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

Course Title: Professional Practices and Communication — Course Code: CE 403
Time: 1 Hour — Full Marks: 20

Answer all questions.

1. What are the most valuable attributes of an Engineer? Explain the ways that cause harm. 2

2. Name three types of morality. Explain any one of them. 3

3. What are the impediments of responsibility? Explain any 2. 3

4. According to IEEE code of ethics, describe at least 4 ethics of an engineer. 2

5. Read the following case and answer the question from ethical point of view. 5

   Approximately 4 years after its occurrence, the tragic 1981 Kansas City Hyatt Regency walkway collapse was in the news again. A November 16, 1985, *New York Times* article reported the decision of Judge James B. Deutsch, an administrative law judge for Missouri's administrative hearing commission. Judge Deutsch found two of the hotels structural engineers guilty of gross negligence, misconduct, and unprofessional conduct.

   The ASCE may have influenced this court ruling. Just before the decision was made, ASCE announced a policy of holding structural engineers responsible for structural safety in their designs. This policy reflected the recommendations of an ASCE committee that convened in 1983 to examine the disaster. The project manager, Judge Deutsch is quoted as saying, displayed ''a conscious indifference to his professional duties as the Hyatt project engineer who was primarily responsible for the preparation of design drawings and review of shop drawings for that project.'' The judge also cited the chief engineer's failure to closely monitor the project manager's work as ''a conscious indifference to his professional duties as an engineer of record.''

   This court case shows that engineers can be held responsible not only for their own conduct but also for the conduct of others under their supervision. It also holds that engineers have special *professional* responsibilities.

   Discuss the extent to which you think engineering societies should play the sort of role ASCE apparently did in this case. To what extent do you think practicing engineers should support (e.g., by becoming members) professional engineering societies' attempts to articulate and interpret the ethical responsibilities of engineers?

6. What is meant by communication? What are the factors that affect communication? Please explain any two. 2.5

7. What are the effective skills for better communication? Please explain some of it (at least 4). 2.5

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

Course Title: Structural engineering V (Prestressed Concrete) Course Code: CE 415
Time: 1 Hr Full Marks: 45

*[There are **three** questions and answer all of them. Assume value for any missing data]*

1. A post-tensioned bonded concrete beam as shown in **Figure: 1** has a prestress of 1400 kN in the steel immediately after prestressing. After losses it eventually reduces and reaches 1300 kN. The beam carries two live loads of P kN each in addition to its own weight 3 kN/m. Under final stage when losses already have taken place and with full live load the extreme bottom fiber stress is 3.5 MPa. Compute the value of P. (10)

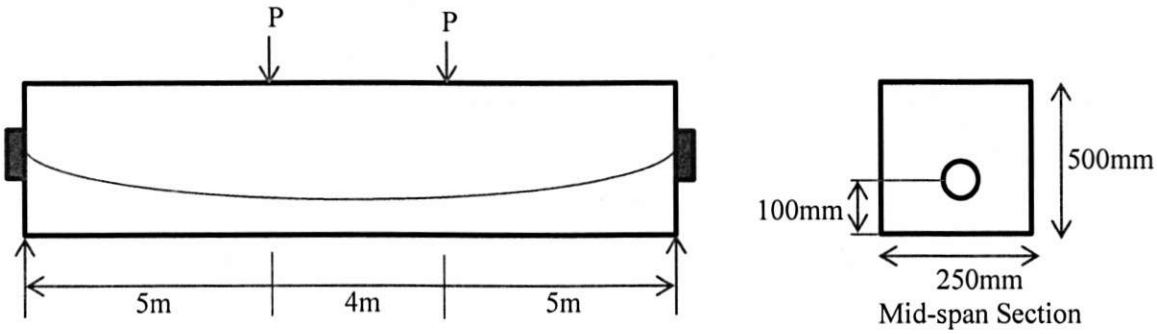


Figure: 1

2. (a) A post-tensioned concrete rectangular beam 400 mm by 500 mm has a simple span of 15 m and it is prestressed with 1152 mm^2 steel which is made up of 6 tendons. The tendons are tensioned one after another to the stress of 1200 MPa. If E_{ci}= 48500 MPa and E_s= 290000 MPa, Compute the loss of prestress due to the elastic shortening of concrete. (5)

(b) A prestressed-concrete rectangular beam 350 mm×500 mm as shown in **Figure: 2** has a simple span of 10 m and is loaded by a uniform load of 35 kN/m excluding its own weight. The prestressing tendon is located as shown in the **Figure: 2** and it produces an effective prestress of 1050 kN. Using the internal resisting couple method find out the fiber stresses at the midspan section. (10)

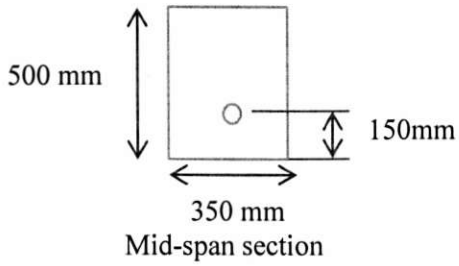


Figure: 2

3. (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: 3**. Find the ultimate moment capacity of the section for design. (8)
(Given: f_{pu}=1800 MPa, f'_c=48 MPa)

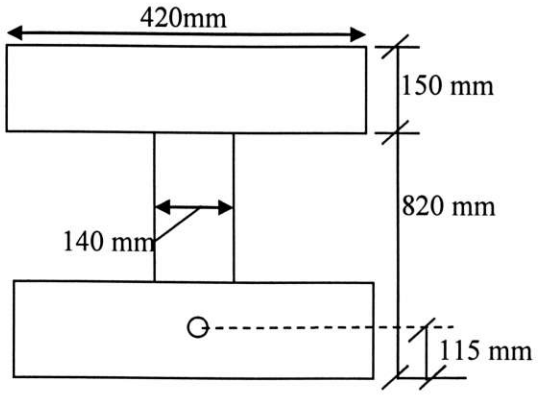


Figure: 3

(b) What are the differences between partial prestressing and fully prestressing? (6)

(c) Write short notes on- (3*2)=6
(i) Stages of loading of prestressed concrete
(ii) Frictional loss of prestressed concrete

Formulae

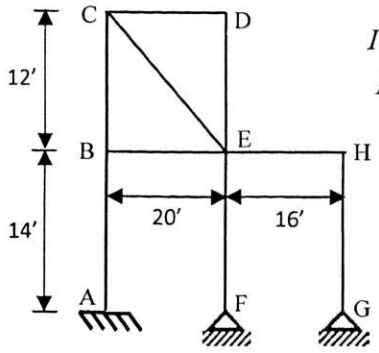
- $f_c = -(F/A) \pm (Fey/I) \pm (My/I)$
- $f_c = -(F/A) \pm \{F(a-e)y/I\}$
- $\Delta f_s = n\,[-(F/A) \pm (Fe^2/I) \pm (Me/I)]$
- $\Delta f_s = n f_c$
- $f_c = -(F/A_c) \pm (Fey/I)$
- $f_c = -(F/A_g) \pm (Fey/I)$
- $f_{ps} = f_{pu}\{1-0.5\rho_p (f_{pu}/f'_c)\}$
- $\rho_p = A_{ps}/bd$
- $a = (A_{ps} f_{ps}/0.85 f'_c b)$
- $w_p = (\rho_p f_{ps}/f'_c) \leq 0.3$
- $M_u = \emptyset A_{ps} f_{ps}\{d-(a/2)\}$
- $A_{pf} = \{0.85 f'_c (b-b_w) h_f\}/f_{ps}$
- $A_w = A_{ps} - A_{pf}$
- $\rho_w = (A_w/b_w d)$
- $w_{pw} = (\rho_w f_{ps}/f'_c) \leq 0.3$
- $M_u = \emptyset[A_{pf} f_{ps}\{d-(h_f/2)\} + A_w f_{ps}\{d-(a/2)\}]$

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

Course Title: Structural Engineering VI (Design of Steel Structures) Course Code: CE 417
Time: 01 Hour Full Marks: 60

Answer all 03 (Three) questions
Assume reasonable value for missing data

1.



(a) Calculate effective length factor (k) for **columns AB, DE** shown in the figure. (08)

(b) If column is W12x53 section (A_g= 15.6 in^2, r_x= 5.23 in, r_y= 2.48 in) and pin supported along weak axis, determine the capacity of **column EF** using A36 steel and AISC-ASD method. Use table-01. (12)

2. (a) Select the lightest W section of A992 steel for a column of 28 ft to carry an axial compression load 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. (16)
Possible sections are given below.

Size	A_g (in^2)	r_x (in)	r_y (in)
W 10×33	9.71	4.19	1.94
W 12×35	10.3	5.25	1.54
W 12×40	11.7	5.13	1.94

(b) Write down the sources of residual stress. (04)

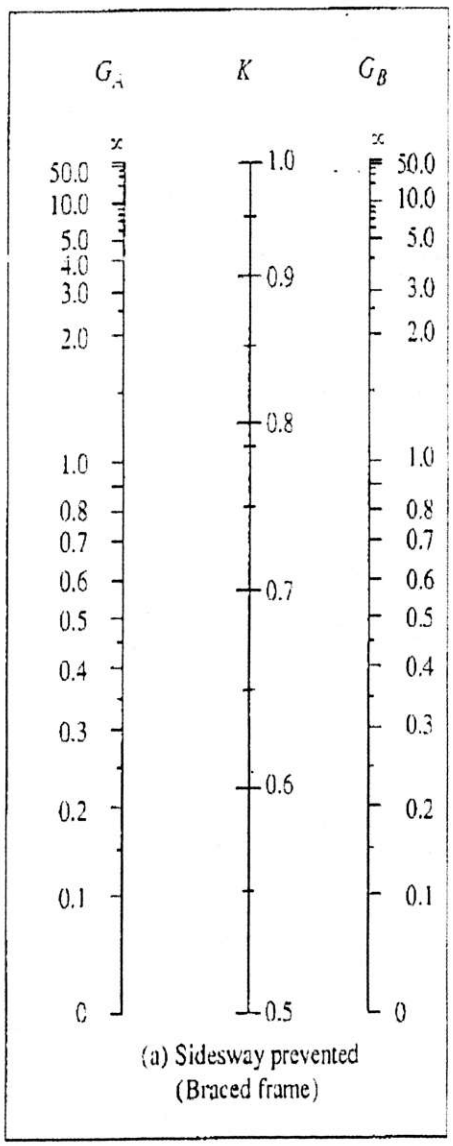
3. (a) Compute the allowable tensile service load that may act on a single angle section of **L 6×4×$^3/_4$** that is connected on both legs. The 4 in. leg contains **a single gage line** of 7/8 in. diameter bolts at mid height of the leg and 6 in. leg contains **double gage lines** of 7/8 in. diameter bolts which are 2 in. apart in the leg. Assume each gage line contains 03 (three) bolts, spacing of bolts is 1.5 in. and no staggering of bolts in the connection. Use A572 grade 50 steel and AISC-ASD method. (12)

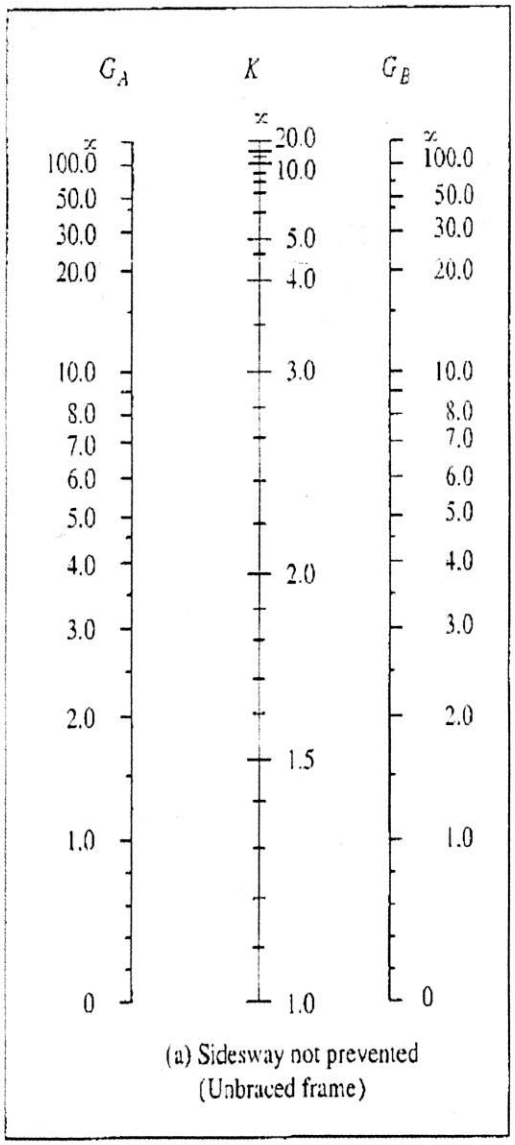
(b) Draw column strength curve and show the regions of short, intermediate and long column. (03)

(c) What is stiffened and unstiffened element? (02)

(d) How failure of short column differs from long column? (03)

Table -01





Critical Buckling Stress:

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

$$F_{cr} = [0.877F_e] \qquad F_e = \frac{\pi^2 E}{(\frac{KL}{r})^2}$$

Block shear capacity: Nominal strength

$$R_n = 0.6F_yA_{gv} + U_{bs}F_uA_{nt}$$

$$R_n = 0.6F_uA_{nv} + U_{bs}F_uA_{nt}$$

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

Course Code: CE 421 **Time: 60 Minutes**
Course Title: Structural Engineering VIII **Full Marks: 3 x 20**

[3] Write down the equation of motion in **matrix form** for the dynamical system described in Figure 3? Find the **Eigenfrequencies and Mode Shapes** of the aforementioned system?

20

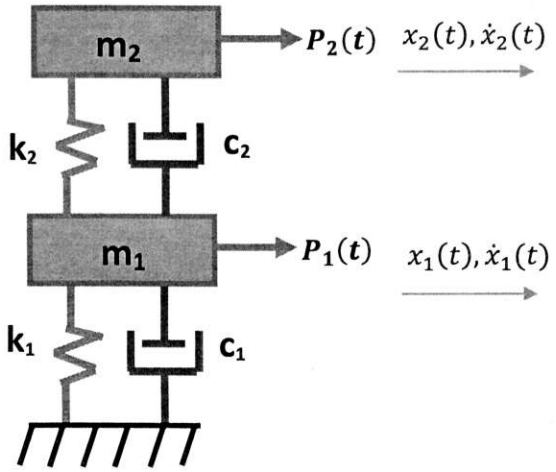


Figure 3

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

Course Code: CE 421 **Time: 60 Minutes**
Course Title: Structural Engineering VIII **Full Marks: 3 x 20**

ANSWER ALL QUESTIONS. *The figures are not drawn to scale.*

[1] Derive and solve the equation of motion for the system presented in Figure 1? **Estimate the displacement** at $t = 0$ & 0.25 sec by using the following data $\emptyset = 0$, $m = 10$ k-sec^2/ft, $k = 15$ k/ft, $c = 0.0912$ k-sec/ft, $\zeta = 3\%$, $\omega = 1.1$ rad/sec, $C_1 = 0.5$, $C_2 = 1.5$.

20

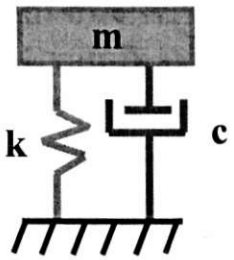


Figure 1

[2] Solve the equation of motion for the external force $\boldsymbol{P(t)} = 3t^2 + 4t - 5$ for the system presented in Figure 2. Estimate the displacement, velocity and acceleration numerically by using the **Newmark-Beta Method** for the following time steps t = 0, 0.1, 0.2?

Consider the system properties are as follow, mass, $m = 1.25$ Kg, spring coefficient, $k = 3.5$ N/m, damping coefficient, $c = 0.25$ N-s/m, the initial conditions are given as $t = 0$, $x_0 = 0$, $\dot{x}_0 = 0$, $\alpha = 0.5$, $\beta = 0.25$.

20

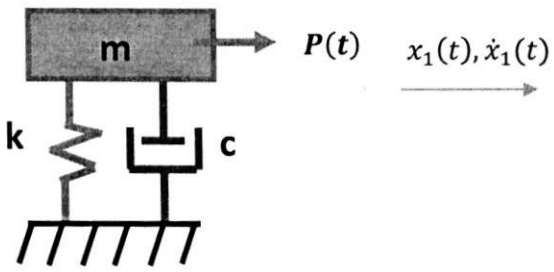


Figure 2

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Fall 2015

Course No: CE 423 **Time: 1 Hour**
Course Title: Structural Engineering IX **Full Marks: 60**
(Earthquake Resistant Design and Retrofitting)

There are three questions. Answer all of them.

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

b) Explain how degree of confinement effects the nominal shear capacity of beam-column joints. **(6)**

c) What are the requirements for concrete and steel reinforcement for earthquake resistant design? **(6)**

2. **a)** Write short note on: (i) High damping natural rubber bearing, (ii) Lead rubber bearing. **(6)**

b) Determine the minimum transverse reinforcement of the column (***Figure 1***) required over length l_0. Column is confined in two sides. Show reinforcement detailing. [Given f'_c= 3 ksi, f_y=60 ksi] **(14)**

Column Size 24 in x 30 in

Longitudinal bar No. 9

Transverse bar No. 4

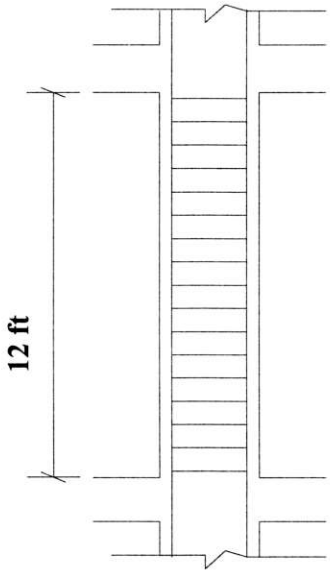
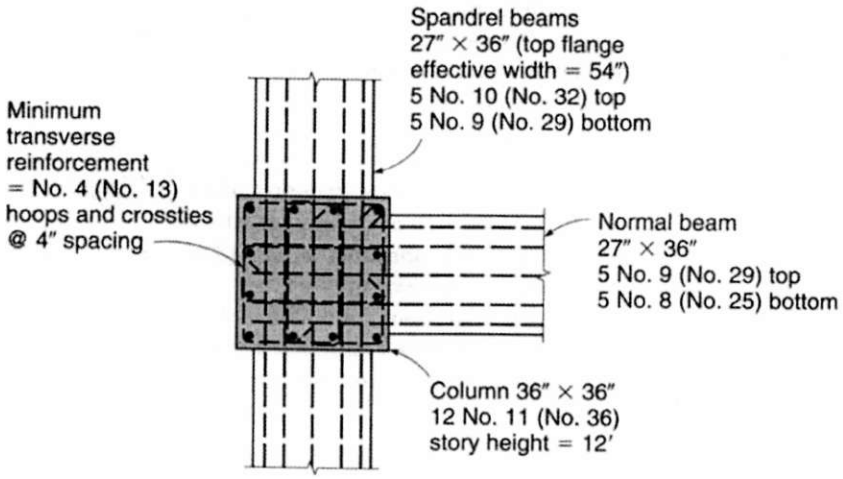
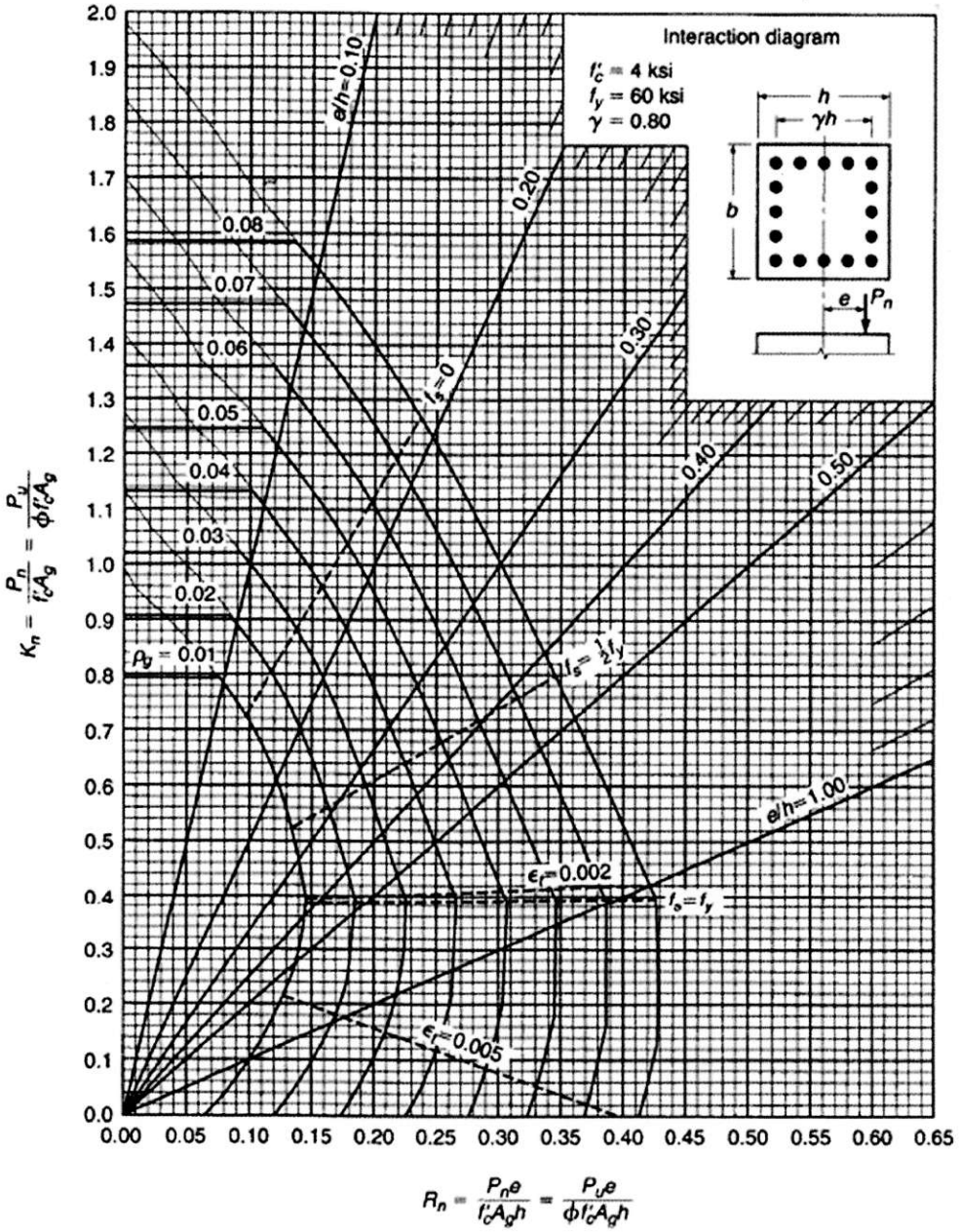
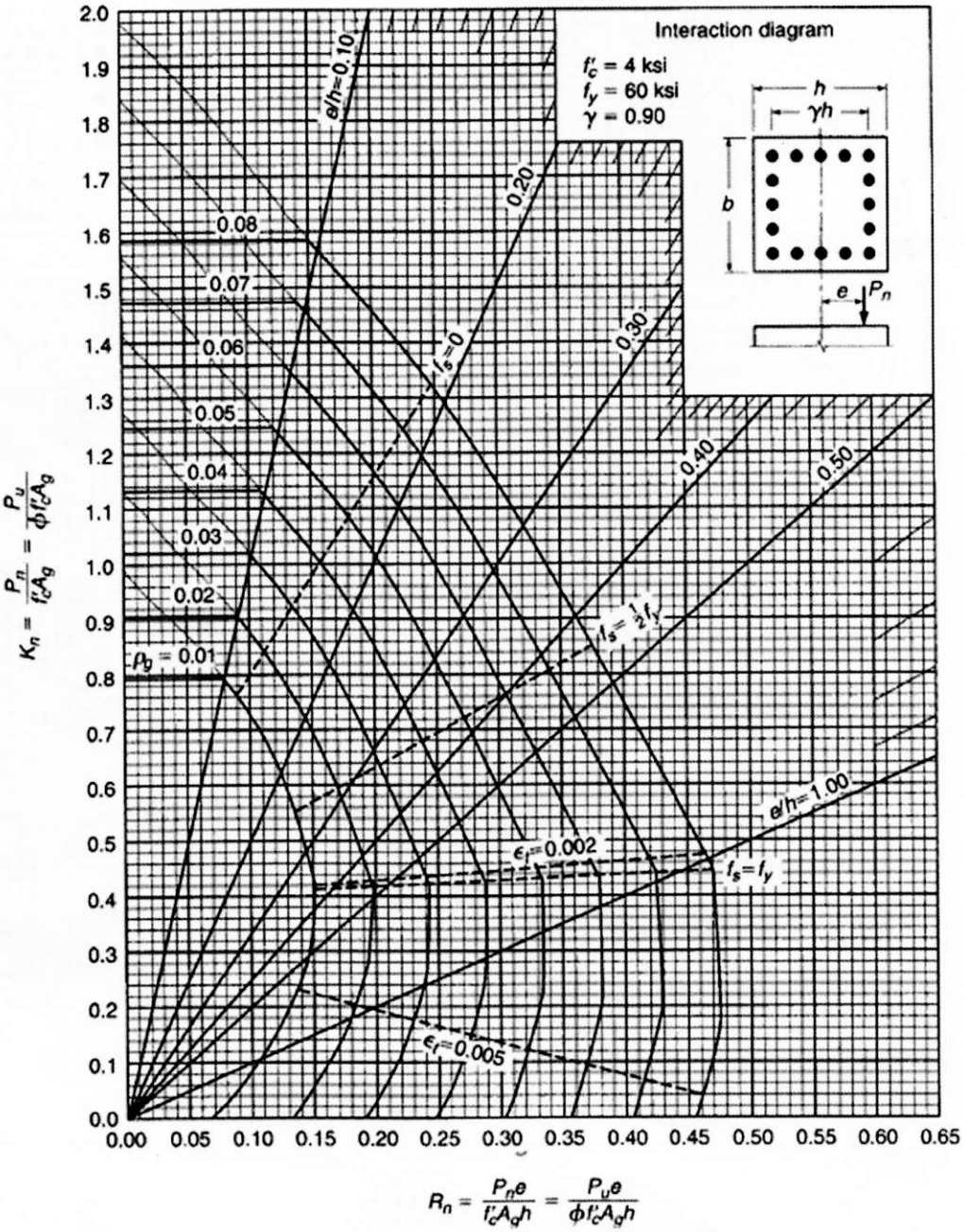


Figure 1

3. The exterior joint shown in the Figure below 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 satisfy weak beam strong column design as per ACI 318-08. **(20)**




Interaction diagram
f'_c = 4 ksi
f_y = 60 ksi
γ = 0.80
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
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$


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
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
$K_n = \frac{P_n}{f'_c A_g} = \frac{P_u}{\phi f'_c A_g}$
$R_n = \frac{P_n e}{f'_c A_g h} = \frac{P_u e}{\phi f'_c A_g h}$

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

Course Title: Environmental Engineering III — Course Code: CE 431
Time- 1 hour — Full marks: 50

There are **THREE** questions. Question **1** is mandatory. In addition, answer any **ONE** between questions **2** and **3**. *(25*2 = 50)*

1. (a) What are the objectives of solid waste management and what are the stages of the process? (3+3)

(b) Why is collection process the largest cost element in solid waste management system? Mention and discuss the various activities related to collection of solid waste. (2+5)

(c) A Municipal Solid Waste sample of 100 kg was collected to analyze the physical properties. Estimate the mass of each component of the sample given in the following table. Also find out overall density, overall moisture content and different types of energy contents (total energy and energy per unit weight). (12)

Component	% by Mass	Moisture Content (%)	Density (kg/m^3)	Energy Content (KJ/Kg)
Paper	31.5	4.2	83	16900
Plastics	10.2	2.3	67	31300
Wood	4.6	18.7	265	19800
Textiles	8.8	9.5	73	18100
Leather	7.6	10.2	155	16800
Rubber	5.2	1.9	140	23400
Metals	12.1	1.3	430	27000
Food waste	13.6	82	230	4200
Miscellaneous	6.4	3.4	102	600

2. (a) Provide examples on how source reduction can be achieved in developing countries? How can you achieve it in your daily life (provide at least 2 examples) (6)

(b) What is a transfer station? Compare the solid waste collection system with and without transfer station on our country's context. (2+5)

(c) Determine the break-even time for a stationary container system with a separate transfer and transport system for transporting wastes collected from a (12)

municipal area to a landfill site. Use graph paper for the plot.
Assume the following data while calculating:

Transportation cost:
Stationary container system using an 18 m^3 compactor: BDT 2000/ hr
Tractor-trailer transport unit with a capacity of 120 m^3: BDT 2500/ hr

Other costs:
Transfer station operating cost: BDT 40/m^3
Extra cost for unloading facilities: BDT 5/m^3

Other data:
Density of wastes in compactor = 350 kg/ m^3
Density of wastes in transport unit = 160 kg/ m^3

3. (a) Mention the key concepts around on-site processing. Give some examples of on-site recyclable and recoverable materials. (6)

(b) Using the data for total energy values given in the table, estimate the energy of the remaining solid wastes if 60% of cardboard, 50% of the paper and 75% of plastics is recovered by the homeowner. Estimate the % (decrease or increase) change in total energy per unit weight of waste after recovery based on 100 kg of waste. (12)

Constituent	Food waste	Paper	Newsprint	Card board	rubber	Plastics
Weight (%)	32.5	35	12	6	5.5	9
Total Energy, (kj)	628,615	527,520	88,305	61,460	20,688	78,573

(c) Classify the collection system of solid waste based on availability of services. Compare these systems with respect to "level of service", "collection cost" and "Susceptibility of scavenging". (4)

(d) Differentiate between biodegradable and non-biodegradable solid waste. (3)

Given Formula:

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

Type of haul	Speed limit km/h	m h/trip	n h/km
Communal	88	0.016	0.011
Block	72	0.022	0.014
Kerbside	56	0.034	0.018
Door-to-door	40	0.050	0.025

Collection					
Vehicle	Loading method	Compaction ratio, z	Pick up loaded container and deposit empty container, h/trip	Empty contents of loaded container, h/container	At-site time q, h/trip
Hauled container (Tilt-frame)	Mechanical	2.0–4.0	0.50		0.129
Stationary container (Compactor)	Mechanical	2.0–4.0		0.050	0.15

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

Course No: CE 433
Full Marks: 60

Course Title: Environmental Engineering IV
Time: 1.0 hour

There are **FOUR** questions. Answer any **THREE**.
[Assume reasonable value of missing data (if any)]

1. (a) Define the term *pollutant.* [5]
   (b) Define *Waste Load Allocation (WLA)* according to USEPA? [5]
   (c) Discuss De-oxygenation curve, Re-oxygenation curve and DO sag curve with a graph. [10]

2. (a) '*Water pollution is all about quantities*' justify the statement. [5]
   (b) How is Waste Assimilative Capacity (WAC) calculated? [5]
   (c) What are phosphate detergent and surfactant detergent? Discuss their effects on water-environment. [10]

3. (a) What do you mean by *disposal by dilution*? [5]
   (b) Discuss *point sources* and *non-point sources* with a sketch. [5]
   (c) What is self-purification of streams? Discuss different types of zones of pollution in a stream with a figure. [10]

4. (a) Mention the name of five harmful Persistent Organic Compounds (POCs) that present in drinking water. [5]
   (b) A city drained wastewater into a nearby river. Draw the sag curve for the given data:
   Wastewater flow rate = 35,000 m^3/d; River flow rate = 250,000 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. [15]

   Necessary equation:

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

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

Course code: CE 439
Course title: Environmental Engineering VII (Environmental Impact Assessment)
Time: 60 Minutes Full marks: 20

Answer ALL questions

1. Define the following: (4)
   - Environmental Impact Assessment (EIA)
   - Screening
   - Initial Environmental Examination
   - Scoping

2. Draw the flow diagram of EIA process and parallel studies. (3)

3. According to Article 7 of the Bangladesh Environmental Conservation Rules (1997), write the procedures to obtain environmental clearance certificate for a red category factory? (3)

4. Explain different levels and forms of public involvement in EIA process. (3)

5. Write four possible outcomes of screening process in EIA. (2)

6. Explain three public involvement techniques used in EIA process along with the advantages and disadvantages? (3)

7. Explain the three main steps of scoping process. (2)

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

Course Title: Environmental Engineering VII — Course Code: CE 531
Time- 1 hour — Full marks: 20

Answer any 4 from the following questions

1. What is GIS? Write down the Disciplines & Technologies connected to GIS? Write down the five Arc GIS platform .How do we describe geographical features? How do we represent these digitally in a GIS? (5)

2. Show the Concept of Vector and Raster data type with a diagram. Show the three different ways you can add data layer and set the co-ordinate system as geographical co-ordinate system (5)

3. (a) Create an empty arc map project name it as your name .set the work place and processing extent. (5)
   (b) Open major rivers of Bangladesh.
   Select lower Meghna.
   Change the color of the selected river into red.
   Create a new layer from the selected layer.

4. Digitize the image that has been given. Add a new field name as building number. Assign the building number as 1,2,3..... (5)
   And finally label the image with building number.

5. (a) 4 different shape files are given. Convert them into single shape file and mention the function you have used to do so.
   (b) Two shape files containing various thana of Bangladesh. Create a new shape showing the common the thana of the two shape files.again create a new shape file showing all the thana of the two different shapefiles. (5)

6. (a) You have been given the shape file of Jamuna and you are being asked to create a protected zone of 500 m surrounding the river boundary. Which function you should go for. Show the necessary steps. (5)
   (b) Thana_bd shape file is given to you. Convert this to district base shape file.