2		
×99[f]	29.1	14.2	14 1/8	0.485	1/2	1/4	14.6	14 5/8	0.780	3/4	1.38	2 1/16	1 7/16		
×90[f]	26.5	14.0	14	0.440	7/16	1/4	14.5	14 1/2	0.710	11/16	1.31	2	1 7/16		

W Shapes
Properties



W14 – W12

Nominal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
132	7.15	17.7	1530	209	6.28	234	548	74.5	3.76	113	4.23	13.6	12.3	25500
120	7.80	19.3	1380	190	6.24	212	495	67.5	3.74	102	4.20	13.5	9.37	22700
109	8.49	21.7	1240	173	6.22	192	447	61.2	3.73	92.7	4.17	13.5	7.12	20200
99	9.34	23.5	1110	157	6.17	173	402	55.2	3.71	83.6	4.14	13.4	5.37	18000
90	10.2	25.9	999	143	6.14	157	362	49.9	3.70	75.6	4.11	13.3	4.06	16000

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering IX
(Earthquake Resistant Design and Retrofitting)
Time: 2 Hours

Course Code: CE 423

Full Marks: 100

There are 7 (Seven) questions. Answer any 5 (Five)

1. a) Define undamped, critically damped and overdamped systems. Derive equation of motion of free vibration of an underdamped SDOF system. **(11)**

b) The free vibration of an undamped system is shown below in ***Figure 1.*** Calculate its (i) undamped natural period, (ii) undamped natural frequency in Hz and radian/second, (iii) stiffness if its mass is 2 lb-sec^2/ft. **(9)**

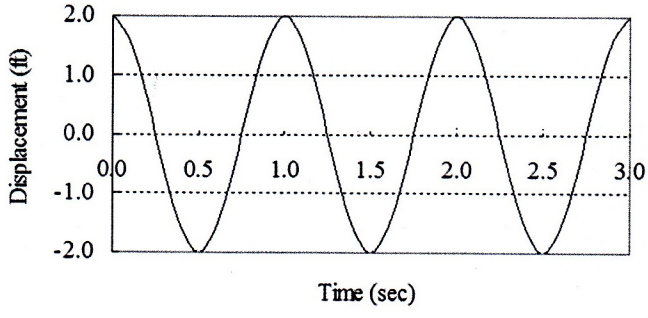


Figure 1

2. a) What are the effects of soil condition on isolated structure? **(3)**

b) A 16 in wide and 20 in deep (including 5 in slab) reinforced concrete beam spans between two interior columns (***Figure 2)*** in a building frame designed for a region of high seismic risk. **(12)**

The clear span of the beam is 22 ft and the reinforcement at the face of the support consists of four No. 9 top bars and four No. 8 bottom bars, each in one layer.

Design the shear reinforcement for the regions adjacent to the column faces for DL = 1.2 kip/ft and LL = 1.4 kip/ft.
Given f'_c= 3000 psi and f_y = 60000 psi.

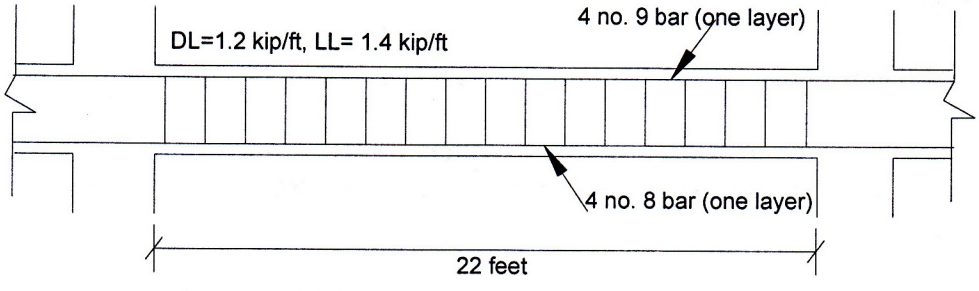


Figure 2

(c) Explain how degree of confinement effects the nominal shear capacity of beam-column joints. **(5)**

3. a) What is seismic base isolation system? What are the characteristics of a well-designed seismic base isolation system? **(8)**

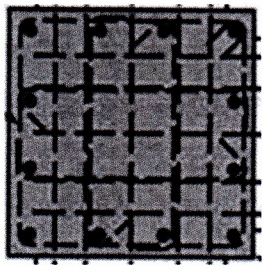
b) Write short notes on: (i) Resonance, (ii) Spherical sliding bearing. **(6)**

c) What is liquefaction? Explain how it takes place during earthquake. **(6)**

4. a) Write short notes on: (i) Anchorage, (ii) Development length. **(6)**

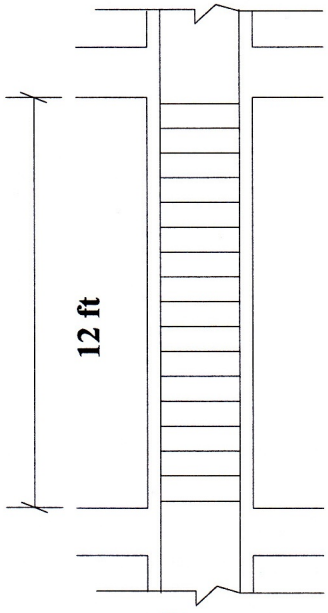
b) What are the requirements for concrete and steel reinforcement for earthquake resistant design? **(4)**

c) Determine the minimum transverse reinforcement of the column (***Figure 3***) required over length l_0. Show the reinforcement detailing in neat sketch. **(10)**



Column Size
36 in x 36 in

(a)



(b)

Figure 3

5. a) What assumptions are made in calculating the flexural resistance of a section strengthened with an externally applied FRP system? **(8)**

b) What are the failure modes of FRP strengthened flexural member as per ACI. **(5)**

c) "Confinement of circular column is better than confinement in rectangular column", Explain why? **(4)**

d) Explain how concrete surface should be prepared before retrofitting. **(3)**

6. a) What are the main causes of deterioration of RC structures in Bangladesh? Discuss the problems that occur commonly during RC construction works in Bangladesh. **(12)**

b) Explain concrete crack sealing by injection method. **(4)**

c) Explain possible reasons for the cracks in RC beams and columns shown in ***Figure 4***. **(4)**

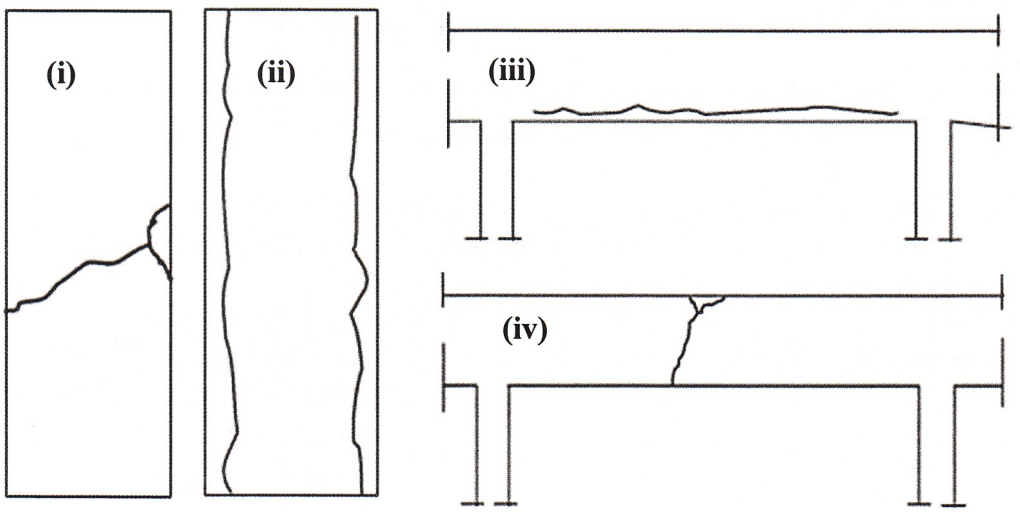
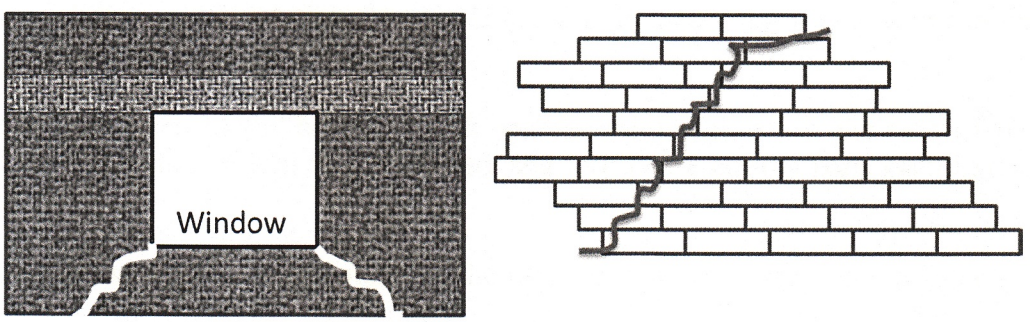


Figure 4

7. a) Why unreinforced masonry (URM) structures are vulnerable to earthquake? What steps should an engineer take to avoid failure of URM structures due to earthquake? **(8)**

b) Write short notes on: (i) Primer, (ii) Adhesive, (iii) FRP **(6)**

c) Narrate the repair methods of the cracks shown in the brick walls in ***Figure 5.*** **(6)**



(i) **(ii)**

Figure 5

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering III — Course Code: CE 431
Time- 2 hours — Full marks: 100

Question no. **6** is mandatory. Answer any **FOUR (4)** from question no. **1-5**. **(5 X 20 = 100)**
(Assume any missing data)

1. (a) Define a hazardous waste emphasizing its characteristics. **[5]**

   (b) Show in a schematic diagram/flowchart, the different ways that humans can be exposed to hazardous waste. **[5]**

   (c) Consider you are an Engineer who works for an industry in Bangladesh that has a lot of toxic chemicals waste to dispose of as part of the manufacturing process. Being established in a developing country, list the general problems that you will expect in the treatment and disposal of this special category of waste. Also state what option would you choose for disposal of this waste? Lastly, as part of your assignment, what are the factors that you would have to consider if the company asks you to cite a landfill site for this type of waste? **[10]**

2. (a) What are the advantages and the challenges of composting process? **[6]**

   (b) How is the anaerobic digestion process that occurs inside a digester (closed reactor) different than the anaerobic digestion when it occurs inside a landfill? State the names of at least three organizations that have implemented biogas technology in Bangladesh. **[6]**

   (c) Estimate the theoretical requirement of air for composting of the organic waste having the structural formula $C_{40}H_{100}O_{30}N$. **[8]**

3. (a)Why is transfer station important in solid waste management system? **[5]**

   (b) Which steps/elements are included in the consideration of economic costs of the solid waste collection? **[5]**

   (c) A transfer station was built with an installation cost of 5,00,000 BDT with yearly operational cost being 50,000 BDT. The transfer station is meant to handle 500 tons/day operating 7 days a week. To be operated to and from the transfer station, a tractor-trailor was bought with 1,00,000 BDT which will require 10,000 BDT for yearly operation and maintenance. The truck carries 50 tons/trip. A driver appointed would require 4,000 BDT

per month including benefits. The capital cost of the building and transfer trucks are to be amortized over a 20 year period using a 10% discount factor. Suppose it takes 45 minutes to make a one-way trip from the transfer station to the disposal site and 5 round trips per day are made. Find the total cost of transfer station and hauling cost in BDT per ton. Plot the result showing the fixed cost and the variable cost varying over time.

4. (a) What is industrial waste? Provide examples of industrial waste and explain how these wastes can be treated? **[7]**

(b) Distinguish between Resource Recovery by Material Separation and Resource Recovery by Material Conversion. **[4]**

(c) A tannery in Hazaribagh dumps waste every day @ a rate of 50 tons per day into a nearby river except Friday. Also, there is no waste collection system available in the surrounding residential area that generates 0.1 tons per capita per day with 1500 people and the ultimate destination for these waste alse is the same river beside tannery. If a waste collection vehicle to be bought for collecting the residential waste costs 50,000 BDT requiring 2 crew members with 10 BDT/hour wage rate @8 working hours/day for 7 days a week, calculate the cost of the total waste collection system for one year (no amortization required; consider yearly operational cost to be 5,000 BDT) if it is to be implemented in the area. Also calculate the total amount of waste that the river is receiving every month when there is no collection system available. **[9]**

5. (a) What is leachate and what is it composed of? How can leachate be controlled? What are the key components of leachate management? **[3+3 = 6]**

(b) Draw the landfill gas generation profiles. **[6]**

(c) A refuse has the following components and bulk densities: **[8]**

Component	Percentage by Weight	Uncompacted bulk density (lb/ft^3)
Newspaper	40	3.81
Garden waste	35	4.45
Glass	25	18.45

Assume that the compaction in the landfill is 44 lb/ft^3. Estimate the % volume reduction achieved during compaction of the waste. Estimate the overall uncompacted bulk density if the garden waste is removed.

6. (a) Explain why sanitary landfill is an easily applicable option for waste disposal. **[3]**

(b) Design a sanitary landfill that will be built in a flat area which will be used ultimately for construction purpose after 20 years i.e. the land is being taken through lease by the Govt. Answer according to the steps given below: **[17]**

i) State the general steps or factors that you will consider while selecting the area
ii) Choose the type of method of landfilling
iii) Mention a leachate management system
iv) State the advantages/disadvantages of the site that you chose and the method that you selected for the area
v) Calculate the required landfill capacity for the current year for a population size of 30,00,000 with per capita waste generation rate of 5.0 lb/capita/day and compacted density of 40 lb/ft^3. Assume that the daily cover consists of 10% of the landfill volume.
vi) State how you can make the landfill environmentally friendly

Given Formulae:

$$C_n H_a O_b N_c + (n+a/4-b/2-3c/4)\, O_2 \rightarrow nCO_2 + (a/2 - 3c/2)\, H_2O + cNH_3$$

$$NH_3 + 2O_2 \rightarrow H_2O + HNO_3$$

$$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$

$$CRF = \left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$

Where, A = Annual cost (BDT/yr)

P = Purchase price, (BDT)

i = interest rate, discount rate (yr^{-1})

n = amortization period (yr)

CRF = Capital Recovery factor

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering IV — Course Code: CE 433
Time: 2 hour — Full marks: 100 (= 4×25)

[ANSWER ALL PARTS (i.e. a, b) OF EACH QUESTION TOGETHER]

(Note: Assume reasonable value for any missing data)

(The symbols have their usual meaning)

Answer any FOUR questions out of FIVE.

1. (a) On March, 4, 2015, the following air quality data have been recorded at CAMS (Continuous Monitoring Stations/Systems) in Dhaka. (10)
   $PM_{2.5}$ = 150 μg/m^3 (24 hr)
   PM_{10} = 180 μg/m^3 (24 hr)
   O_3 = 0.200 ppm (1 hr)
   Calculate Air Quality Index (AQI) for that day. Also, prepare the AQI report.

   (b) Briefly explain – (i) Criteria pollutant, (ii) Air toxin, (iii) Lofting plume, (iv) Fumigating plume and (v) Fanning Plume (15)

2. (a) A stack emitting 70 g/s of SO_2 has an effective stack height of 200 m. The wind speed is 3 m/s at 10 m, and it is a cloudy summer day. Estimate the ground level SO_2 concentration – (12)
   (i) directly downwind at a distance of 1.5 km
   (ii) at a point located 1.5 km downwind and 0.5 km of cross- downwind axis
   (iii) at a point downwind where SO_2 is maximum

   (b) (i) Briefly describe the approaches for engineering control of air pollutants. (6)

   (ii) Explain the effects of air-fuel ratio on pollution with relevant figure. (7)

3. (a) A lake of 150×10^4 m^2 area is being fed by a stream flow of 10 m^3/s. Phosphorus (P) concentration in the stream water is 0.0004 g/m^3. The lake also receives a wastewater flow of 0.5 m^3/s, which contain 11.0 mg/L (= 11.0 g/m^3) of phosphorus. P settling rate is given by 10 m/yr (= 3.17×10^{-7} m/s). (10)
   (i) Estimate average P concentration in the lake.
   (ii) Estimate P removal rate at the treatment plant to keep P concentration below 0.02 mg/L.

   (b) (i) What is eutrophication? Briefly explain the classification of lakes from the viewpoint of eutrophication. (6)

   (ii) Briefly describe the layers in a lake due to availability of sunlight, with necessary figure. (4)

   (iii) What are the principal controlling factors for eutrophication? (5)

4. (a) A city discharges 1500 m^3/d of sewage into a stream whose minimum rate of flow is 5.0 m^3/s. The velocity of stream is 5 m/s. The temperature of the sewage is 20°C and that of the water stream is 15°C. The 20°C BOD_5 of the sewage is 190 mg/L and that of the stream water is 1 mg/L. The sewage contains no DO while the stream is 90% saturated with dissolved oxygen. The values of K_d and K_r at 20°C are 0.25/d and 0.65/d respectively. Use the temperature coefficient of 1.047 for K_d and 1.024 for K_r. Determine: (12)
(i) The maximum oxygen deficit, critical (minimum) DO and its location.
(ii) Sketch the DO profile for a 150-km reach of the stream below the discharge. Attach the graph paper with your answer script.

(b) (i) What are the source and sink of DO in river to be considered for Streeter-Phelps DO model? Also mention the assumptions to be made for the model. (5)

(ii) What are the drawbacks of Streeter-Phelps oxygen-sag curve? (3)

(iii) Explain the effects of – (i) temperature and (ii) NBOD on DO sag curve with relevant figures. (5)

5. (a) Briefly explain the effects of oxygen demanding waste on river water quality. (3)

30 mL wastewater is mixed with dilution water to fill 300 mL BOD bottle. The drop of DO after 5 days is 4.8 mg/L. For a BOD bottle filled with only dilution water, DO drop is 1.2 mg/L after 5 days. If $k = 0.21\ d^{-1}$ at 20°C, what is the CBOD remaining after 5 days? (10)
Again, the total concentration of organic and ammonia nitrogen in the wastewater is 25.0 mg/L. Estimate the ultimate strength of the sample.

(b) What are the problems associated with eutrophication? Explain the mechanisms of eutrophication control. (8)

Explain why river water quality becomes worse during summer months. (4)

Formulae:

$$I_P = \frac{I_{Hi} - I_{Lo}}{BP_{Hi} - BP_{Lo}}(C_P - BP_{Lo}) + I_{Lo}$$

$\sigma_y = ax^{0.894}$, $\sigma_z = cx^d + f$

$$C(x,y,z) = \frac{Q}{2\pi u \sigma_y \sigma_z} \times \exp\left(\frac{-y^2}{2\sigma_y^2}\right)\left[\exp\left(-\frac{(z-H)^2}{2\sigma_z^2}\right) + \exp\left(-\frac{(z+H)^2}{2\sigma_z^2}\right)\right]$$

$$C_{\max} = \frac{Q}{u} \times \frac{C_u}{Q_{\max}}$$

$BOD_t = L_0 (1 - e^{-kt})$

$$P = \frac{S}{Q + \upsilon_s \cdot A}$$

$$D = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t} - e^{-k_r t}\right) + D_0 e^{-k_r t}$$

$$k_r = \frac{3.9u^{1/2}}{H^{3/2}} \qquad t_c = \frac{1}{k_r - k_d} \ln\left[\frac{k_r}{k_d}\left(1 - \frac{D_0[k_r - k_d]}{k_d \cdot L_0}\right)\right]$$

$$D_{\max} = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t_c} - e^{-k_r t_c}\right) + D_0 e^{-k_r t_c}$$

$DO_{(sat)} = 14.62 - 0.39\ T + 0.007714\ T^2 - 0.0000646\ T^3$

$k_{d\ (at\ T°C)} = k_{20°C} \cdot (1.047)^{T-20}$, $k_{r\ (at\ T°C)} = k_{r20°C} \cdot (1.024)^{T-20}$

$BOD_m \cdot V_m = BOD_w \cdot V_w + BOD_d \cdot V_d$

Breakpoints							AQI	Category
O_3 (ppm) 8-hr	O_3 (ppm) 1-hr (i)	$PM_{2.5}$ ($\mu g/m^3$) 24-hr	PM_{10} ($\mu g/m^3$) 24-hr	CO (ppm) 8-hr	SO_2 (ppm) 24-hr	SO_2 (ppm) Annual		
0.000-0.064	---	0.0-15.4	0-54	0.0-4.4	0.000-0.034	(ii)	0-50	Good
0.065-0.084	---	15.5-40.4	55-54	4.5-9.4	0.035-0.144	(ii)	51-100	Moderate
0.085-0.104	0.125-0.164	40.5-65.4	155-254	9.5-12.4	0.145-0.224	(ii)	101-150	Unhealthy for sensitive group
0.105-0.124	0.165-0.204	65.5-150.4	255-354	12.5-15.4	0.225-0.304	(ii)	151-200	Unhealthy
0.125-0.374	0.205-0.404	150.5-250.4	355-424	15.5-30.4	0.305-0.604	0.65-1.24	201-300	Very unhealthy
(iii)	0.405-0.504	250.5-350.4	425-504	30.5-40.4	0.605-0.804	1.25-1.64	301-400	Hazardous
(iii)	0.505-0.604	350.5-500.4	505-604	40.5-50.4	0.805-1.004	1.65-2.04	401-500	Hazardous

(i) In some cases, in addition to calculating the 8-hr ozone index, the 1-hr ozone index may be calculated and the maximum of the two values is reported

(ii) NO_2 has no short term air quality standard and can generate an AQI only above 200

(iii) 8-hr O_3 values do not define higher AQI values (≥ 301). AQI values of 301or higher are calculated with 1-hr O_3 concentrations.

Surface wind speed[a] (m/s)	Day solar insolation			Night cloudiness[e]	
	Strong[b]	Moderate[c]	Slight[d]	Cloudy (≥ 4/8)	Clear (≤ 3/8)
< 2	A	A–B[f]	B	E	F
2–3	A–B	B	C	E	F
3–5	B	B–C	C	D	E
5–6	C	C–D	D	D	D
> 6	C	D	D	D	D

[a]Surface wind speed is measured at 10 m above the ground.
[b]Corresponds to clear summer day with sun higher than 60° above the horizon.
[c]Corresponds to a summer day with a few broken clouds, of a clear day with sun 35–60° above the horizon.
[d]Corresponds to a fall afternoon, or a cloudy summer day, or clear summer day with the sun 15–35° above the horizon.
[e]Cloudiness is defined as the fraction of sky covered my clouds.
[f]For A–B, B–C, or C–D conditions, average the values obtained for each.
Note: A, Very unstable; B, moderately unstable; C, slightly unstable; D, neutral; E, slightly stable; F, stable. Regardless of windspeed, class D should be assumed for overcast conditions, day or night.
Source: Turner (1970).

TABLE 7.7 WIND PROFILE EXPONENT p FOR ROUGH TERRAIN[a]

Stability class	Description	Exponent, p
A	Very unstable	0.15
B	Moderately unstable	0.15
C	Slightly unstable	0.20
D	Neutral	0.25
E	Slightly stable	0.40
F	Stable	0.60

[a] For smooth terrain, multiply p by 0.6; see Table 7.8 for further descriptions of the stability classifications used here.

Source: Peterson (1978).

Stability	a	$x \leq 1$ km			$x \geq 1$ km		
		c	d	f	c	d	f
A	213	440.8	1.941	9.27	459.7	2.094	−9.6
B	156	106.6	1.149	3.3	108.2	1.098	2.0
C	104	61.0	0.911	0	61.0	0.911	0
D	68	33.2	0.725	−1.7	44.5	0.516	−13.0
E	50.5	22.8	0.678	−1.3	55.4	0.305	−34.0
F	34	14.35	0.740	−0.35	62.6	0.180	−48.6

[a] The computed values of σ will be in meters when x is given in kilometers.

Source: Martin (1976).

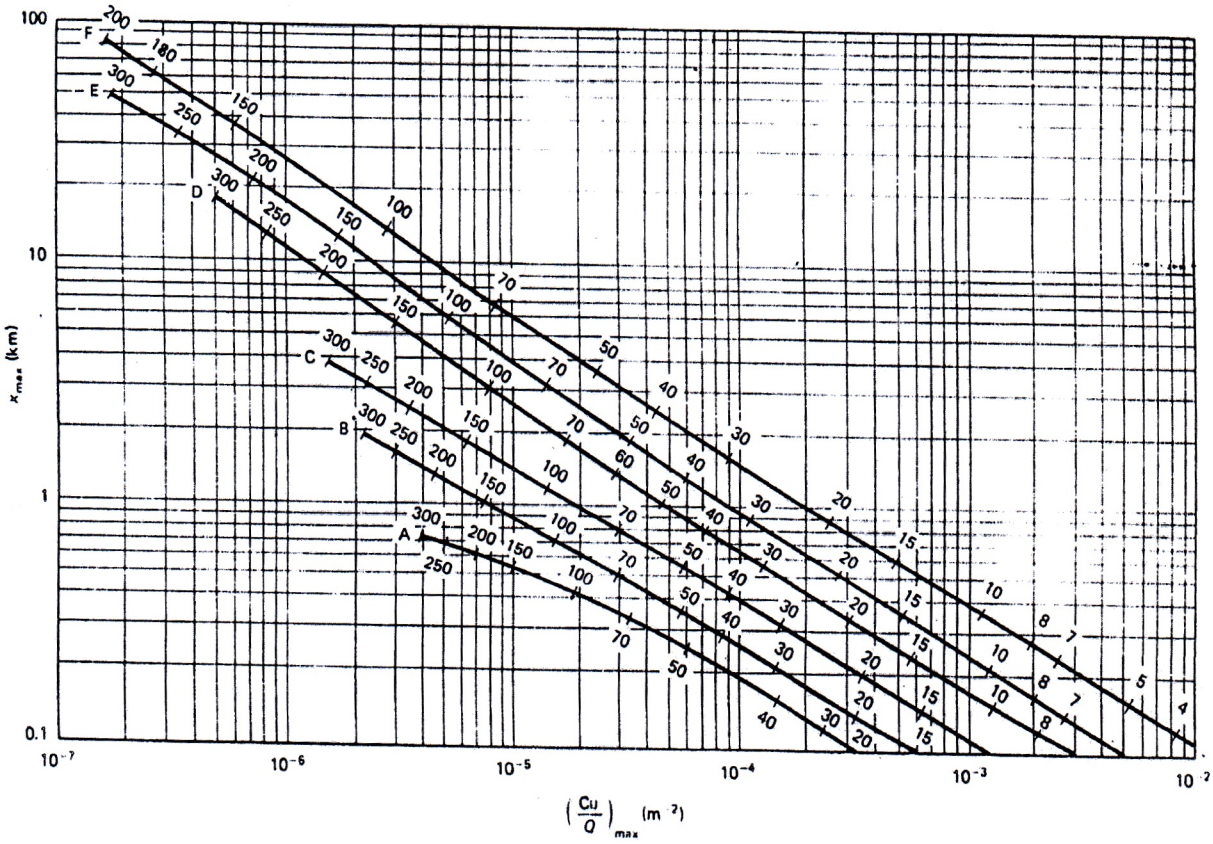


Figure 7.30 To determine the peak downwind plume concentration, enter the graph at the appropriate stability classification and effective stack height (numbers above the lines, in meters) and then move across to find the distance to the peak, and down, to find a parameter from which the peak concentration can be found (Turner, 1970).

University of Asia Pacific

Department of Civil Science and Engineering

Semester Final Examination, Fall-2014

Program: B.SC Engineering (2nd Year/2nd Semester)

Course Title: Principle of Economics Course Code: ECN 201 Credit: 2.00

Time: 2 Hours Full Marks: 50

Answer any **five** from the following questions:

1. (a) What are the features of monopoly ? Explain deadweight loss with a diagram. (6)

(b) In case of a monopolist: P= 200-4Q, TC= 5Q+4 (4)

Find out the profit maximizing price and quantity.

2. (a) Calculate Nominal GDP, Real GDP, GDP Deflator : Here, Base Year = 2010 (6)

Year	Price of X	Quantity of X	Price of Y	Quantity of Y
2010	240	25	210	30
2013	265	30	300	36

i. Estimate the Nominal GDP for 2010 and 2013. ii. What is the Real GDP in 2013?

iii. Find the GDP deflator for 2013

(b) What are the differences between GDP Deflator and CPI? Define: GDP Deflator. (4)

3. How can economy revive itself after recession? What kind of policies should be taken to tackle the problem of recession? Explain (10)

4. What is inflation? Explain the reasons behind inflation (10)

5. (a) Suppose price of a consumer basket of goods in year 2000=160 and in 2010=235. Find the CPI in 2010. What is the inflation rate for 2010? [Base Year= 2000] (5)

(b) What are the consequences of inflation? Explain. (5)

6. Explain different types of unemployment. (10)

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B.Sc. Engineering (Civil)

Course title: Environmental Engineering VII — Course code: CE 439
Time: 120 minutes — Full marks: 50

There are SIX (6) questions. Answer question no. 01 (COMPULSORY) and any THREE (3) from the rest.

1. A) Define the following: 8
   - Environmental Impact Assessment (EIA)
   - Screening
   - Environmental policy
   - Impact analysis
   - Impact mitigation
   - Environmental management plan
   - EIA review
   - Environmental Auditing

   B) Draw the flow diagram of EIA process and parallel studies. 6

2. A) According to the Bangladesh Environmental Conservation Rules (1997), write seven factors that should be considered while declaring any area as *ecologically critical area.* 3

   B) According to Article 7 of the Bangladesh Environmental Conservation Rules (1997), write the procedures to obtain environmental clearance certificate for a red category factory. 6

   C) Explain four main types of social impacts. 3

3. Write the name of your own group work's project.

   One of the following projects: a) Rampal Thermal Power Plant b) Padma Multipurpose Bridge Project c) Deep Sea Port in Sonadia

   A) Identify the three most important impacts of your project. Write only the names. 1

   B) Graphically show the time versus impact significance of these three impacts at different phases of your specific project. Draw three different figures for three selected impacts. 8

   (Examples of different phases of the project are: *before the project started, at planning/initiation phase, at implementation/construction phase* and *at operational*

phase/after construction phase etc.)

C) According to Environmental Conservation Rules (1997) of Bangladesh, in which category the following industrial units and projects can be classified (i.e. Green, Orange A, Orange B, Red)? 3

Industrial Unit/Project	**Category**
Tea processing	
Medical and surgical instruments (excluding production)	
Dry-cleaning	
Power plant	

4. A) What are the typical parameters (impact characteristics) that need to be taken into account for impact prediction and decision-making in an EIA process? 4

   B) Produce an EIA sample impact identification checklist for your own group work's project. 8

   For one of the following projects a) Rampal Thermal Power Plant b) Padma Multipurpose Bridge Project c) Deep Sea Port in Sonadia

5. A) Explain the three steps process (or main elements) of impact mitigation. 4

   B) A University is proposing to construct a new residential campus in Gazipur in an area covering 100 acres. After completion, the new campus will accommodate around 2500 students, staffs and faculties. There will be two residential halls, where around 800 students will reside. The area proposed for the new campus is located in an area mainly used for agriculture and there is a river nearby. 8

   For this project, write the benefits of public participation during EIA process for the following stakeholder groups (**write four benefits for each stakeholder group**):

   - The proponent/supporter
   - The decision-maker
   - Affected communities

6. A) Elaborately explain six different components of Environmental Management Plan (EMP). 5

   B) Explain the main steps of EIA review. 3

   C) Graphically show three different steps of Environmental Auditing (EA). 4