Department of Civil Engineering
Final Examination Spring 2015
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

In the mid 1980s, Sam was Alpha Electronics' project leader on a new contract to produce manufactured weaponry devices for companies doing business with NATO government agencies.41 The devices were advanced technology land mines with electronic controls that could be triggered with capacitor circuits to go off only at specified times, rather than years later when children might be playing in old minefields. NATO provided all the technical specifications and Alpha Electronics fulfilled the contract without problems. However, Sam was concerned that one new end user of this device could negate the safety aspects of the trigger and make the land mines more dangerous than any others on the market. After the NATO contract was completed, Sam was dismayed to learn that Alpha Electronics had signed another contract with an Eastern European firm that had a reputation of stealing patented devices and also of doing business with terrorist organizations. Sam halted the production of the devices. He then sought advice from some of his colleagues and contacted the U.S. State Department's Office of Munitions Controls. In retrospect, he wishes he had also contacted the Department of Commerce's Bureau of Export Administration, as well as the Defense Department. He ruefully acknowledges that the issue would have been brought to a close much more quickly. The contract that Sam unilaterally voided by his action was for nearly $2 million over 15 years. Sam noted that no further hiring or equipment would have been needed, so the contract promised to be highly profitable. There was a $15,000 penalty for breaking the contract. On the basis of global corporate citizenship, it was clear that Alpha Electronics could legally produce the devices for the NATO countries but not for the Eastern European company. The Cold War was in full swing at that time. On the basis of local corporate citizenship, it was clear that Alpha Electronics had to consider the expected impact on local communities. In particular, there was no guarantee regarding to whom the Eastern European company would be selling the devices and how they would end up being used. Sam took matters into his own hands without any foreknowledge of how his decision would be viewed by his company's upper management, board of directors, or fellow workers, many of whom were also company stockholders. Happily, Sam was never punished for his unilateral action of halting production. He recently retired from Alpha Electronics as a corporate-level vice president. He was especially gratified by the number of Alpha employees who were veterans of World War II, the Korean War, and the Vietnam War who thanked him for his action. Sam strongly believed his action was the right thing to do, both for his company and for the public welfare.
What ideas typically covered in an engineering ethics course might support that conviction?

2(a)	Describe the most common causes of dispute in construction contract.	4
(b)	Briefly describe "Engineer's Decision Clause" and its advantages.	2+2
(c)	When is mediation a better option?	2
3(a)	What is meant by arbitration?	2
(b)	Write down the advantages of arbitration.	3
(c)	When should litigation be applied?	2
(d)	Write down the disadvantages of litigation.	3
4(a)	What are the common components of a thesis?	2
(b)	What are the points need to be considered for writing a good abstract?	4
(c)	What does citation mean? Why is citation important?	2+2
5(a)	What are the criteria you should consider for giving a good presentation?	4
(b)	Mention the 5 basic processes of Bid Management.	2
(c)	What information is typically collected for pre-qualification?	2
(d)	What is meant by Winners curse and Lowball bids? Please explain.	2

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
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 Final Design and check the adequacy of the following section **Figure: 1** not allowing and considering tension in concrete. Given, M_T=435 kN-m, M_G=285 kN-m, F=671 kN, F_0=808 kN, f_o= 1035 MPa, f_b= -12.5MPa, f_t= -11MPa and f_{se}= 865 MPa. (20)

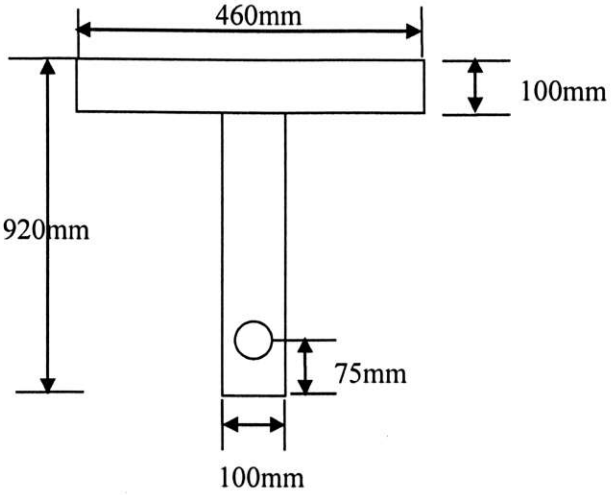


Figure: 1

(b) What are the differences between pretensioning and posttensioning? (5)

2. (a) A symmetric I-section is prestressed with 1850 mm^2 steel with an effective stress 1200 MPa. The c.g.s of strands which supply the prestress is 115 mm above the bottom of the beam as shown in **Figure: 2**. Find the ultimate moment capacity of the section for design. (Given: f_{pu}=1800 MPa, f'_c= 48 MPa) (20)

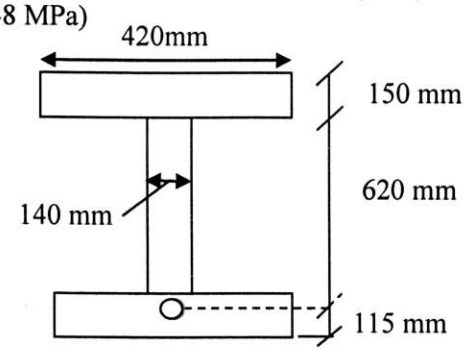
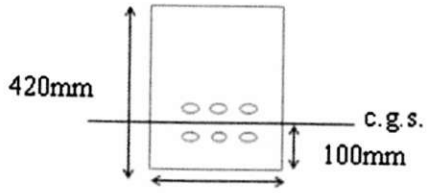


Figure: 2

(b) Define "transfer length" and write down the parameters which affect the length of transfer for prestressing steel of pretensioned member. (5)

3. (a) A pretensioned concrete beam has a section of 250 mm by 420 mm **Figure: 3**. It is eccentrically prestressed with 500 mm^2 of steel which is anchored to the bulkheads at a unit stress of 1200 MPa. The c.g.s. is 100 mm above the bottom fiber. Assuming, $n = 7$, using exact method compute the stresses in the concrete immediately after transfer due to the prestress only. (20)

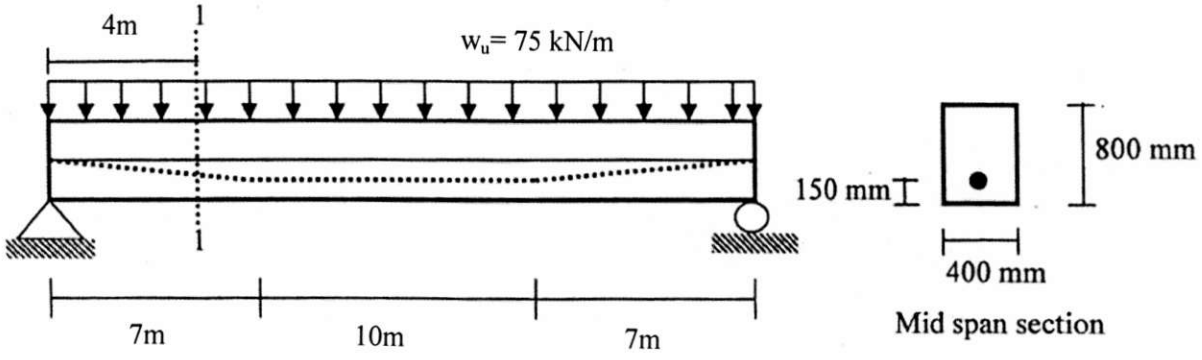


Beam section

Figure: 3

(b) Write down the assumptions of first method used for calculating camber or deflection of prestress concrete. (5)

4. (a) Check the shear strength for the beam shown in **Figure: 4** at section 1-1 which is 4m from support. Given that this section is adequate for w_u= 75 kN/m on the basis of its flexural strength. (**Given:** f'_c=*40* MPa, f_{se} = *1100* MPa, A_{ps} = 1760 mm^2) (20)



Mid span section

Figure: 4

(b) Draw the layouts for posttensioned beams. (5)

5. **(a)** 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 2.** [Given, f_o=860MPa, f_{se}= 750 MPa f'_c= 40 MPa, f'_t= 1.58 MPa, f'_b= 3.16 MPa, M_G= 75 kN-m, M_T=270 kN-m at midspan]. Determine the position for the c.g.s. line. (20)

(b) Draw the location of limiting zone for c.g.s. in prestressed concrete section. (5)

List of useful Formulae

$F= M_T/(0.65h)$, 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 $M_L= M_T - M_G$

*$A_c=F_o/f_b[1+\{e-(M_G/F_o)/k_t\}]$ * $A_c=Fh/f_tC_b$ * $K= r^2/c$ * $f_{ps}=f_{pu}\{1-0.5\rho_p (f_{pu}/f'_c)\}$ * $\rho_p=A_{ps}/bd$*

*$a=(A_{ps}f_{ps}/0.85f'_cb)$ * $w_p=(\rho_p f_{ps}/f'_c) \leq 0.3$ * $M_u=ØA_{ps}f_{ps}\{d-(a/2)\}$ * $A_{pf}=\{0.85f'_c(b-b_w)h_f\}/f_{ps}$*

*$A_w = A_{ps}- A_{pf}$ * $\rho_w= (A_w/ b_w d)$ * $w_{pw}=(\rho_w f_{ps}/f'_c) \leq 0.3$*

$M_u=Ø[A_{pf}f_{ps}\{d-(h_f/2)\} + A_w f_{ps}\{d-(a/2)\}]$

*$f_c = -(F/A_c) \pm (Fey/I)$ * $f_c = -(F/A_g) \pm (Fey/I)$*

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

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

*$a_1= M_T/F$ * $a_2= M_G/F_o$*

*$e_t = f'_bI/Fc_b$ * $e_b= f'_tI/F_oc_t$*

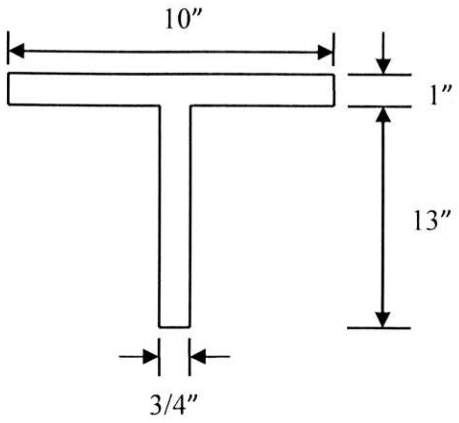
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering VI (Design of Steel Structures) Course Code: CE 417
Time: 2 Hours Full Marks: 120

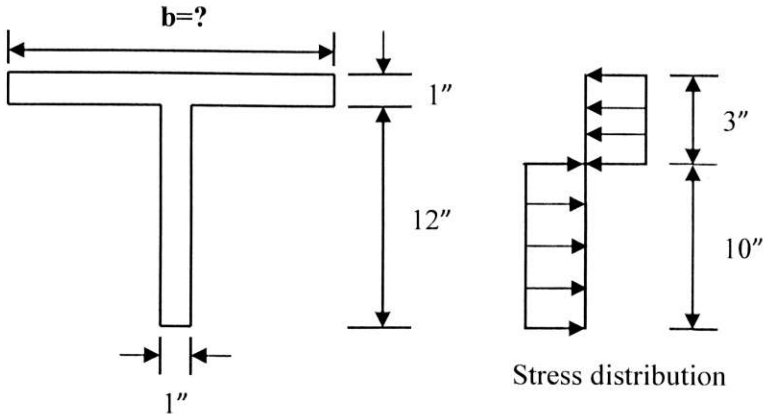
There are **Eight (08)** questions. Answer any **Six (06)** questions

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

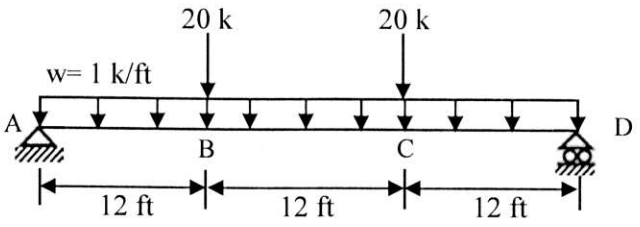
   (b) Cross section of a beam is shown in the following figure. Assume A992 grade steel. (16)
   Calculate
   i. Yield moment
   ii. Plastic moment
   iii. Shape factor



2. (a) Compute the value of **b** and **plastic moment (M_p)** of the following beam section. Given yield stress F_y= 40 ksi. (06)

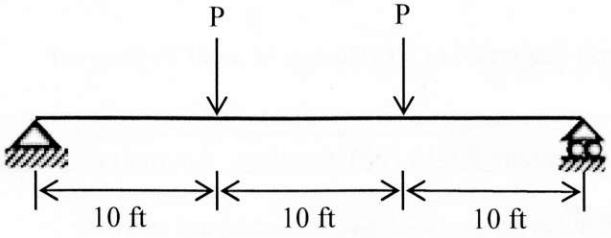


   (b) The beam shown in the figure below has lateral supports at locations A, B, C and D. (14)
   Compute C_b for segment AB and BC. Use **Annexure-2**.



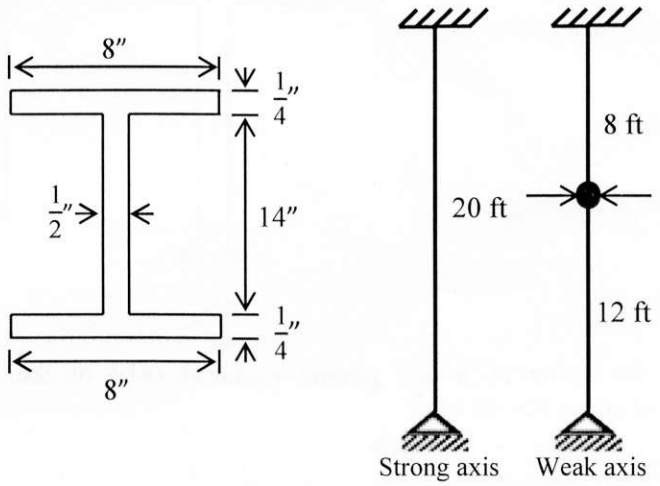
3. (a) What is shear lag? (02)

(b) The beam in the following figure is W 12×50 section. It is laterally supported at both ends and at points of concentrated load. What is the maximum permissible value of P? Use A572 grade 50 steel. Neglect self-weight of the beam and follow AISC-ASD principle. Use **Annexure-1**. (18)

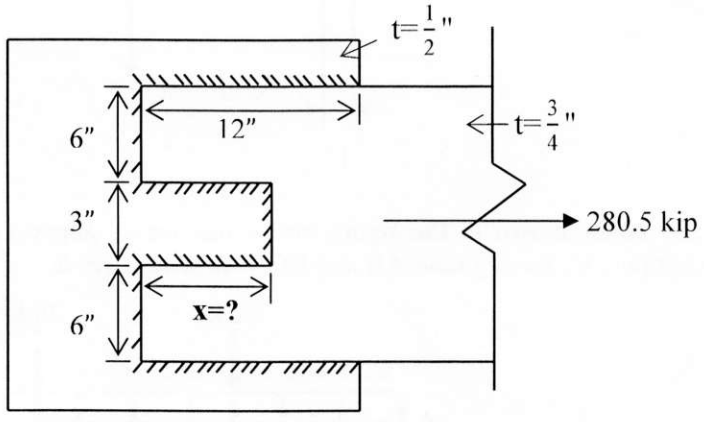


4. (a) Briefly discuss residual stress including its effect. (05)

(b) Using AISC-ASD method, determine the capacity of column having cross section and support conditions shown in the figures below. Use A572 grade 50 steel. Use **Annexure-3**. (15)



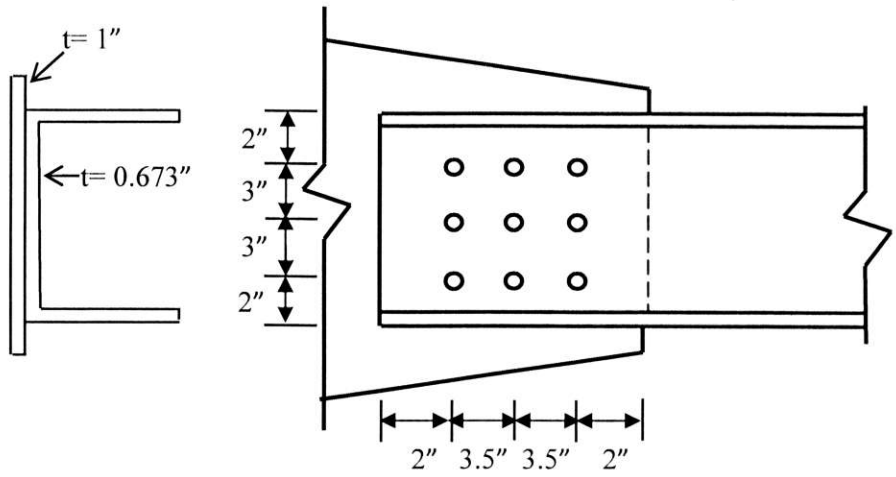
5. (a) A 1/2 in thick plate is connected to 3/4 in thick plate as shown in the figure below by 5/16 in fillet weld. Connection is to transmit a factored load of 280.5 kip. Using AISC-LRFD method with A36 steel plate and E60XX electrodes, design additional longitudinal weld (x) on both sides of the groove. Use **Annexure- 5**. (10)



(b) Show that shape factor of a rectangular beam section is 1.5 (06)

(c) List possible defects in welds. (04)

6. (a) Compute the allowable load capacity for the bearing type connection of two members in the the following figures. Connecting members are C10x30 (A_g= 8.82 in^2, thickness of web, t_w=0.673 in) channel section and 1 in thick gusset plate. Use AISC-ASD method with 7/8-in-diam A325 bolts in standard holes and A36 steel members. Bolt threads are excluded from the shear plane. Use **Annexure- 4**. (14)



(b) Write short notes on (06)

i. Lateral torsional buckling (LTB) of beam.
ii. Stiffened and unstiffened element.

7. (a) Select the lightest W section of A992 steel for a column of 28 ft length to carry compressive forces of 65 kips dead load and 145 kips live load in a braced frame structure. Member is assumed pinned at top and bottom and in addition has weak direction support at mid-height. Use AISC-LRFD method. See **Annexure-3**. (14)
Properties of the sections are given below.

Size	Ag (in^2)	r_x (in)	r_y (in)
W 10×33	9.71	4.19	1.94
W 10×45	13.3	4.32	2.01
W 12×40	11.7	5.13	1.94

(b) Show in sketches possible modes of failure of bolted connection. (06)

8. (a) Two C10x30 (A_g= 8.82 in^2, thickness of web, t_w=0.673 in) channel sections are connected to a 1 in thick gusset plate to transmit 70 kips dead load and 240 kips live load. (12)
Evaluate the number of 3/4-in-diam A325 bolts required for a bearing type connection with threads excluded from the shear planes. Use AISC-ASD method with A36 steel members. Use **Annexure- 4**.

(b) Draw column strength curve and show regions of short, intermediate and long column in the curve. How failure of short column differs from long column? (05)

(c) Explain moment gradient factor (C_b). (03)

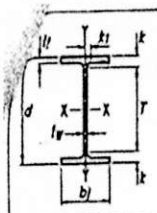


Table 1-1 (continued)
W Shapes
Dimensions

Table 1-1 (continued)
W Shapes
Properties

W14 – W12

Shape	Area, A	Depth, d	Web Thickness, t_w	$t_w/2$	Flange Width, b_f	Flange Thickness, t_f	Distance k_{det}	Distance k_{set}	k_1	T	Work-able Gage	Compact Section Criteria $h/2t$	Compact Section Criteria b/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	5/16	14.7	14¾	1.03	1	1.63	2⅝16	1⅝16	10	5½	7.15	17.7	1530	209	6.28	234	548	74.5	3.76	113	4.23	13.6	12.3	26500
×120	35.3	14.5	14½	0.590	9/16	5/16	14.7	14⅝	0.940	15/16	1.54	2¼	1½			7.80	19.3	1380	190	6.24	212	495	67.5	3.74	102	4.20	13.5	9.37	22700
×109	32.0	14.3	14⅜	0.525	½	¼	14.6	14⅝	0.860	⅞	1.46	2¼16	1½			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	14.6	14⅝	0.780	¾	1.38	2¼16	1⅞16			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	1⅞16			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	14¼	0.510	½	¼	10.1	10⅛	0.855	⅞	1.45	1 11/16	1⅛16	10⅞	5½	5.92	22.4	881	123	6.05	139	148	29.3	2.48	44.8	2.85	13.5	5.07	6710
×74	21.8	14.2	14⅛	0.450	7/16	¼	10.1	10⅛	0.785	13/16	1.38	1⅝	1 1/16			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	1⅛16			6.97	27.5	722	103	6.01	115	121	24.2	2.46	36.9	2.80	13.3	3.01	5380
×61	17.9	13.9	13⅞	0.375	⅜	3/16	10.0	10	0.645	⅝	1.24	1½	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	3/16	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	5/16	3/16	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[c]	12.6	13.7	13⅝	0.305	5/16	3/16	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	3/16	10.0	10	0.640	⅝	1.24	1½	15/16	9¼	5½	7.82	27.0	475	78.0	5.28	86.4	107	21.4	2.51	32.5	2.82	11.6	2.10	3570
×53	15.6	12.1	12	0.345	⅜	3/16	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	3/16	8.08	8⅛	0.640	⅝	1.14	1½	15/16	9¼	5½	6.31	26.8	391	64.2	5.18	71.9	58.3	13.9	1.96	21.3	2.25	11.6	1.71	1880
×45	13.1	12.1	12	0.335	5/16	3/16	8.05	8	0.575	9/16	1.08	1⅜	15/16			7.00	29.6	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	3/16	8.01	8	0.515	½	1.02	1⅜	⅞			7.77	33.6	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	3/8	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	⅜	10.3	10⅜	1.12	1⅛	1.62	1 13/16	1			4.62	11.6	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			5.18	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			5.86	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			6.58	16.7	394	75.7	4.44	85.3	134	26.4	2.59	40.1	2.91	9.63	3.56	3100
×60	17.6	10.2	10¼	0.420	7/16	¼	10.1	10⅛	0.680	11/16	1.18	1⅜	13/16			7.41	18.7	341	66.7	4.39	74.6	116	23.0	2.57	35.0	2.88	9.54	2.48	2640
×54	15.8	10.1	10⅛	0.370	⅜	3/16	10.0	10	0.615	⅝	1.12	1 5/16	13/16			8.15	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	3/16	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

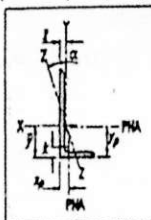


Table 1-7
Angles
Properties

Table 1-7 (continued)
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 $\bar{r}_o$	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	$\tan\alpha$	Q_s 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.		
L7×4×¾	1¼	28.2	7.69	37.8	8.39	2.21	2.50	14.8	1.87	1.47	3.97	3.31	9.00	3.01	1.08	1.00	5.60	0.550	5.64	1.71	0.855	0.324	1.00
×⅝	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	4.69	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	2.38	9.03	1.70	0.310	0.851	3.38	5.79	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	0.198	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	1.66	15.4	0.918	3.68	9.24	3.18	35.4	8.55	1.79	1.66	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	1⅛	28.7	8.46	28.1	6.64	1.82	1.77	11.9	0.705	1.61	4.17	3.24	28.1	6.64	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	1 1/16	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	4.38	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	5.26	0.306	0.129	0.338	3.35	13.0	2.95	1.88	1.60	5.26	0.306	5.20	1.23	1.19	1.00	0.826

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- 2

$$C_b = \frac{12.5M_{max}}{2.5M_{max} + 3M_A + 4M_B + 3M_C} R_m \leq 3.0$$

Annexure- 3

Critical Buckling Stress:

$F_{cr} = [0.658^{Fy/Fe}]\, F_y$

$F_{cr} = [0.877F_e]$

Annexure- 4

$R_n = mA_b F_{nv}$

$R_n = 1.2\, L_c t\, F_u \leq 2.4\, d\, t\, F_u$

Annexure- 5

For weld metal

$R_n = 0.60\, t_e F_{EXX}$

For base metal

$R_n = 0.60\, t\, F_y$ (yielding)

$R_n = 0.60\, t\, F_u$ (rupture)

Department of Civil Engineering
Final Examination Spring 2015
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering IX (Earthquake Resistant Design and Retrofitting) | Course Code: CE 423
Time: 2 Hours | Full Marks: 100

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

1. **a)** Derive equation of motion of free vibration of a critically damped SDOF system. **(8)**

   b) A beam shown in **Figure 1** is pulled for ¼ inch in the downward direction and then suddenly released to vibrate freely. Determine natural time Period of the system and develop and solve the equation of motion for vibrations resulting at free end. Also develop the equation showing variation in the forces with time. Ignore the self-weight of beam as well as damping effect. [Take E = 29,000 ksi and I = 150 in^4] **(12)**

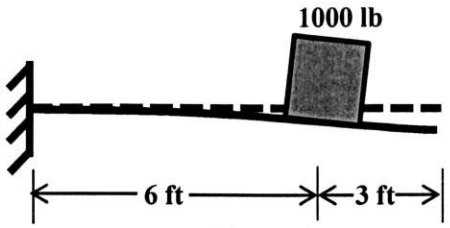


Figure 1

2. **a)** Define Tsunami. Discuss how epicenter is identified after an earthquake event? **5**

   b) What is Ferrocement? Explain the use of ferrocement in repair works. **4**

   c) What are the effects of soil condition on isolated structure? **3**

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

3. **a)** Explain the primary factors responsible for retrofitting necessity in RC structures. **(5)**

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

   c) What is FRP? Discuss different applications of FRP in RC structures. **(6)**

   d) Write short notes on (i) Wet layup technique, (ii) Pultrusion. **(5)**

4. a) What are the specifications for concrete and steel reinforcement for earthquake resistant design? **(5)**

b) The exterior joint shown in the **Figure 2** is a part of a reinforced concrete frame designed to resist earthquake loads. A 6 in slab, not shown, is reinforced with No. 5 bars spaced 10 in center-to-center at the same level as the flexural steel in the beams. The member section dimensions and reinforcement are as shown. The frame story height in 12 ft. Material strengths are f'_c =4000 psi and f_y =60000 psi. The maximum factored axial load on the upper column framing into the joint is 2500 kips, and the maximum factored axial load on the lower column is 3000 kips. Check if the joint satisfies weak beam strong column condition as per ACI 318-08. **(15)**

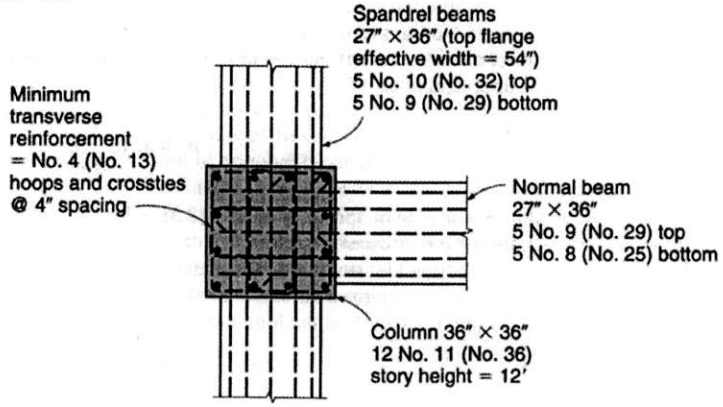


Figure 2

5. a) Check if the joint shown in **Figure 2** satisfies the shear requirement or not. **(12)**

b) Write short notes on: (i) Rubber bearing, (ii) Friction pendulum system. **(5)**

c) What are TMD and TLD? **(3)**

6. a) What is the size and location of opening in masonry wall according to ERD guidelines? Show in neat sketches. **(8)**

b) Determine the time to start corrosion of steel inside concrete in a beam with clear cover =25 mm. [Given, Coefficient of carbonation= 3.75] **(4)**

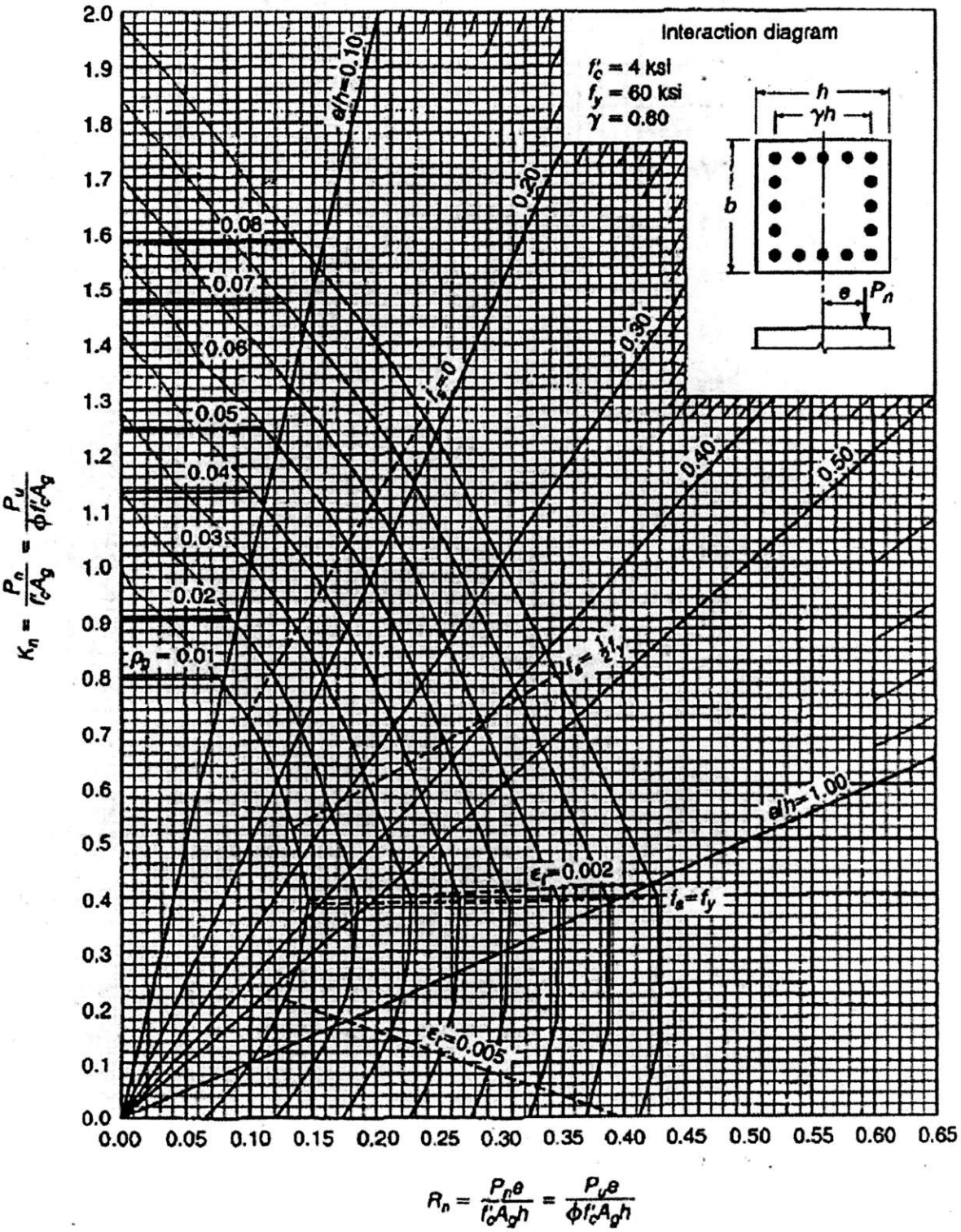
c) Explain the procedure to repair the opening of a window in masonry wall system. **(4)**

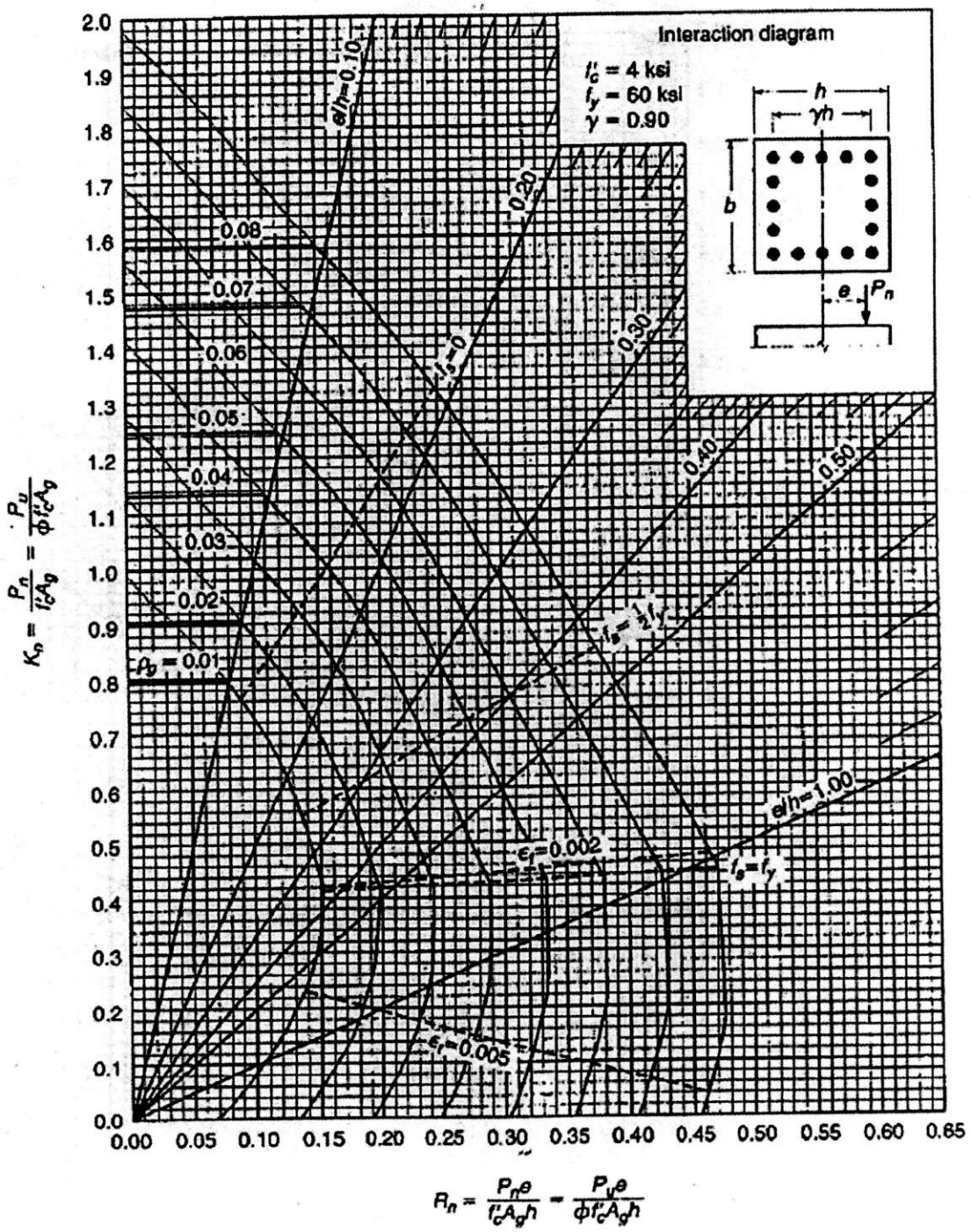
d) Explain different types of cracks in masonry walls. **(4)**

7. a) What is brick masonry? What steps should an engineer take to avoid failure of URM structures due to earthquake? **(6)**

b) What are the failure modes of FRP strengthened flexural member as per ACI. **(6)**

c) What are the construction details of bearing of R.C.C. roof slab over a masonry wall? Show in neat sketch. **(8)**


Interaction diagram
f'_c = 4 ksi
f_y = 60 ksi
γ = 0.60
h
γh
b
e
P_n
e/h=0.10
0.20
0.30
0.40
0.50
1.00
0.08
0.07
0.06
0.05
0.04
0.03
0.02
ρ_g = 0.01
ϵ_t=0.002
f_s=f_y
ϵ_t=0.005
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$


Interaction diagram
f'_c = 4 ksi
f_y = 60 ksi
γ = 0.90
h
γh
b
e
P_n
e/h=0.10
0.20
0.08
0.07
0.06
0.30
0.05
0.40
0.50
0.04
0.03
0.02
ρ_g = 0.01
$f_s = \frac{1}{2} f_y$
e/h=1.00
ϵ_t=0.002
$f_s = f_y$
ϵ_t=0.005
f_s=0
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
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) State the differences between the anaerobic digestion and composting processes. (5)

   (b) Which component in the solid waste management system covers the majority of the solid waste management cost? Classify this component based on the availability of service. State which of these services are available in Bangladesh. (5)

   (c) Solid wastes from a newly build up area is to be collected in large containers (drop boxes), some of which will be used in conjunction with stationary compactor. Based on traffic studies in similar type of areas, it is estimated that the average time to drive from the garage to the first container and from the last container to the garage each day will be 25 minutes and 40 minutes respectively. If the average time required to drive between containers is 5 minutes and the one way distance to the disposal site is 20 km (speed limit 72 km/h), determine the number of containers that can be emptied per day, based on 8-hr working day. Assume Off-route factor 0.15 for this case. (10)

2. (a) Discuss the composition of leachate (in terms of which constituents/contaminants are present in leachate?). Mention the methods you have to adopt if you need to treat the leachate for COD, heavy metals and Total Dissolved Solids. (6)

   (b) Discuss the differences between the area method and the trench method of landfilling. (4)

   (c) Being a site Engineer, you have carried out a site investigation for locating a landfill. Results suggest that there are three soil layers lying between the base of the landfill and the underlying aquifer. The obtained depths of the soil layers, the porosity and the permeability of each layer are tabulated below. Show how you can calculate the time that the leachate would require to migrate to the aquifer. What is the amount of leachate if the area of the landfill is 60 hectares? What are the environmental controls that you need to adopt as an Engineer to prevent the negative environmental impacts from the landfills? (10)

Layers of soil	Depth (m)	Porosity (%)	Permeability (m/s)
Layer A	2.5	40	2.5×10^{-8}
Layer B	1.5	45	1.9×10^{-7}
Layer C	1.8	42	5.3×10^{-7}

3. (a) Write down the general formula for anaerobic digestion. (3)

(b) Show the major stages of waste degradation in landfills in a schematic. (6)

(c) Estimate the theoretical volume of methane (CH_4), carbon-di-oxide (CO_2) and Ammonia (NH_3) that would be expected from anaerobic digestion of per ton of waste having the composition $C_{60}H_{94.3}O_{37.8}N$. The density of CH4, CO_2 and NH_3 at standard temperature and pressure (STP) are 0.7167 kg/m^3, 1.9783 kg/m^3 and 0.696 kg/m^3 respectively. Also determine the percentage composition of the resulting gas mixture (relative fractions of the three gases). (11)

4 (a) Discuss the significance of recycling and reuse of waste. What are the associated risks involved? (8)

(b) Discuss the difference in digestion or energy recovery process happening in an anaerobic chamber with that happening in a landfill. (3)

(c) You work for an industry which disposes various kinds of wastes as residuals of the manufacturing processes involved. Which categories of the wastes should be considered as hazardous? What are the general problems to be expected to treat and dispose this hazardous waste in our country? List the factors that you have to consider if the company asks you to cite a landfill site for the hazardous waste. (9)

5 (a) Define industrial waste with examples. Provide a flow diagram of industrial waste management. (7)

(b) What is life cycle assessment? Mention the four stages of life cycle assessment. (5)

(c) Calculate the required landfill area for the Dhaka North community for the year 2016 using the following data : (8)

Projected Population = 15,00,000
Per capital generation rate = 0.55 kg/cap/day
Diversion Factor = 0.20
Compacted waste density = 700 kg/m^3
Average depth of landfilling = 7.5 m
Assume a daily soil cover is used that accounts for 20% of the landfill volume.

6 (a) Draw the hierarchy of priorities in hazardous waste management. How can elimination of generation of hazardous waste be achieved? (5)

(b) Show the recycling pattern of urban solid waste in Bangladesh in a schematic. (5)

(c) A transfer station was built with an installation cost of 5,00,000 BDT with yearly operational cost being 40,000 BDT. The transfer station is meant to handle 350 tons/day operating 6 days a week. To be operated to and from the transfer station, a tractor-trailor was bought with 1,20,000 BDT which will require 10,000 BDT for yearly operation and maintenance. The truck carries 50 tons/trip. A driver appointed would require 3,000 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 30 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. (10)

Given Formula:

Haul Container System	**Stationary Container System**
$T_{hcs} = (PT_{hcs} + q + m + nx)$ $PT_{hcs} = pc + uc + dbc$ $Md = \{(1-W)L\ (t_1 + t_2)\}\ /Thcs$	$T_{scs} = (PT_{scs} + q + m + nx)$ $PT_{scs} = C_t uc + (S-1)(dbc)$ $C_t = \frac{V_v z}{V_c f}$ $\quad M_{dc} = \frac{V_d}{V_v z}$ $L = \frac{(t_1 + t_2) + M_{dc}(PT_{scs} + q + m + nx)}{1 - W}$

$$C_aH_bO_cN_d + \frac{4a-b-2c+3d}{4}H_2O \rightarrow \frac{4a+b-2c-3d}{8}CH_4 + \frac{4a-b+2c+3d}{8}CO_2 + d\,NH_3$$

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

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 Spring 2015
Program: B.Sc. Engineering (Civil)
Final Quiz, CE 433

Course Title Environmental pollution and its control **Course Code CE-433**
Time-2 hours **Full marks: 120**

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

(Assume reasonable value for any missing data)

Section-A

[Answer any 3(three) from the following 4 (four) questions]

1. (a) Find out the probable water quality problems, affected water use and associated water quality variables for the following manifestation of problem in surface water body.(i)Significant fish kill (ii)Disease transmission (6)
   (b) Why residents of Los Angels in USA often need to change their automobile tires? (2)
   (c) What do you understand by particles of anthropogenic origin? Why it is often considered as harmful? What is Phytotoxin ? (5)
   (d) Write down the names of different air pollution control devices.
   (e) Alveolar deposition is not significant whenever head airways and tracheobronchial airways deposition is high. Explain the statement with necessary figures. (7)

2. (a) What are the negative impacts on atmosphere due to air pollution? (3)
   (b) What are the differences between Absorption and Adsorption ? (2)
   (c) What is the significance of the term 'Air fuel ratio'? Explain its effect on Emission, Power and Fuel economy? (7)
   (d) What is blue baby syndrome? (2)
   (e) Explain phosphorous model for a lake with a net sketch. (6)

3. (a) What are the differences between point sources and non-point sources? (3)
   (b) What do you understand by oxygen demanding waste? Why COD is always higher than BOD? (4)
   (c) What is Eutrophication? What are the problems associated with this phenomena? What might be the controlling factors? (9)
   (d) What are volatile organic compounds? Mention few of their characteristics along with examples. (4)

4. (a) Explain the different particle deposition mechanisms. (6)
(b) Briefly describe the layers in a stratified lake with necessary figures. Which type of lake becomes more vulnerable to summer stratification? Explain your answer. (7)
(c) What are the limiting factors? It was found in a sample from a lake that N/P>15.Which one is the limiting factor between these two nutrients? (3)
(d) What is thermal stratification? (1)
(e) Write down the classification of lakes according to the degree of enrichment of nutrient and organic matter. (3)

Section-B

[Answer any 3 (three) from the following 4 (four) questions]

5. (a) For a lake fed by a stream and also receiving wastewater, Given, $A = 100\times10^6\ m^2$ $Q_w = 0.4\ m^3/s$, $P_w = 10\ g/m^3$, $Qs = 20\ m^3/s$, $Ps = 1.0\ g/m^3$, $\upsilon_s = 10\ m/yr$. (i) Estimate average P concentration in lake. (ii) Estimate P removal rate at a treatment plant to keep P concentration below 0.04 mg/L. (14)
(b) A 25 mL sample of sewage is mixed with enough dilution water to fill a 300 mL BOD bottle. The bottle has an initial DO of 8.2 mg/L and at the end of 5 days measured DO is 2.8 mg/L. Calculate BOD_5 for the sewage. (6)

6. (a) For a BOD test: initial DO = 8.5 mg/L. After 5 days, DO = 4.5 mg/L. If dilution factor P = 50 and k = 0.20/d, calculate: (i) BOD_5 (ii) ultimate CBOD, (iii) BOD remaining after 5-days. (10)
(b) Draw schematic diagram of a cyclone collector. (7)
(c) What are the sources of DO in Surface water? (3)

7. A wastewater treatment plant serving a city of 2 million people discharges 1.10 m^3/s of treated effluent having an ultimate BOD of 50.0 mg/L and DO concentration of 2.0 mg/L into a stream that has a flow of 8.70 m^3/s with a BOD of its own, equal to 6.0 mg/L. DO concentration equal to 8.3 mg/l and a temperature of 20°C.The de-oxygenation constant, k_d is 0.20/day.
(i) Estimate the ultimate BOD of the river just downstream from the outfall. (20)
(ii) If the stream has constant cross section so that it flows at a fixed speed equal to 0.30 m/s, estimate the BOD remaining in the stream at a distance of 30000 m downstream.
(iii)Estimate the initial dissolved oxygen deficit of the mixture of wastewater and river water just downstream from the discharge point.

8. (20)

Wastewater:	River:
T = 25°C	T = 25°C
Q_w= 5000 m3/d	Q_r= 55000 m3/
BOD_5 = 70 mg/L	BOD_5 = 4 mg/L
DO = 2 mg/l	DO = 8 mg/L

Given, k value for mixture of waste water and river water = 0.23/d. Velocity of stream = 0.2 m/s .Average stream depth = 2.66 m. Estimate DO_{min}, x_c, t_c and sketch DO profile for a 100 km reach. Also, estimate BOD_5 of a sample taken at the critical point.

Formulae

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

$$D_c = \frac{k_d}{k_r} \cdot L_0 \cdot e^{-k_d \cdot t_c}$$

$$\mathbf{DO_{min} = DO_{sat} - D_c}$$

$$t_c = \frac{1}{k_r - k_d} \ln\left[\frac{k_r}{k_d}\left(1 - \frac{D_0[k_r - k_d]}{k_d \cdot L_0}\right)\right]$$

$$DO_{sat} = 14.62 - 0.394\,T + 0.007714\,T^2 - 0.0000646\,T^3$$

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

$$k_{r(20^\circ C)} = \frac{3.9u^{1/2}}{H^{3/2}}$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
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
   - Scoping
   - 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) Mass Rapid Transit in Dhaka City d) Rooppur Nuclear Power Plant.

   A) Identify the three most important impacts of your project. Write only the names. 2

   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. 10

   (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.)

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) Mass Rapid Transit in Dhaka City d) Rooppur Nuclear Power Plant.

5. A) Draw the figure showing three steps (or main elements) of impact mitigation. 4

   B) Government is proposing to construct a new export processing zone (EPZ) in an area covering 267 Acres. After completion, the EPZ will have 250 industrial plots. The area proposed for the new EPZ is located in a rural 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 five benefits for each stakeholder group):

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

6. A) What are the different components of Environmental Management Plan (EMP) and explain how to address those EMP components. 2+4

   B) What are the objectives of EIA Review? 2

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