4-2

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

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

Answer all questions.

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

In 1968, Norm Lewis was a 51-year-old doctoral candidate in history at the University of Washington. While taking his final exam in the program, he excused himself to go to the bathroom, where he looked at his notes. For the next 32 years, Lewis told no one. At age 83, he decided to confess, and he wrote to the president of the university admitting that he had cheated and that he had regretted it ever since.

Commenting on the case, Jeanne Wilson, president of the Center for Academic Integrity remarked, ''I think there is an important lesson here for students about the costs of cheating. He has felt guilty all these years, and has felt burdened by this secret, believing that he never really earned the degree he was awarded.'' Wilson's position is that the University of Washington should not take action against Lewis, given his confession, his age, and the fact that, after all, he did complete his coursework and a dissertation. But, she added, ''On the other hand, I think an institution might feel compelled to revoke the degree if we were talking about a medical or law degree or license, or some other professional field such as engineering or education, and the individual were younger and still employed on the basis of that degree or license.''

Discuss the ethical issues this case raises, both for Dr. Lewis and for University of Washington officials. Evaluate Jeanne Wilson's analysis, especially as it might apply to engineers.

2(a)	Describe the most common causes of dispute in construction contract of Bangladesh.	3
(b)	Briefly describe "Engineer's Decision Clause" and its advantages.	1+2
(c)	Name various types of dispute resolution methods. Which one you consider the best? Why?	4
3(a)	What is meant by arbitration?	2
(b)	Write down the advantages of arbitration.	3
(c)	What is meant by litigation?	2
(d)	Write down the disadvantages of litigation.	3
4(a)	What are the components need to be considered for preparing 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 things you should consider for giving a good presentation?	4
(b)	In making presentation slides (ppt), what things you should consider most?	2
(c)	Write down the 4 characteristics of good procurement process.	2
(d)	What is meant by Winners curse and Lowball bids? Please explain.	2

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

Course Title: Structural Engineering VI (Design of Steel Structures) | Course Code: CE 417
Time: 2 Hours | Full Marks: 100

There are **Seven (07)** questions. Answer any **Five (05)** questions

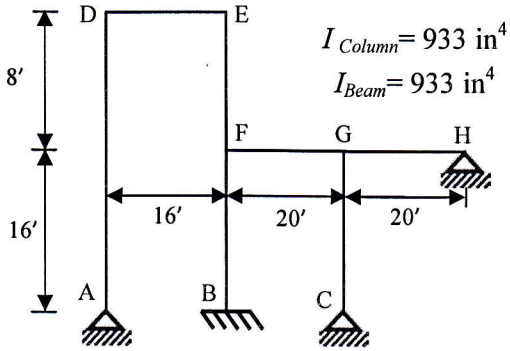
1. (a) A W12×50 section of A36 steel is used as a column to support an axial compressive load of 145 kips. Length of column is 20 feet and the ends are pinned. Without regards to load resistance or strength reduction factors, investigate the stability of the column section under compressive load. [Given, A_g= 14.6 in^2, r_x= 5.18 in, r_y= 1.96 in] (05)

   (b) A 18 feet long compression member is pinned at top and bottom along both axes and has weak direction support at mid-height. A total service load (compression) of 400 kips consists of 50% dead load and 50% live load must be supported by the compression member. Use ASTM A572 grade 50 steel. Select the lightest W section by using **AISC-LRFD** method. (15)

   Properties of the sections are given below.

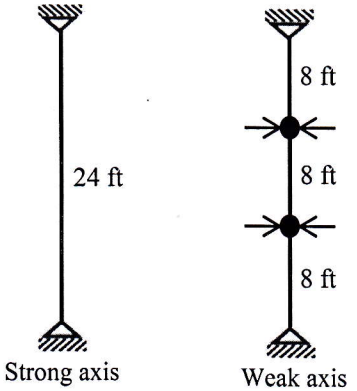
Size	Ag (in^2)	r_x (in)	r_y (in)
W8×58	17.1	3.65	2.10
W10×49	14.4	4.35	2.54
W12×53	15.6	5.23	2.48

2. (a) Calculate effective length factor (k) for columns **BF, FE and CG** as shown in the figure. (12)



   (b) A W12×58, 24 feet long column is pinned at both ends and braced in the weak direction at the third points of column height as shown in the following figure. If A992 steel is used, determine the compressive strength of the column. (08)

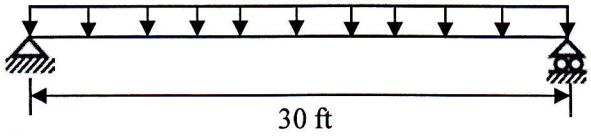
   [Given, A_g= 17 in^2, r_x= 5.28 in, r_y= 2.51 in]



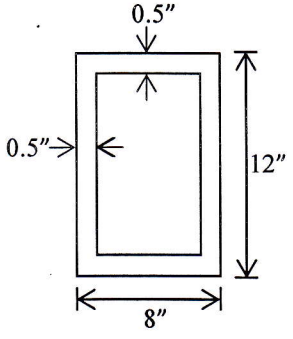
3. (a) A W16×31 section of A992 steel is used as simply supported beam of 30 feet span with loading condition as shown in the following figure. Compression flange of the section is embedded in a concrete floor slab. Using **AISC-ASD** method, check the adequacy of the beam regarding flexural strength. (10)

w_{DL}= 450 lb/ft (in addition to self-weight);

w_{LL}= 550 lb/ft



(b) Cross section of a built up Hollow Structural Section (HSS) is shown in the following figure. Calculate shape factor of the section. (10)



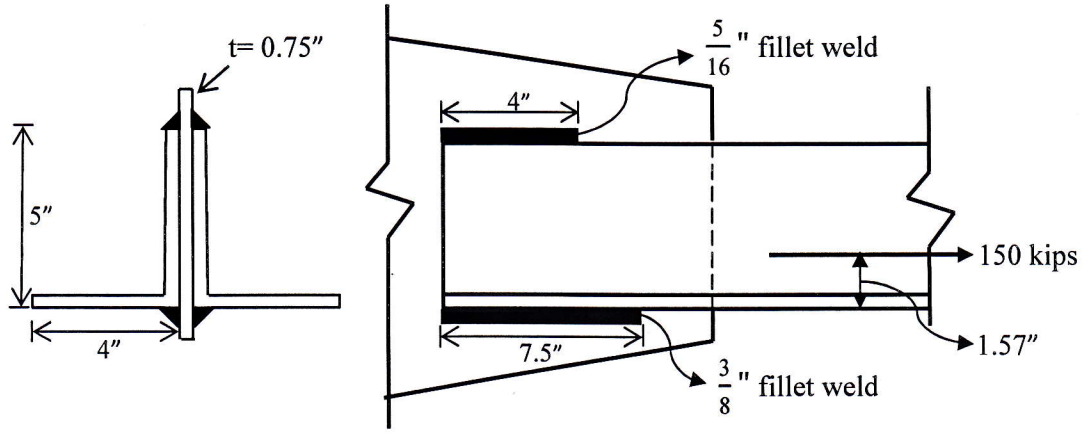
4. A simply supported beam with a span length of 45 feet is laterally supported only at its ends. It is subjected to service dead load of 400 lb/ft (including self-weight) and service live load of 1000 lb/ft. If W14×90 section of A572 grade 50 steel is used (20)

i. Check the adequacy of section for flexure.

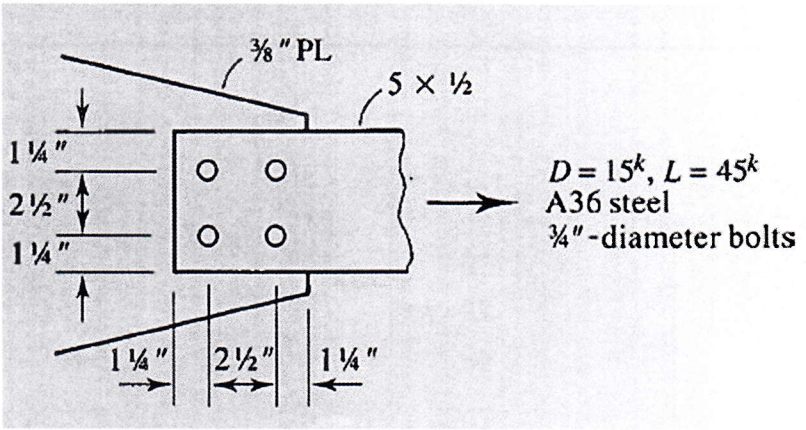
ii. Also check the section for shear.

5. (a) List possible defects in welds. (03)

(b) Two L5×4×1/2 sections are to be connected to a 0.75 inch gusset plate to transmit a total service load of 150 kips as shown in the figure. Use E60XX electrodes and A36 steel for base metal. Check the adequacy of the weld connection . If the connection is inadequate, redesign the weld connection. Use **AISC-ASD** method. (17)



6. (a) Check bolt spacing, edge distances and bearing strength of the connection according to **AISC-ASD** method as shown in the following figure. A36 steel and ¾ inch diameter A325 (thread excluded) bolts are used. (10)



(b) A plate 3/8×6 is used as a tension member to resist a service dead load of 12 kips and live load of 33 kips. This member will be connected to a 3/8 inch gusset plate with 3/4-inch-diameter A325 bolts. A36 steel is used for both the tension member and the gusset plate. Assume that bearing strength is adequate and threads are included in the shear plane. Determine the number of bolts required based on shear. Use **AISC-ASD** method. (06)

(c) Illustrate possible failure modes of bolt connections due to shear and bearing. (04)

7. Write short notes on (20)
   i. Moment gradient factor (C_b).
   ii. Shear lag.
   iii. Lateral torsional buckling (LTB) of beam
   iv. Elastic and plastic section modulus.
   v. Advantages and disadvantages of steel structures over concrete structures.

Formulae for CE 417

Beam LTB formula's

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

Critical Buckling Stress:

$F_{cr} = [0.658^{Fy/Fe}]\,F_y$ $\qquad F_e = \dfrac{\pi^2 E}{\left(\frac{KL}{r}\right)^2}$

$F_{cr} = [0.877F_e]$

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

Nominal shear in beam:

If $\frac{h}{tw} < 2.24\sqrt{\frac{E}{Fy}}$

Then $V_n = 0.6\,F_y A_w$

$R_n = mA_b F_{nv}$

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

For weld metal

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

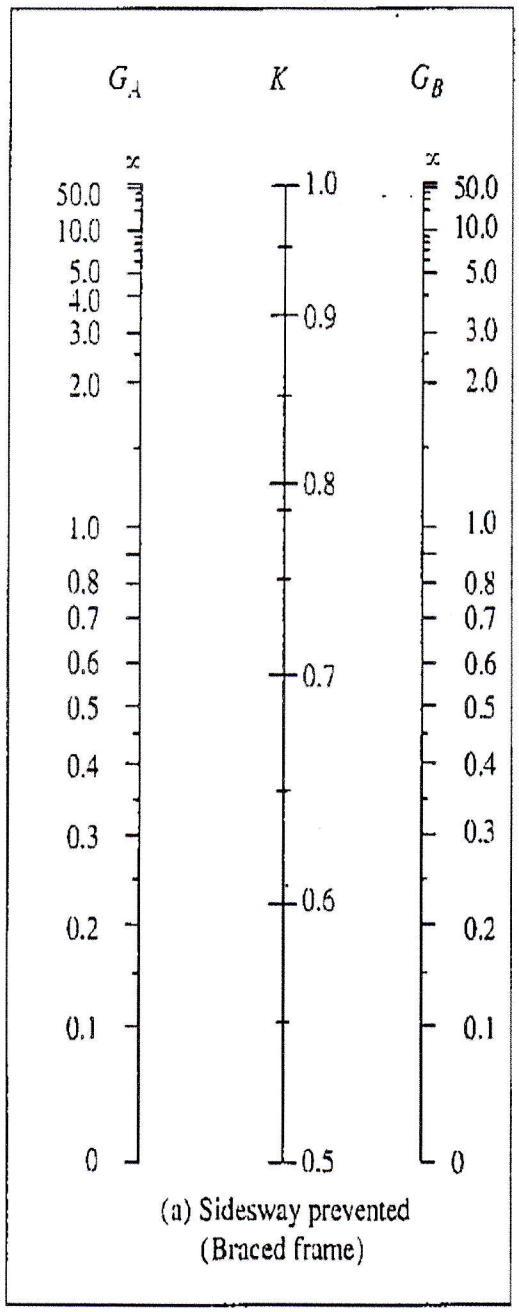
For base metal

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

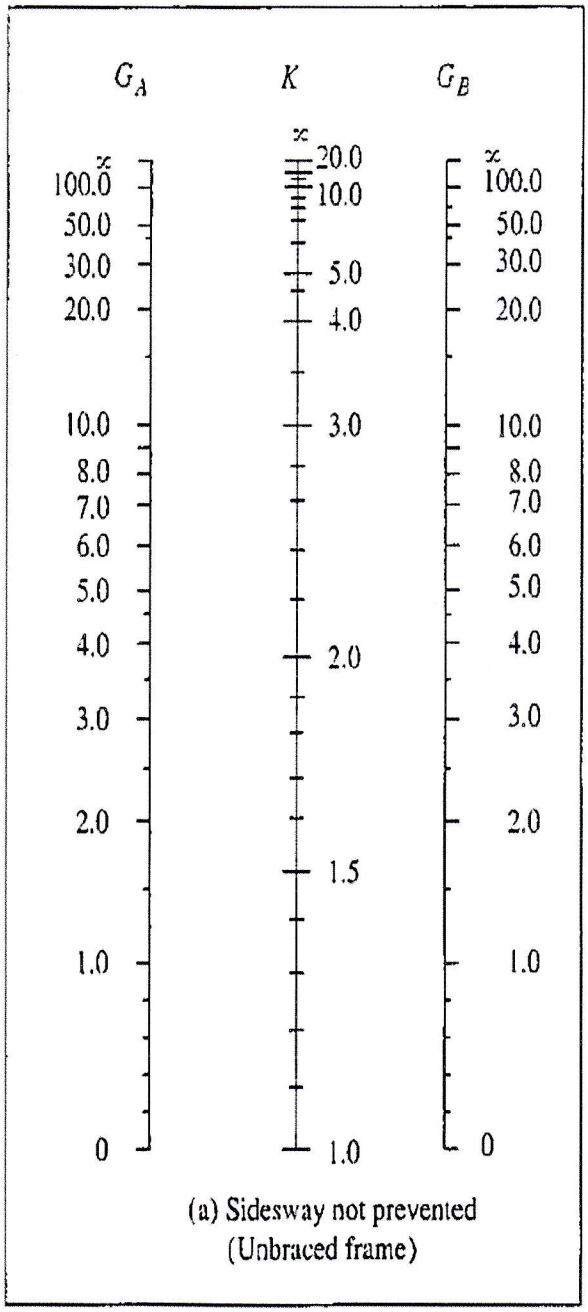
$R_n = 0.60\,t\,F_u$ (rupture)

Alignment Chart

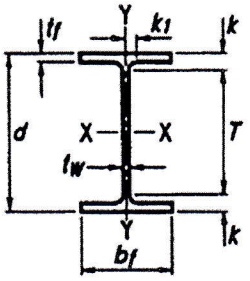
Question 2(a)



(a) Sidesway prevented
(Braced frame)



(a) Sidesway not prevented
(Unbraced frame)



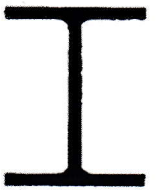
Question 3(a)

W Shapes
Dimensions

Shape	Area, A	Depth, d		Web: Thickness, t_w		$\frac{t_w}{2}$	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k, k_{des}	Distance: k, k_{det}	Distance: k_1	T	Work-able Gage
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W16×100	29.5	17.0	17	0.585	9/16	5/16	10.4	10 3/8	0.985	1	1.39	1 7/8	1 1/8	13 1/4	5 1/2
×89	26.2	16.8	16 3/4	0.525	1/2	1/4	10.4	10 3/8	0.875	7/8	1.28	1 3/4	1 1/16		
×77	22.6	16.5	16 1/2	0.455	7/16	1/4	10.3	10 1/4	0.760	3/4	1.16	1 5/8	1 1/16		
×67[c]	19.7	16.3	16 3/8	0.395	3/8	3/16	10.2	10 1/4	0.665	11/16	1.07	1 9/16	1		
W16×57	16.8	16.4	16 3/8	0.430	7/16	1/4	7.12	7 1/8	0.715	11/16	1.12	1 3/8	7/8	13 5/8	3 1/2 9
×50[c]	14.7	16.3	16 1/4	0.380	3/8	3/16	7.07	7 1/8	0.630	5/8	1.03	1 5/16	13/16		
×45[c]	13.3	16.1	16 1/8	0.345	3/8	3/16	7.04	7	0.565	9/16	0.967	1 1/4	13/16		
×40[c]	11.8	16.0	16	0.305	5/16	3/16	7.00	7	0.505	1/2	0.907	1 3/16	13/16		
×36[c]	10.6	15.9	15 7/8	0.295	5/16	3/16	6.99	7	0.430	7/16	0.832	1 1/8	3/4		
W16×31[c]	9.13	15.9	15 7/8	0.275	1/4	1/8	5.53	5 1/2	0.440	7/16	0.842	1 1/8	3/4	13 5/8	3 1/2
×26[c,v]	7.68	15.7	15 3/4	0.250	1/4	1/8	5.50	5 1/2	0.345	3/8	0.747	1 1/16	3/4	13 5/8	3 1/2

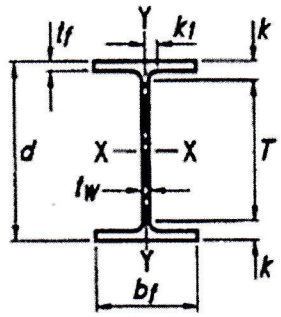
Question 3(a) (Continued..)

W Shapes
Properties



W16 – W14

Nom-inal Wt.	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
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
100	5.29	24.3	1490	175	7.10	198	186	35.7	2.51	54.9	2.92	16.0	7.73	11900
89	5.92	27.0	1300	155	7.05	175	163	31.4	2.49	48.1	2.88	15.9	5.45	10200
77	6.77	31.2	1110	134	7.00	150	138	26.9	2.47	41.1	2.85	15.8	3.57	8590
67	7.70	35.9	954	117	6.96	130	119	23.2	2.46	35.5	2.82	15.7	2.39	7300
57	4.98	33.0	758	92.2	6.72	105	43.1	12.1	1.60	18.9	1.92	15.7	2.22	2660
50	5.61	37.4	659	81.0	6.68	92.0	37.2	10.5	1.59	16.3	1.89	15.6	1.52	2270
45	6.23	41.1	586	72.7	6.65	82.3	32.8	9.34	1.57	14.5	1.88	15.6	1.11	1990
40	6.93	46.5	518	64.7	6.63	73.0	28.9	8.25	1.57	12.7	1.86	15.5	0.794	1730
36	8.12	48.1	448	56.5	6.51	64.0	24.5	7.00	1.52	10.8	1.83	15.4	0.545	1460
31	6.28	51.6	375	47.2	6.41	54.0	12.4	4.49	1.17	7.03	1.42	15.4	0.461	739
26	7.97	56.8	301	38.4	6.26	44.2	9.59	3.49	1.12	5.48	1.38	15.3	0.262	565



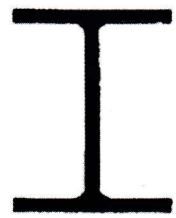
Question 4(b)

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	Work-able 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		

Question 4(b) (Continued…)

W Shapes
Properties



W14 – W12

Nom-inal 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 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) What is a transfer station? What are the benefits and the problems associated with transfer stations? (2+5)

(b) What are the commonly adopted environmental controls in a modern landfill? (4)

(c) A summary table for the chemical components of a solid waste sample is given below. Determine approximate chemical formulas with and without sulfur. (9)

Component	Moisture	Carbon	Hydrogen	Oxygen	Nitrogen	Sulfur	Ash
Mass (kg)	25.60	50.20	5.56	35.00	0.45	0.26	7.14
Molar Mass (kg/mol)	-	12.00	1.00	16.00	14.00	32.00	-

2. (a) What are the challenges/risks in recycle/recovery of waste? Explain with example the difference between resource recovery by material separation and resource recovery by material conversion. (4+4)

(b) Show the difference between direct haul system without a transfer station and a system with a transfer station using a diagram. (4)

(c) A tannery dumps waste every day @ a rate of 50 tons per day into Buriganga river except Saturday. Also, there is no waste collection system available in the surrounding residential area that generates 0.1 tons per capita per day with 2000 people and the ultimate destination for this waste is Buriganga river beside tannery. If a waste collection vehicle to be bought for collecting the residential waste costs 60,000 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 6,000 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. (8)

3. (a) Define Life Cycle Assessment. What are the considerations to be adopted in industrial waste collection and disposal? (6)

(b) Show the flow chart of anaerobic digestion and mention the uses of the final products of the process. Why is the energy recovery rate higher in anaerobic digestion than the recovery from landfill? (6)

(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. (8)

4 (a) What are the factors that will affect the success of composting process? List the advantages of composting process. (7)

(b) Categorize hazardous waste and provide examples of any three of these categories. (4)

(c) 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 the following: (9)

1) Choose the type of method of landfilling
2) Mention a leachate management system
3) 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.

5 (a) What are the key concepts of source reduction? Explain with example how you would calculate source reduction for a given community. (6)

(b) Discuss the ways that the landfill gases can be controlled. (4)

(c) The following five soil layers are lying between the base of a landfill and the underlying aquifer. How long will it take for leachates to migrate to the aquifer? Also calculate the amount of leachate that will flow down if the landfill area is 60 hectares. Comment whether the site is appropriate for a landfill or not. (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}
Layer D	2.8	39	3.8×10^{-5}
Layer E	3.0	41	4.1×10^{-8}

6 (a) Show the pathway that hazardous waste travels in an environment connecting different environmental reservoirs. State your opinion on how it is possible to reduce the impact of these hazardous substances on us consulting their pathways. (7)

(b) What are the site selection factors for a landfill? Mention which of these require weather specific, time specific and cost specific considerations. (5)

(c) Following table shows a comparison of costs for trucks making one, two or three trips per day to disposal site. Perform an economic analysis for each of the options (1, 2 or 3 trips) by estimating the annual cost per ton of waste and annual cost per household using the given information. Also discuss each of the options in terms of their suitability for optimum cost and time. Which option will provide the maximum benefit? (8)

Number of trips per day	Houses served per truck	Minimum truck size (yd^3)	Total waste (ton)	Annual Truck cost ($/yr)	Annual Labor Cost ($/yr)
1	2050	35	3200	164,556	99,840
2	1700	15	2600	82,643	99,840
3	1350	8	2000	55,338	99,840

Given Formula:

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

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 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 preliminary design for section of a prestressed-concrete beam to resist a total moment of 520 kN-m including girder self-weight moment 95 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 (f_{se}) for steel is 850 MPa, and allowable stress for concrete under working load (f_c) is -11 MPa. (8)

   (b) Make final design for the preliminary section obtained in 1(a) based on elastic theory and allowing tension in the concrete both at transfer and under working load. [Given values are f'_t=2.1 MPa, f'_b = 1.65MPa, f_b = -12.5 MPa, f_0 = 1035 MPa, F_o= 968 kN]. (17)

2. (a) A simply supported concrete beam of 12 m span post tensioned with 960 mm^2 of high-tensile steel to an initial prestress of 1000 MPa. A concentrated load of 45 kN is applied at midspan immediately after prestressing. If E_c= 36000 MPa compute the initial deflection at midspan due to prestress and self-weight of the beam. Cross section of the rectangular beam is of 320 mm width 500 mm depth. The c.g. of cable is 150 mm from bottom at midspan and 200 mm from top at end of section. Also estimate the deflection after 2.5 months assuming creep factor of 1.75. [Given that 15% loss of prestress occurs]. (15)

   (b) Draw four layouts of tendons in simple pre-tensioned simply supported beam. (5)

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

3. A section of simply supported composite beam of 25m span is shown in **Figure 1.** The precast stem is prestressed with an effective force of 1300 kN assuming a total loss as 15%. After this precast portion is erected in place, a top slab of 120 mm by 1000 mm wide is cast in place and it produces a moment of 140 kN-m. After the slab has hardened the composite section is to carry a uniformly distributed live load moment of 650 kN-m. Moment at midspan due to weight of the precast section is 120 kN-m. Compute the stresses in the section at different stage of loading and also draw the stress distribution at these stages. [Given, A_{ps}= 2200 mm^2, f_{pu}=1340 MPa, f'_c= 35 MPa]. (25)

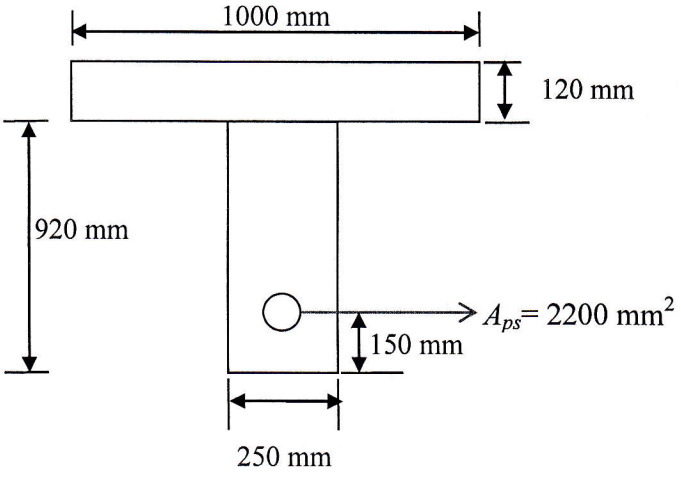


Figure: 1

4. (a) Check shear strength for station a-a for the beam shown in **Figure 2**. The symmetric I-shaped noncomposite section spans 20 m and it is adequate for w_u = 85 kN/m. Given, F = 1860 kN, f'_c= 50 MPa and w_d = 6.5 kN/m (beam weight),e = 340 mm. (15)

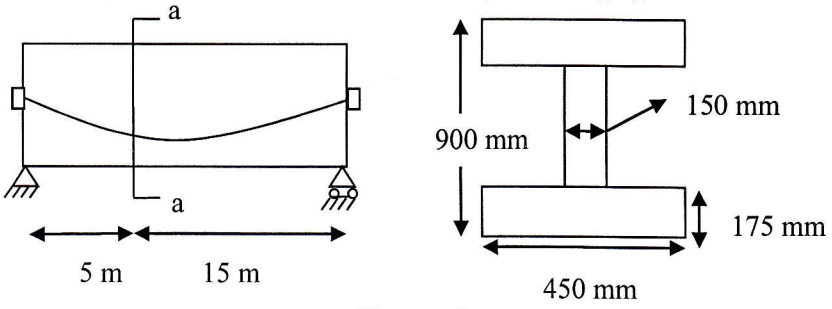


Figure: 2

(b) Define length of transfer. Write down the most important factors which affect the length of transfer. (10)

5. (a) Draw the stress distribution diagram in concrete for several location of compressive force by the elastic theory. (10)

(b) Fourteen steel wires of 9 mm diameter with anchorages are used for prestressing of a 15 m pretensioned beam. The simply supported beam has symmetrical I-section shown in **Figure 2.** Determine the position for the c.g.s. line. (15)
[Given, f_o= 860MPa, f_{se}= 750 MPa, f'_c= 40 MPa, M_G= 75 kN-m, M_T=270 kN-m at midspan]

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 $M_L = M_T - M_G$

*$A_c = F_o h/(f_b c_t - f'_t c_b)$ * $A_c = Fh/(f_t C_b - f'_b c_t)$ *$K = r^2/c$ * $f_{ps} = f_{pu}\{1-0.5\rho_p (f_{pu}/f'_c)\}$ * $\rho_p = A_{ps}/bd$

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

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

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

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

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

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

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

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

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 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 (14 + 12*3 =50).

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

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

2. A) According to Environmental Conservation Rules (1997) of Bangladesh, in which category can the following industrial units and projects be classified (i.e. Green, Orange A, Orange B, Red)? (5)

Industrial Unit/Project	Category
Ship-breaking	
Assembling and manufacturing of toys (plastic made items excluded)	
Cinema hall	
Sewage treatment plant	
Public toilet	

   B) Elaborately explain three steps process of impact mitigation. (3)

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

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 four most important impacts of your project. Write only the names. (2)

B) Graphically show the time versus impact significance of these four 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) Write down the main advantages and disadvantages of different impact identification methods. (4)

B) Following the scoping process, compile eight specific impacts and classify the impacts according to their importance: (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) 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) The Karnaphuli River has divided Chittagong district in two parts. One part is confined with the city and the port; the other part is the area of heavy industry. So Government of Bangladesh has decided to construct Karnaphuli Multi-Lane Tunnel to connect the divided 2 (two) part of Chittagong district due to Karnaphuli River. The proposed Tunnel will connect the Chittagong Port City directly with other side of the Karnaphuli River and indirectly with other parts of the country through Dhaka-Chittagong-Cox's Bazar Highway. The width of the river at the site of the proposed Tunnel is 700 meters and the water depth is 9-11 meters. The indicative length of the proposed Tunnel is 2000 meters. (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) Elaborately explain six different components of Environmental Management Plan. (4)

B) Explain the main steps of EIA review. (4)

C) Explain four main types of social impacts.. (4)

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

Course Title: Environmental Engineering IV | Course No: CE 433
Time: 2 hours | Full Marks: 100

There are **FIVE** questions. Answer any **FOUR** (4*25=100)
[Assume reasonable value of missing data (if any)]

1. (a) What are the major causes of marine pollution? [5]
   (b) Discuss about the following categories of water pollutants:
   i) Nutrients
   ii) Heavy metals
   iii) Pesticides
   iv) Volatile organic compounds (VOCs) [20]

2. (a) Draw a graph mentioning De-oxygenation curve, Re-oxygenation curve and DO sag curve. [5]
   (b) Write short notes on i) indoor air pollution ii) IAQ [10]
   (c) What are the major causes of industrial pollution? What remedial measures can be taken to minimize the pollution? [10]

3. (a) What are the effects of noise pollution? [5]
   (b) Define Photochemical smog and Sulfurous smog. Describe the formation of Photochemical smog with figure. [20]

4. (a) Mention some characteristics of industrial environmental pollution. [5]
   (b) What is eutrophication and degree of eutrophication of a lake? Mention the four groups of algae with example that are relevant in eutrophication problem. [10]
   (c) Discuss (in terms of composition, sources, characteristics, category and health effects) the major air pollutants i) Particulate matter and ii) Ozone [10]

5. (a) What are the sources of Oxygen Demanding Wastes that contribute to water pollution? [5]
   (b) A city drained wastewater into a nearby river. Draw the sag curve for the given data:
   Wastewater flow rate = 30,000 m^3/d; River flow rate = 200,000 m^3/d
   BOD_{ww} = 250 mg/L; BOD_{river} = 20 mg/L
   DO_{ww} = 2.5 mg/L; DO_{river} = 6.5 mg/L; $DO_{saturation}$ = 9.0 mg/L
   De-oxygenation rate = 0.25 /d; Re-oxygenation rate = 0.55 /d
   Also find out the critical time from the graph.
   Necessary equation: [20]

$$DO_t = \frac{k_1 \times BOD_u}{k_2 - k_1} \left(e^{-k_1 \cdot t} - e^{-k_2 \cdot t}\right) + DO_a \left(e^{-k_2 \cdot t}\right)$$

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

Course Code: CE 421 | **Time: 120 Minutes**
Course Title: Structural Engineering VIII | **Full Marks: 20x6 = 120**

Answer any 6 of the following 8 Questions. Each question carries equal marks. *The figures are not drawn to scale.*

[1] Consider a damped dynamical system (as shown in Figure 1) that has the stiffness 15 $\frac{k}{ft}$ and mass 1.15 $\frac{k-s^2}{ft}$ is subjected to initial conditions $t = 0, \dot{x}_0 = 5.0\ \frac{ft}{s}$, $x_0 = 0.5$ ft.

(a) Solve the equation of motion and estimate the damped natural frequency and natural period of the system for the damping ratio, $\zeta = 0, 0.05$.

(b) Estimate the displacement of the problem solved in (a) for the time vector t = 0, 0.2, 2 sec.

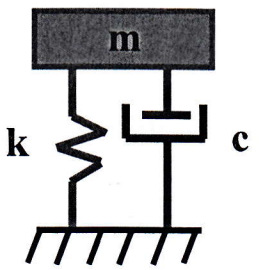


Figure 1

[2] For the system presented in Figure 2, calculate the displacement, velocity and acceleration numerically by using the **Newmark-Beta Method** $\alpha = 0.5, \beta = 0.25$ for the following time steps t = 0, 0.12 sec. Assume the system properties are as follows, mass, $m = 25$ Kg, spring coefficient, $k = 600\ \frac{N}{m}$, damping coefficient, $c = 1.5\ \frac{N-s}{m}$, the initial conditions are given as $t = 0$, $x_0 = 0$, $\dot{x}_0 = 0$, and the external force $\boldsymbol{P(t)} = e^{-2t} + 2 - t$.

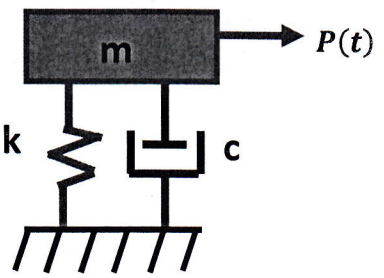


Figure 2

[3] Derive the equations of motion of the system depicted in Figure 3. Solve the Eigenvalue Problem and determine the **Eigenfrequencies and Mode Shapes** of the aforementioned system by considering $m_1 = 2m, m_2 = m, k_1 = k_2 = k$.

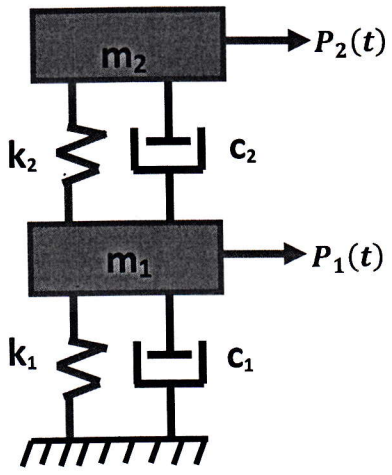


Figure 3

[4] Find the Modal Mass, Stiffness and Damping of a system by considering the following properties, $\omega_1 = 0.84$ rad/sec , $\omega_2 = 6.16$ rad/sec, $m_1 = 11.12$ kg, $m_2 = 15.18$ kg, $k_1 = 800.08 \frac{\text{N}}{\text{m}}$, $k_2 = 700.80 \frac{\text{N}}{m}$, $P_2 = 100\sin(3.5t)$ N, $P_1 = 100$N, $c_1 = 1.12 \frac{\text{N-s}}{\text{m}}$, $c_2 = 1.2 \frac{\text{N-s}}{\text{m}}$. The 1st mode shape is $\begin{Bmatrix} 0.615 \\ 1 \end{Bmatrix}$ and the 2nd mode shape is $\begin{Bmatrix} -2.5613 \\ 1 \end{Bmatrix}$.

[5] Consider a system has $m_1 = m_2 = 150$ kg, $k_1 = k_2 = 2005 \frac{\text{N}}{m}$, $c_1 = c_2 = 5 \frac{\text{N-s}}{\text{m}}$, and the input force vector is $\boldsymbol{P} = \begin{bmatrix} 10 \\ 250\cos(1.2t) \end{bmatrix} \boldsymbol{N}$ and estimate the accelerations for the following time-steps $t = 0,\ 0.5$ sec by using the special case of Newmark-Beta Method (Constant Average Acceleration). Assume the initial conditions are given as $t = 0,\ x_0 = 0,\ \dot{x}_0 = 0$

[6] (a) Define Earthquake? Why does it happen?
(b) Define Epicenter and Focus with appropriate sketches?
(c) Write down the types of Seismic Waves. Which (wave) one is the most devastating?
(d) Determine the Magnitude of an Earthquake that has amplitude of the seismograph 50 mm and epicentral distance 195 km.

[7] (a) Define Response Spectrum. When will you consider Response Spectrum Analysis?
(b) What are differences between a typical Response Spectrum with Code Recommendation?
(c) What is Equivalent Static Analysis? What are the available technologies for Earthquake Vibration Mitigation?
(d) Determine the Natural Frequency, Period and the Base Shear as per BNBC for the system which has mass = 100 $\frac{kg\text{-}sec^2}{m}$, stiffness = 50000 $\frac{\text{N}}{m}$, c = 223.6 $\frac{\text{N-s}}{m}$, damping 5%,

the height of the building is 50 m, $C_t = 0.083$ for steel moment resisting frames, $Z = 0.15$ (for Dhaka), s=1 (for hard soil), R=5.

[8] (a) Why Irregularities in Plan and Elevation are so serious for Earthquake? Draw two examples of each (except those already in the lecture note).

(b) What is Ductility? Which one is better in terms of Earthquakes from your knowledge ductile or stiff structure?

(c) According to the BNBC what would be the minimum size of a Beam, Column and minimum Steel Ratio of Beam and Column?

(d) Draw a sketch of a Linear System and Elastoplastic System and derive the expression of the maximum displacement.

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 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) What are the effects of soil condition on isolated structure? **(3)**

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

c) What is seismic base isolation system? What are the characteristics of a well-designed seismic base isolation system? **(6)**

d) Write short notes on: (i) Rubber bearing, (ii) Friction pendulum system. **(6)**

2. a) The exterior joint shown in the **Figure 1** 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 storey height is 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 2000 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)**

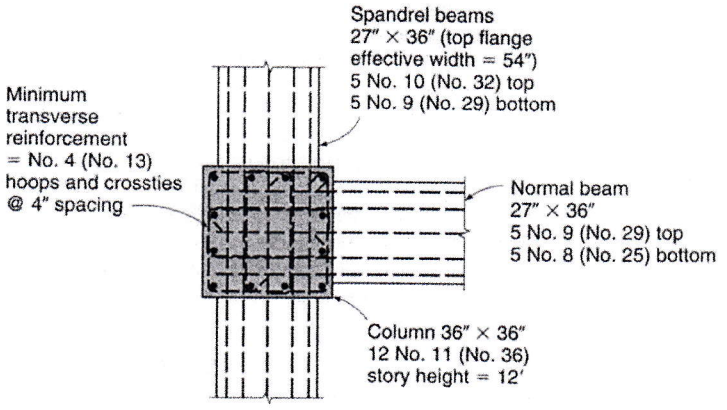


Figure 1

b) Explain how confinement affects the shear capacity in the joint? **(5)**

3. a) Check the joint shown in **Figure 1** whether it satisfies the shear requirement or not. **(12)**

b) Write down the size and location of opening in masonry wall according to the ERD guidelines? Show in neat sketches. **(8)**

4. a) What is FRP? What are the benefits of FRP over steel in retrofitting works? **(5)**

b) Determine the number layers of carbon fiber wrap required to strengthen a circular column of diameter 500 mm with unsupported length of 3000 mm. **(15)**

Given: $f'_c = 30$ MPa, $f_y = 400$ MPa, $f_{frpu} = 1200$ MPa, $t_{frp} = 0.3$ mm, $f_{rp} = 0.75$, $A_{st} = 2500$ mm^2

RC column factored axial resistance (pre-strengthening) = 3110 kN
New axial live load requirement $P_L = 1550$ kN
New axial dead load requirement $P_D = 1200$ kN
New factored axial load, $P_f = 4200$ kN

5. a) What are the assumptions of flexural strengthening of beam/slab using FRP? **(5)**

b) Calculate the moment resistance (M_r) for an FRP-strengthened rectangular concrete section shown in **Figure 2**. **(15)**
[Given: $f'_c = 45$ MPa, $f_y = 400$ MPa, $E_s = 200$ GPa,
$A_{frp} = 60$ mm^2, $A_s = 128$ mm^2, $\varepsilon_{frpu} = 1.55$ %, $E_{frp} = 155$ GPa]

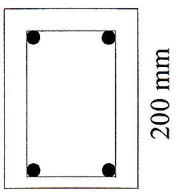


Figure 2

6. a) What is FRP? What are the benefits of FRP over steel in retrofitting works? **(5)**

b) Write short notes on: (i) Wetlayup technique, (ii) Pre-cured technique **(5)**

c) What are the possible reasons of structural deficiencies? What are the parameters that should be taken into consideration during the evaluation of deficient structure? **(5)**

d) How concrete substrate affects the FRP strengthening? **(2)**

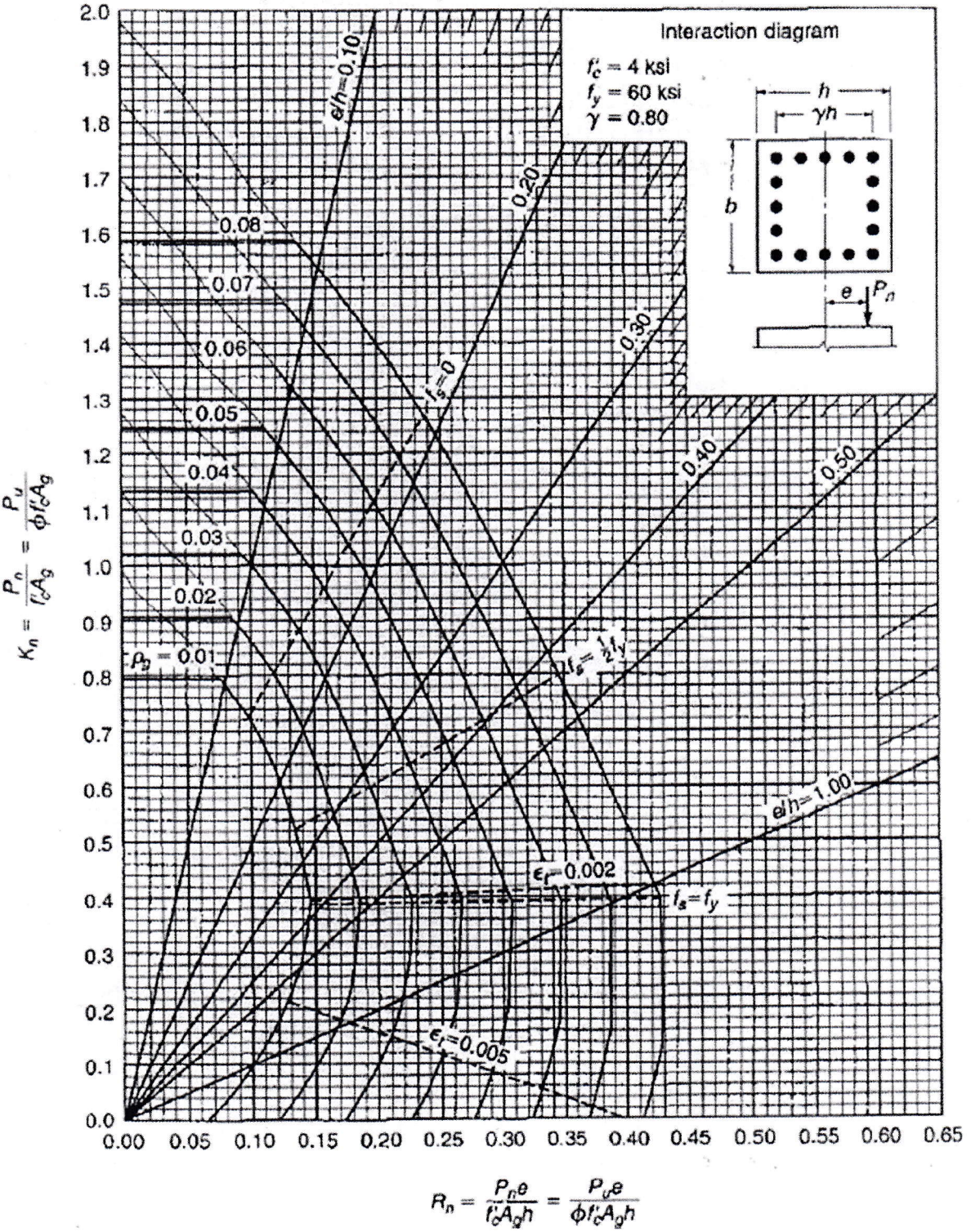
e) "Confinement of circular column is better than confinement in rectangular column", Explain why? **(3)**

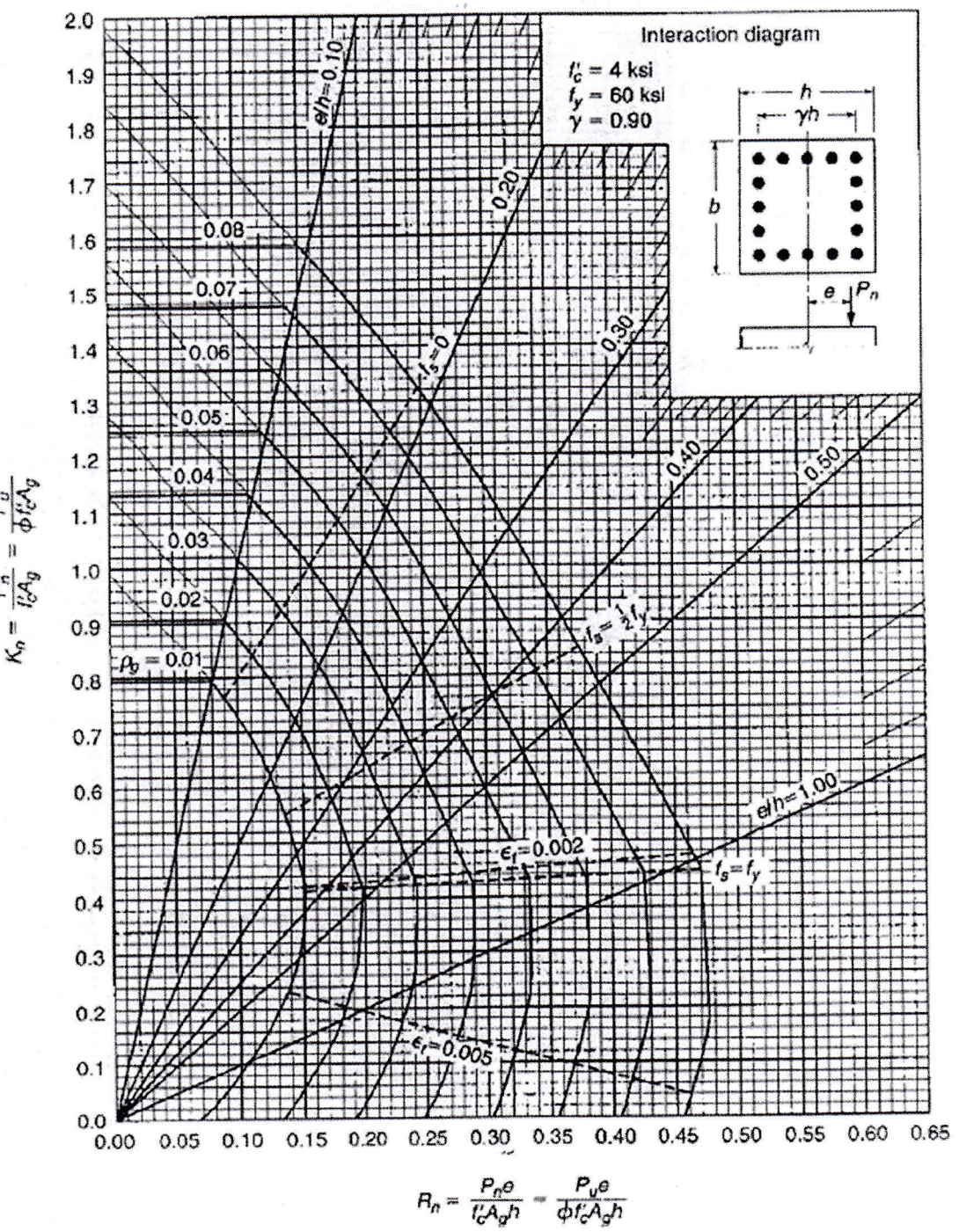
7. a) What is brick masonry? What steps should an engineer take to avoid failure of unreinforced masonry structures due to earthquake? **(4)**

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

c) Explain the procedure to repair the opening of a window in masonry wall system. **(6)**

d) Bangabandhu Jamuna bridge is repaired by using CFRP and the cost was 15% of the original construction cost. Do you think that, building a new bridge would have been a better option? Give justifications on your answer. **(6)**


Interaction diagram
f'_c = 4 ksi
f_y = 60 ksi
γ = 0.80
h
γh
b
e
P_n
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$
e/h=0.10
0.20
0.30
0.40
0.50
e/h=1.00
0.08
0.07
0.06
0.05
0.04
0.03
0.02
ρ_g = 0.01
$f_s = 0$
$f_s = \frac{1}{2} f_y$
$f_s = f_y$
ϵ_t=0.002
ϵ_t=0.005
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65


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
0.30
0.40
0.50
e/h=1.00
0.08
0.07
0.06
0.05
0.04
0.03
0.02
ρ_g = 0.01
f_s=0
$f_s=\frac{1}{2}f_y$
$f_s=f_y$
ϵ_t=0.002
ϵ_t=0.005
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$

Formulas

- $\alpha_1 = 0.85 - 0.0015 f_c^{'} > 0.67$
- $\beta_1 = 0.97 - 0.0025 f_c^{'} > 0.67$
- $\phi_s A_s f_s + \phi_{frp} A_{frp} E_{frp} \varepsilon_{frp} = \phi_c \alpha_1 f_c^{'} \beta_1 bc$
- $\left(\frac{l_u}{D_g}\right) \leq \left(\frac{6.25}{\sqrt{P_f / f_c^{'} A_g}}\right)$
- $f_{lfrp} = \left(\frac{2 N_b \phi_{frp} f_{frpu} t_{frp}}{D_g}\right)$
- $f_{cc}^{'} = f_c^{'} + k_1 f_{lfrp}$
- $\omega_w = \frac{2 f_{lfrp}}{\phi_c f_c^{'}}$
- $P_{\max} = k_e [\alpha_1 \phi_c f_{cc}^{'} (A_g - A_s) + \phi_s f_y A_s]$