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

Course Title: Professional Practice and Communication — Course Code: CE 403
Time: 2 hour — Full marks: 100

There are 6 (six) questions. Answer any 5 (five) of them (20*5=100)

1. a. What are the 7Cs of communication? Out of them, explain conciseness, concreteness and clarity of communication with examples. (12)
   b. Describe barriers in communication from the aspects of communicator and receiver. (5)
   c. How can you improve listening skill? (3)

2. a. How can you say a 'Research title' good or bad? Explain with examples. (5)
   b. What are the do's and don'ts in writing a proposal? (6)
   c. What do you understand by 'Democratic and Participatory' leadership style followed in a meeting? (5)
   d. Name more commonly used different contract formats. (4)

3. a. Write down the chronological procedures followed in solicited major proposals. (10)
   b. What do you mean by RFP? What information it should include? (6)
   c. What does citation mean? Why is citation important? (4)

4. a. What is your understanding about professional ethics? (4)
   b. Explain preventive ethics and aspirational ethics. (12)
   c. What are the characteristics of reasonable care model. (4)

5. a. Name the six dispute resolution methods. (3)
   b. Describe arbitration and litigation as methods of dispute resolution. How do these two methods differ from others? (12)
   c. What are the criteria you should consider for giving a good presentation? (5)

6. Write short notes on any 4(four) of the following: (5*4)
   a. Egocentrism
   b. Participant roles in meeting
   c. Supererogation model
   d. Fiduciary risk
   e. Memo

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

Course title: Environmental Engineering VI | Course code: CE 437
Time: 120 minutes | Full marks: 100

There are FIVE (5) questions. Answer question no. 01 (COMPULSORY) and any THREE (3) from the rest (28 + 3*24 = 100).

1. A) Explain the following: (12)
   - Environment management system
   - Ecosystem
   - Biodiversity
   - Ecological justification of environmental value
   - Climate change
   - Wetland
   - Environmental Unity
   - Greenhouse effect

   B) Explain four internationally agreed principles of environmental resources management. (6)

   C) Select two principles of environmental resources management which are most appropriate for managing international (transboundary) environmental resources of Bangladesh and justify your answer. (5)

   D) Explain (with conceptual diagram) how increasing diversity can stabilize ecosystem functioning. (5)

2. A) Explain five key principles of United Nations Framework Convention on Climate Change (included in Article 3 of the Convention). (10)

   B) List eight laws in Bangladesh that are related to pollution and conservation, agriculture, land use, water resources, and forestry. (5)

   C) Explain any four articles of the constitution of Bangladesh which are most relevant for environmental management in Bangladesh. Justify why you have selected these four articles. (9)

3. A) What is ISO 14001? What benefits does ISO 14001 bring to an organization or business? (2+6)

   B) Explain the different requirements of ISO 14001 certification and implementation (plan-do-check-act cycle). (8)

C) What are the differences among goal, aim and objective? How can you set SMART environmental objectives? (4+4)

4. A) Demonstrate why environmental policy is important for implementing environmental management system in an organization as per clause 4.2 of ISO 14001. (8)

   B) Prepare a draft environmental policy for University of Asia Pacific. (8)

   C) Set up five important environmental objectives and targets that are important to achieve the commitments specified in the draft environmental policy of UAP. (8)

5. A) Explain four steps of pollution prevention hierarchy of waste management as stipulated by Environmental Protection Agency (EPA), USA. (6)

   B) Analyze the current pollution prevention hierarchy for waste management in Bangladesh. Which step in pollution prevention hierarchy is most important but ignored in Bangladesh? (6)

   C) Recommend four policy steps that could improve pollution prevention practices in Bangladesh. (6)

   D) Explain the process of ozone layer depletion in the stratosphere. (6)

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

Course Code: CE 421 **Time: 120 Minutes**
Course Title: Structural Engineering VIII **Credit Hour: 2.0** **Full Marks: 20x6 = 120**

Answer any 6 of the following 8 Questions. Any missing data can be assumed reasonably.

[1] A damped single-degree-of-freedom (SDOF) system has a mass of 15 kg subjected to external force $P(t) = [e^{2t} + 4]\ N$. There are 4 columns and the size of them are $0.5m \times 0.5m$. Derive and solve the equation of motion of the SDOF and determine the displacement, velocity and acceleration at time t = 3 sec. Given, Young's modulus, $E = 2 \times 10^4$ MPa, the system has 4% damping, the initial conditions are given as $t = 0,\ x_0 = 0.015$ m, $\dot{x}_0 = 0.15\ \frac{m}{sec}$. **(20)**

[2] (a) Determine the damped and undamped natural frequency, natural periods of a single-storey building that has a floor height 7.5 m. Given, mass, m = 5000 Kg, damping ratio is 4%, there are 20 columns and the size are $0.45m \times 0.45m$, Young's modulus, $E = 415$ MPa. **(10)**

(b) A 4-storied industrial steel building has each floor height of 3.5 m. Determine the lateral forces at each floor level as per BNBC for each floor size $30m \times 30m$, slab thickness $0.2m$, damping ratio 4%. Use appropriate sketch if necessary. **(10)**

[3] (a) Determine the magnitude of an earthquake by using two different empirical formulae. Assume that the amplitude of the seismograph is 50 mm and epicentral distance is 250 km. **(3)**

(b) What is Ductility? **(1+4+2)**
Assume that two different materials have ductility factors of 4 and 9. Distinguish between these which one you would select and why for an earthquake resisting design?
What is the purpose of "*Yield Reduction Factor*"?

(c) What is damping? **(1+3+6)**
What is the impact of damping and how you can add more damping into a system?
Explain different conditions of damping and which one is the realistic and why?

[4] (a) What is earthquake? What causes earthquake? **(1+2+4)**
Explain Elastic-Rebound theory with appropriate sketch.

(a) What is Response Spectrum? What are drawbacks of Response Spectrum Analysis? **(1+2+3)**
Explain the Acceleration Spectra (recommend by code).

(b) What is Retrofitting? What are the purposes of Retrofitting? **(1+2+4)**
Write a short note on different alternatives of retrofitting.

[5] Use the Constant Average Acceleration method to determine the displacement, velocity and acceleration numerically for the following time steps t = 0:0.15:0.3 sec. Assume the system mass, spring coefficient, damping is given in Question [1]. Given, $t = 0,\ x_0 = 0,\ \dot{x}_0 = 0$. **(20)**

[6] What is the purpose of Modal Analysis? Determine the Eigenfrequencies and Mode Shapes of a 2-DOFs that has mass and stiffness matrices as follows, $M = \begin{bmatrix} 11 & 0 \\ 0 & 14 \end{bmatrix}$ Kg, $K = \begin{bmatrix} 23 & -10 \\ -10 & 10 \end{bmatrix} \frac{\text{kN}}{\text{m}}$. Which mode is the most dangerous one and why? **(20)**

[7] The mode shapes of a 2- DOF system are $\Phi_1 = \begin{Bmatrix} 0.745 \\ 1 \end{Bmatrix}$ and $\Phi_2 = \begin{Bmatrix} -2.014 \\ 1 \end{Bmatrix}$. Perform the Modal Analysis to determine the displacements of a 2-DOFs at t = 0.1 sec. Given, $\begin{Bmatrix} p_1 \\ p_2 \end{Bmatrix} = \begin{Bmatrix} e^{3t} + 3t^3 \\ e^{3t^3} \end{Bmatrix}$ N, $C = \begin{bmatrix} 73.92 & -48.86 \\ -48.86 & 48.86 \end{bmatrix} \frac{\text{N-s}}{\text{m}}$, $M = \begin{bmatrix} 10 & 0 \\ 0 & 15 \end{bmatrix}$ Kg, $K = \begin{bmatrix} 20 & -10 \\ -10 & 10 \end{bmatrix} \frac{\text{kN}}{\text{m}}$. **(20)**

[8] A two storied RC building is shown in Figure 1. Determine the velocities of the building by using Constant Average Acceleration method at $t = 0.15$ sec. Given, $\begin{Bmatrix} x_1(0) \\ x_2(0) \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0.01 \end{Bmatrix}$ m, $\begin{Bmatrix} \dot{x}_1(0) \\ \dot{x}_2(0) \end{Bmatrix} = \begin{Bmatrix} 0.09 \\ 0.1 \end{Bmatrix} \frac{\text{m}}{\text{sec}}$, $\begin{Bmatrix} p_1 \\ p_2 \end{Bmatrix} = \begin{Bmatrix} e^{2t} + 4 \\ e^{3t} + 2 \end{Bmatrix} N$, $C = [0.05M + 0.07K] \frac{\text{N-s}}{\text{m}}$, $E = 2 \times 10^4$ MPa, slab thickness is $0.15m$.

(20)

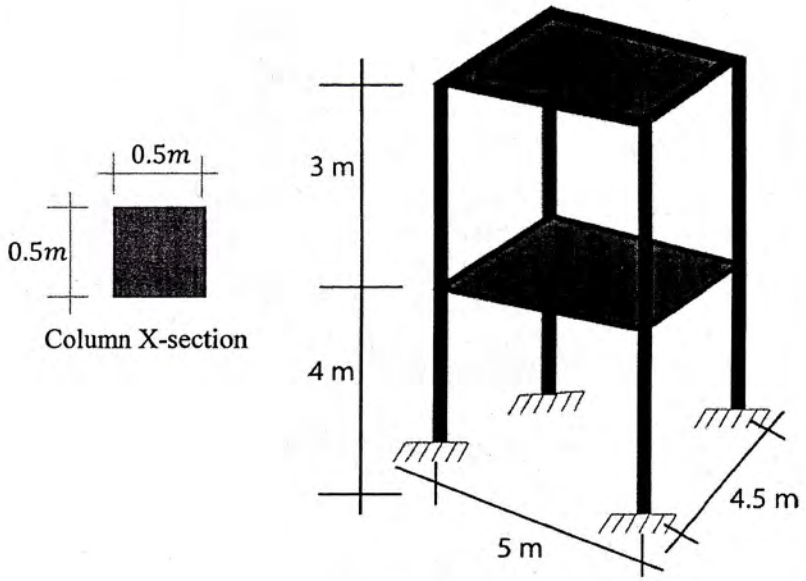


Figure 1

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

Course Title: Structural Engineering VI | Course Code: CE 417
Time: 2 hours | Full Marks: 100 (= 5×20)

[Answer any **five** (05) out of following **seven** (07) questions]

1. Compute the allowable load capacity in tension for the connection of two members in the following figure 1. Connecting members are Cl2x25 (Ag=7.35 in^2, thickness of web, t=0.387 in) channel section and 1 inch thick gusset plate. Use AISC- LRFD method with 7/8-in-diameter A325 bolts in standard holes and A36 steel members. Assume that the effective net area is 85% of the computed net area. (20)

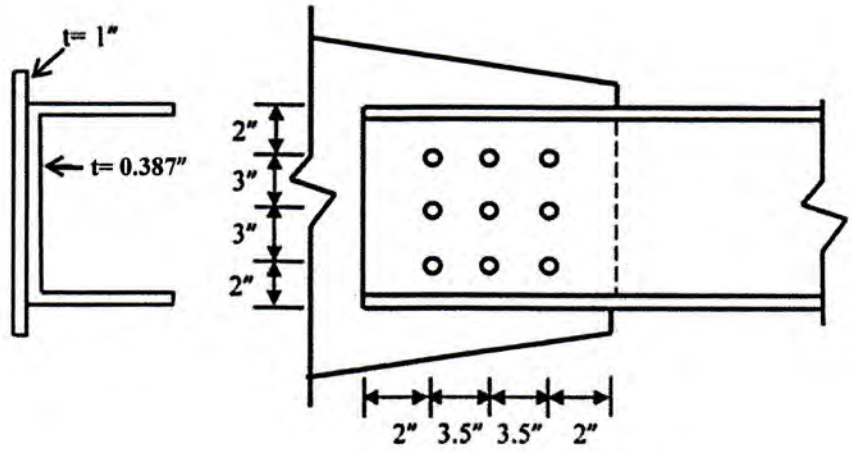


Figure 1

2. The residual stress for a 20 x 2 inch plate to be used as a tension member is shown in Fig. 2. Derive the equation for stress-strain behavior in tension of the plate. Given, Fy= 36 ksi, E= 30,000 ksi. (20)

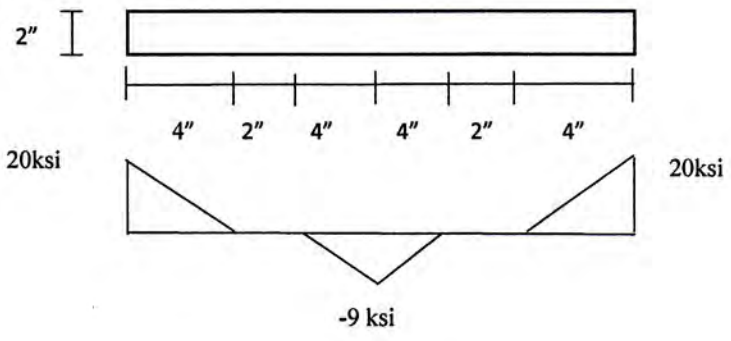


Figure 2

3. (a) Determine the effective length coefficients for all the columns (AB, BC, DE, and EF) of the frame shown in figure 3. Moment of inertia of all columns are 200 in^4 and moment of inertia of the beams are shown in the figure. Alignment chart is given with the question. (10)

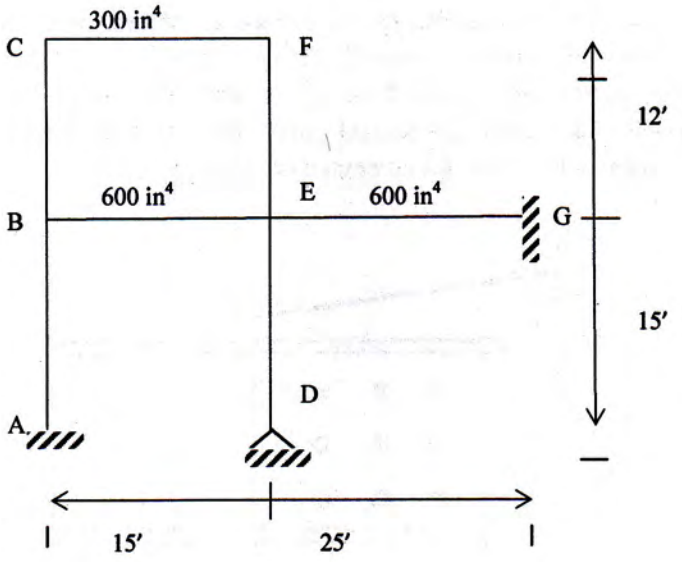


Figure 3

(b) Determine elastic shear stress distribution on W24x162 beam subjected to a service load shear force 300 kips shown in figure 4. Also compute the portion of shear carried by the flange. Given, $I_x = 5170\ in^4$. (10)

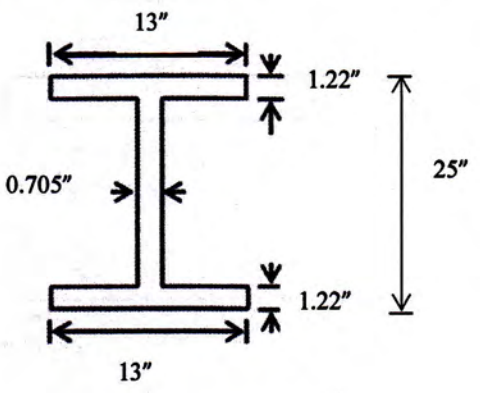


Figure 4

4.(a) Determine allowable compressive load carrying capacity of the 20 ft column shown in figure 5 using AISC-ASD method. It consists of W12x50 section having A992 Grade 50 steel. Support conditions are shown in the figure, and column has weak direction support (braced) at mid height. Given, E= 29,000 ksi. Necessary formulae, dimensions and properties of the section are given with the question. (17)

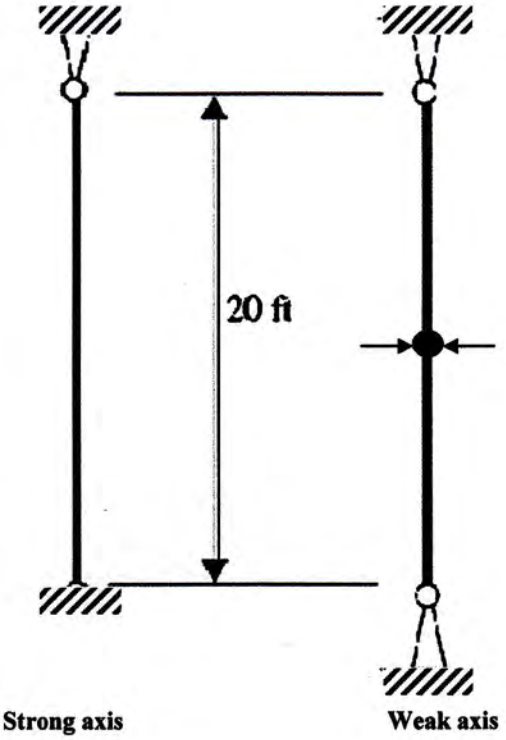


Figure 5

(b) Define compact, noncompact, slender sections. (03)

5.(a) Find out yield moment, plastic moment and shape factor of the following section. Assume A992 Grade 50 steel. (17)

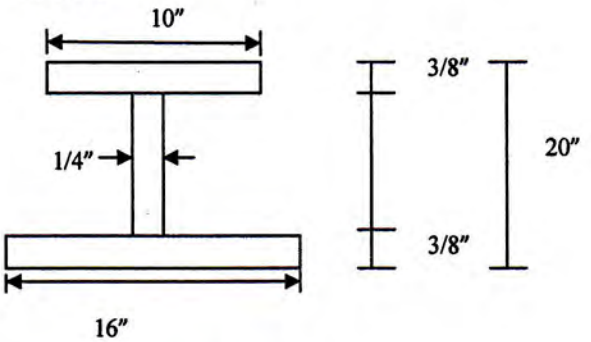


Figure 6

(b) What are the disadvantages of structural steel as a building material? (03)

6.(a) A 36 feet simply supported beam of W14x109 size carries two concentrated loads as shown in figure 7. 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. Given, E= 29,000 ksi. Dimensions and properties of the section are given with the question. (17)

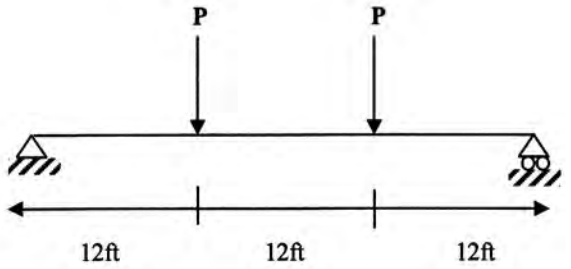


Figure 7

(b) What is limit state? Explain briefly serviceability and strength limit state. (03)

7.(a) Select the lightest W section to carry a uniform dead load of 0.8 k/ft and a live load of 1.5 k/ft on a simply supported span of 38 ft. Adequate lateral support is provided. The live load deflection is limited to L/360. Use A572 grade 50 steel and follow AISC-LRFD method. Given, E= 29,000 ksi. Dimensions and properties of different W sections are given with the question. (16)

(b) Find out shape factor of a rectangular beam section. (04)

Formulae for CE 417

Beam LTB formula's

$L_p = 1.76 r_y \sqrt{(E/F_y)}$ $\qquad L_r = 1.95 r_{ts} \frac{E}{0.7F_y} \sqrt{\frac{Jc}{S_x h_o}} \sqrt{1 + \sqrt{1 + 6.76\left(\frac{0.7F_y S_x h_o}{E} \frac{}{Jc}\right)^2}}$

- **Lateral torsional buckling (LTB)**

If $L_b \le L_p$, no LTB:

$$M_n = M_p \le 1.5 M_y$$

If $L_p < L_b \le L_r$, inelastic LTB:

$$M_n = C_b \left[M_p - (M_p - M_r)\left(\frac{L_b - L_p}{L_r - L_p}\right)\right] \le M_p$$

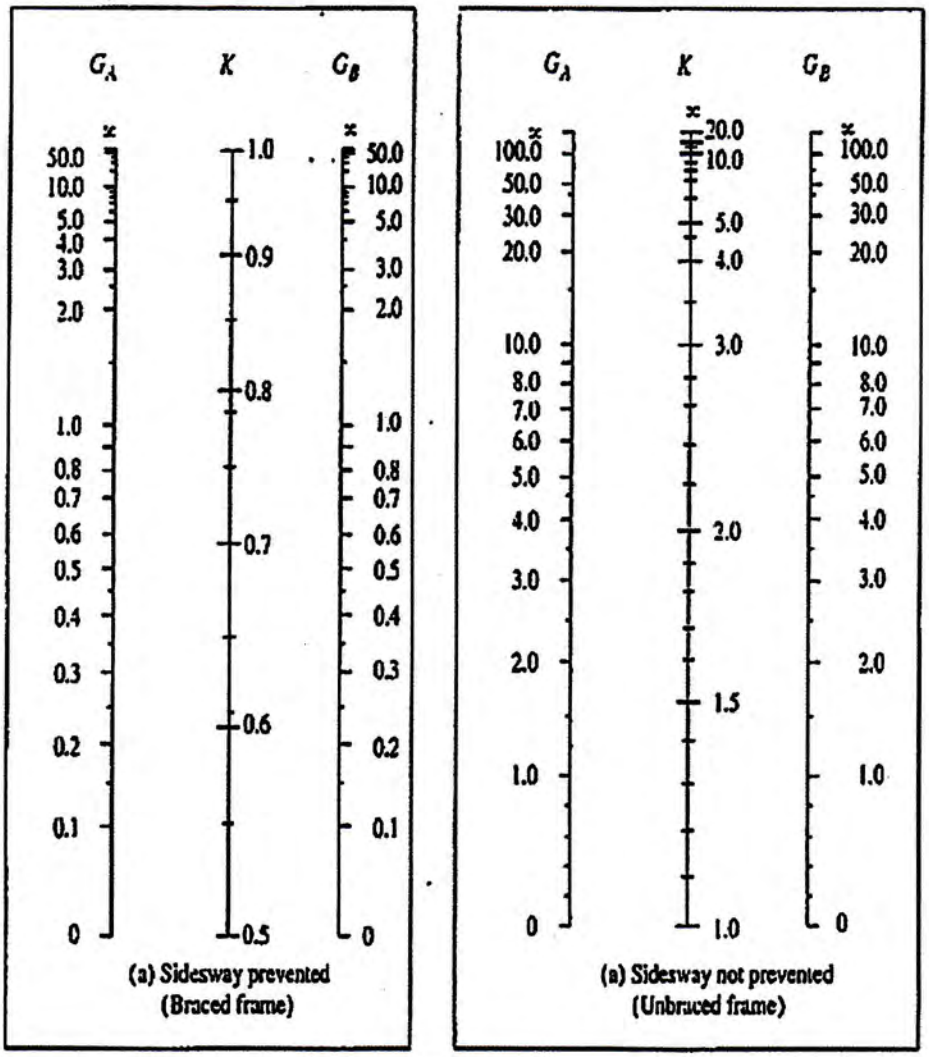
If $L_b > L_r$ (slender member), elastic LTB:

$$Mn = F_{cr} S_x \le M_p$$

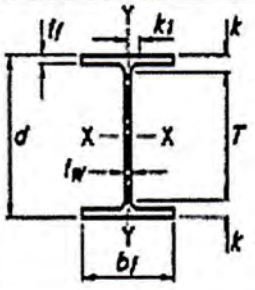
Where,

$$F_{cr} = \frac{C_b \pi^2 E}{\left(\frac{L_b}{r_{ts}}\right)^2} \sqrt{1 + 0.078 \frac{Jc}{S_x h_o}\left(\frac{L_b}{r_{ts}}\right)^2}$$

Alignment chart (Question 3a)



Condition	Sidesway	No sidesway
Far end of beam hinged	1/2	3/2
Far end of beam fixed	2/3	2



Question (4a)

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.
W12×58	17.0	12.2	12 1/4	0.360	3/8	3/16	10.0	10	0.640	5/8	1.24	1 1/2	15/16	9 1/4	5 1/2
×53	15.6	12.1	12	0.345	3/8	3/16	10.0	10	0.575	9/16	1.18	1 3/8	15/16	9 1/4	5 1/2
W12×50	14.6	12.2	12 1/4	0.370	3/8	3/16	8.08	8 1/8	0.640	5/8	1.14	1 1/2	15/16	9 1/4	5 1/2
×45	13.1	12.1	12	0.335	5/16	3/16	8.05	8	0.575	9/16	1.08	1 3/8	15/16	↓	↓
×40	11.7	11.9	12	0.295	5/16	3/16	8.01	8	0.515	1/2	1.02	1 3/8	7/8	↓	↓

Question (4a)(continued…)

W Shapes
Properties

W12 – W10

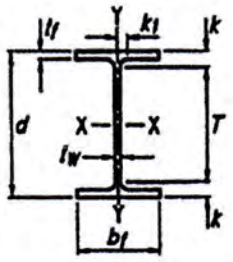
Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
58	7.82	27.0	475	78.0	5.28	86.4	107	21.4	2.51	32.5	2.82	11.6	2.10	3570
53	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
50	6.31	26.8	391	64.2	5.18	71.9	56.3	13.9	1.96	21.3	2.25	11.6	1.71	1880
45	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	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

Critical Buckling Stress:

$F_{cr} = [0.658^{Fy/Fe}]\, F_y$ [if $KL/r \leq 4.71\sqrt{(E/F_y)}$]

$F_{cr} = [0.877 F_e]$ [otherwise]

(Question 6a, 7a)



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_1	T	Work-able Gage
	in.^{2}	in.		in.		in.	in.		in.		k_{des} in.	k_{det} 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		

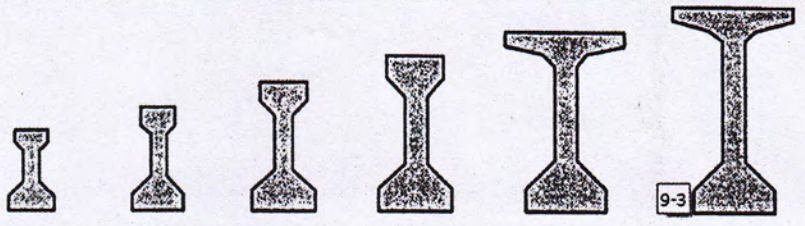
(Question 6a, 7a continued…)

W Shapes
Properties

W14 – W12

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

Properties, Dimensions and Maximum Spans for AASHTO-PCI I-Girders



Type I Type II Type III Type IV Type V Type VI

9-3

Beam Properties and Basic Dimensions

Type	Area	Centroid to Btm	Moment of Inertia	Height	Width		
					Top Flange	Web	Bottom Flange
	(in.^{2})	(in.)	(in.^{4})	(in.)	(in.)	(in.)	(in.)
I	276	12.59	22,750	28	12	6	16
II	369	15.83	50,980	36	12	6	18
III	560	20.27	125,390	45	16	7	22
IV	789	24.73	260,730	54	20	8	26
V	1,013	31.96	521,180	63	42	8	28
VI	1,085	36.38	733,320	72	42	8	28

Standard Prestressing Tendons (A23.3-04 Clause N3.1.1)

	Grade f_{pu} (MPa)	Size Designation	Nominal Dimensions	
			Diameter (mm)	Area (mm²)
Seven Wire Strand	1860	9	9.53	55
	1860	11	11.13	74
	1860	13	12.70	99
	1860	15	15.24	140
	1760	16	15.47	148
Pre-Stressing Wire	1550	5	5.00	19.6
	1720	5	5.00	19.6
	1620	7	7.00	38.5
	1760	7	7.00	38.5
Deformed Prestressing Bars	1080	15	15.0	177
	1030	26	26.5	551
	1100	26	26.5	551
	1030	32	32.0	804
	1100	32	32.0	804
	1030	36	36.0	1018

Table 5.8.2 Suggested simple span multipliers to be used as a guide in estimating long-term cambers and deflections for typical prestressed components

	Without composite topping	With composite topping
At erection:		
(1) Deflection (downward) component—apply to the elastic deflection due to the component weight at release of prestress	1.85	1.85
(2) Camber (upward) component—apply to the elastic camber due to prestress at the time of release of prestress	1.80	1.80
Final:		
(3) Deflection (downward) component—apply to the elastic deflection due to the component weight at release of prestress	2.70	2.40
(4) Camber (upward) component—apply to the elastic camber due to prestress at the time of release of prestress	2.45	2.20
(5) Deflection (downward)—apply to elastic deflection due to superimposed dead load only	3.00	3.00
(6) Deflection (downward)—apply to elastic deflection caused by the composite topping	—	2.30

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B.Sc. in Civil Engineering

Course Title: Structural Engineering V | Course Code: CE 415
Time: 2 (Two) hours | Full Marks: 100

There are 6 (Six) questions in this section. Answer any 5(Five).

Assume reasonable values for any missing data. Symbols used have their usual meanings.

1. (a) Describe briefly the different sources of prestress loss in a prestressed concrete member. **2**

   (b) Make a final design for the section of a prestressed-concrete AASHTO-PCI I- Girder to resist a total moment (M_T) of 750 kN-m including girder self-weight moment allowing no tension in the concrete both at transfer and under working load. Assume a trial depth of the section is $42\sqrt{(M_T)}$ in mm (where M_T is in kN-m). I-Girder beam is simply supported and having a span of 15 m. Prestressing will be done with Grade 1860 MPa #9 (diameter 9.53 mm) low-relaxation seven-wire strand. Find out the prestressing force which is needed to be applied at initial stage and the number of strand required for prestressing. Also, show a possible strand layout following ACI code. Assume 20% loss of prestress due to elastic shortening. **18**

   Given: $E_s = 2 \times 10^5$ MPa; $E_c = 2.5 \times 10^4$ MPa; $f_{ci}' = 34$ MPa; $f_c' = 40$ MPa; Relaxation losses = 3%; $f_{pi}=0.75\,f_{pu}$

2. (a) Compare with brief Pre-stressed concrete with Reinforced Concrete with respect to serviceability, safety and economy. **3**

   (b) The cross section of a precast pretensioned single-tee beam is shown in **Fig. 1**. The beam is simply supported and having a span of 25 m. The low-relaxation prestressing strands were tensioned to a stress of 1400 MPa in the pretensioning bed, prior to casting of the concrete. The strands have constant eccentricity along the span of the beam. Compute the camber at mid-span before the application of live load and long term deflection (final) under the effect of a concentrated live load of 60 kN at mid-span of the beam. Use the multipliers of PCI design handbook. **17**

   Given: $E_s = 2 \times 10^5$ MPa; $E_c = 2.5 \times 10^4$ MPa; $f_c' = 35$ MPa; Relaxation losses = 3%; CG of section (from bottom), $y_b = 710.9$ mm; $I = 2.99 \times 10^{10}$ mm^4

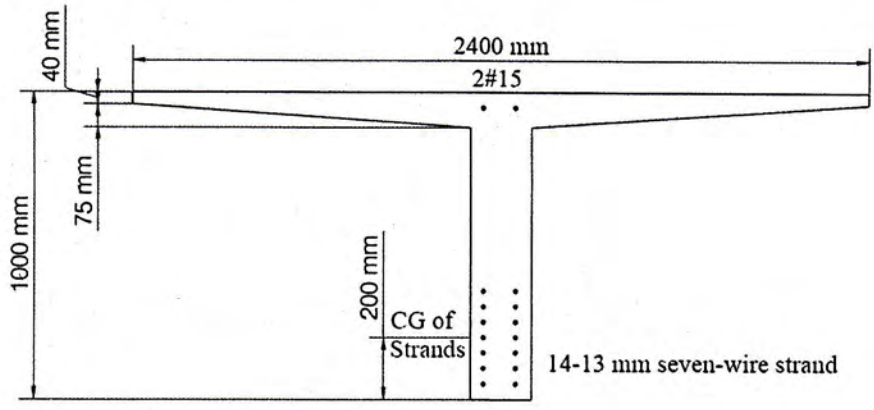


Fig. 1

3. (a) Describe briefly the different stages of loading to which a prestressed concrete member is often subjected. **3**

   (b) Draw four layouts of tendons for post-tensioned simply supported beam. **2**

   (c) A beam having an inverted T cross section is to be designed to carry a service live load of 17 kN/m and superimposed dead load of 6 kN/m in addition to its own weight, on a 12 m cantilever span as shown in **Fig. 2**. The member will be post-tensioned using two 65 mm tendons each composed of 12#13 low relaxation seven wire strands (f_{po}=0.75 f_{pu}). Concrete strength at 28 days is specified to be 30 MPa. Prestress losses can be estimated as P_i = 0.95 P_o and P_e = *0.90* P_o. Calculate the fiber stresses after long-term losses have occurred (total load and P_e) in the concrete at the support and at the free end. Are these stresses acceptable (ACI code)? **15**

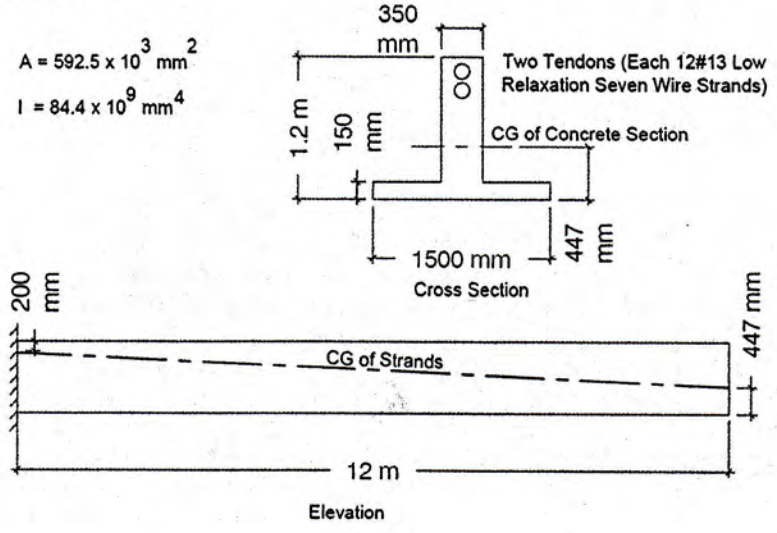


Fig. 2

4. (a) What is the basic difference between the internal couple of a prestressed and that of a reinforced beam section? **3**

   (b) Define length of transfer in Pretensioned concrete. Write down the factors that affect the length of transfer. **4**

   (c) Calculate the ultimate capacity of the beam shown in **Fig. 2**. If the capacity is **13**

unacceptable (ACI code), provide additional tension reinforcement.

5. A 3-ft depth AASHTO type II girder, precast and pretensioned, will be used with a 145 x 2440 mm cast-in-place slab to form a composite beam that will span 16 m between simple supports. The precast beam and the slab concrete will be made using concrete with $f_c' =$ 35 MPa. An initial prestress force of 2100 kN, applied 294 mm below the centroid of the precast beam is reduced by time dependent losses to 1750 kN. The loads to be carried by the girder are: Girder own weight = 5 kN/m, Concrete slab weight = 8.4 kN/m, Superimposed dead load = 2.7 kN/m, and Live load 16.5 kN/m. Find the flexural stresses in the beam corresponding to the following load combinations: **20**

   i. Initial prestress plus self-weight of the precast beam.
   ii. Effective prestress plus all non-composite dead loads.
   iii. Effective prestress plus full service loads.

   Knowing that the prestressing steel consist of 19-13 mm diameter seven-wire strands, calculate the ultimate flexural strength of the AASHTO type II girder.

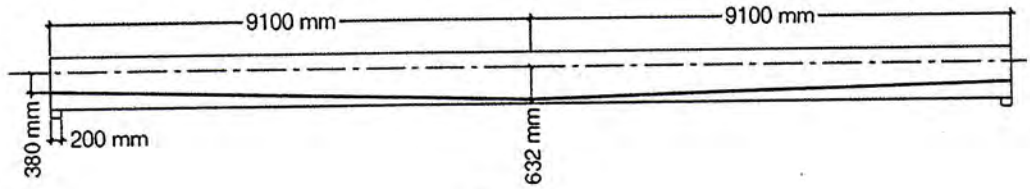
6. (a) What is the difference (analysis and design) between bonded and un-bonded prestressed beams? **2**

   (b) What is the difference between creep and relaxation? **1**

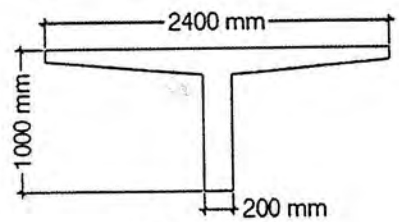
   (c) For the 18.2 m post-tensioned beam shown in **Fig. 3**, calculate total load intensity 'w' causing web shear cracks and flexure-shear cracks at a distance, x= 650 mm from support. **17**

   Given: $A_c = 376{,}000$ mm^2; $A_{ps} =$ 12#13 mm low relaxation strands;
   $E_s = 2 \times 10^5$ MPa; $E_c = 2.5 \times 10^4$ MPa; $f_{pe} = 1080$ MPa; $f_c' = 35$ MPa; CG of section (from bottom), $y_b = 714$ mm; $I = 3.63 \times 10^{10}$ mm^4; $V_p = 35$ kN.

   Hint: You have to find the cracking moment, M_{cr} at x= 650 mm using first concept of prestressed concrete according to your text book.



Elevation



CPCI 2400x1000

Cross Section

Fig. 3

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B.Sc. in Civil Engineering

Course Code: CE 425 — Time: 2 (Two) Hours
Course Title: Structural Engineering X — Full Marks: (20 + 8x10) = 100

*Answer **Question 1 (Question 1 is mandatory) and any 8 (eight)** from rest of the questions (**2-10**)*

1. Prepare a mix design using BRE mix method with the following data:

   Target Mean Strength: 38 N/mm^2 at 28 days
   Cement Type: 42.5 N
   Aggregate type: Crushed Granite
   Max. Aggregate size: 20 mm
   Aggregate density: 2700 Kg/m^3
   Sand density: 2600 Kg/m^3
   Fine aggregate grading: 44%
   Slump: 30-60 mm

   Necessary graphs and tables provided at the end of this document. Assume reasonable value for any missing data.

2. What is 'green concrete'? How can you produce 'green concrete'? Discuss its potential use in the context of Bangladesh.

3. Using the formulae below, calculate the Bogue compound contents of the following Portland cements.

$C_3S = 4.07(CaO) - 7.60(SiO_2) - 6.72(Al_2O_3) - 1.43(Fe_2O_3) - 2.85(SO_3)$
$C_2S = 2.87(SiO_2) - 0.75(C_3S)$
$C_3A = 2.65(Al_2O_3) - 1.69(Fe_2O_3)$
$C_4AF = 3.04(Fe_2O_3)$

Bulk Oxide Content, %	**Cement 1**	**Cement 2**	**Cement 3**
CaO	63.0	66.0	66.0
Al_2O_3	7.7	7.0	5.5
Fe_2O_3	3.3	3.0	4.5
SiO_2	22.0	20.0	20.0
SO_3	0.1	0.1	0.2

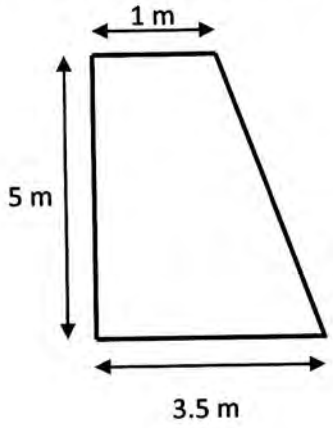
Which of the cements is likely to be low heat cement and which one is rapid hardenings cement? Give reasons for your answers.

4. How will the shape of the heat evolution (hydration) curve of PC be affected by:
   (i) the mean particle size of the cement grains;
   (ii) the temperature of the surrounding environment;
   (iii) the composition of the cement with respect to the C_3S, C_2S, C_3A and C_4AF phases

5. Describe the various forms of water present in hardened concrete matrix. Explain why curing is crucial for quality concrete.

6. Determine the concrete pressure at every 0.5 m height of a mass concrete retaining wall.

Given:
For wall element $C_1 = 10$, $C_2 = 0.45$,
Wet density of concrete = 25 kN/m^3,
Concrete temperature at placing = 10° C,
Uniform supply rate of one 6 m^3 truck every 20 minutes.



7. Write short notes on: Accelerating, Retarding, Plasticizer, Superplasticizer and water resistant admixture. In each case you should state their properties, influencing factors, application, mechanism and effect on concrete.

8. Discuss the problems associated with concreting in hot weather and their remedies.

9. Show in an outline the different types of cracks in concrete. Discuss Plastic settlement of concrete. How can we minimize the plastic settlement cracks in concrete?

10. What are the Initiation and propagation period of carbonation? Discuss the mechanism of carbonation. Write about determination of carbonation depth. Discuss the factors influencing carbonation.

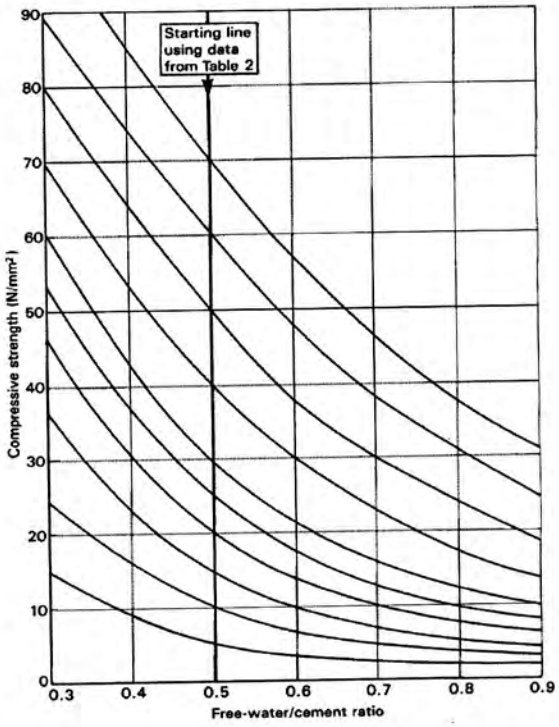
Table 2 Approximate compressive strengths (N/mm²) of concrete mixes made with a free-water/cement ratio of 0.5

Cement strength class	Type of coarse aggregate	Compressive strengths (N/mm²) Age (days) 3	7	28	91
42.5	Uncrushed	22	30	42	49
	Crushed	27	36	49	56
52.5	Uncrushed	29	37	48	54
	Crushed	34	43	55	61

Throughout this publication concrete strength is expressed in the units N/mm². 1 N/mm² = 1 MN/m² = 1 MPa. (N = newton; Pa = pascal.)

Table 3 Approximate free-water contents (kg/m³) required to give various levels of workability

Slump (mm)		0–10	10–30	30–60	60–180
Vebe time (s)		>12	6–12	3–6	0–3
Maximum size of aggregate (mm)	Type of aggregate				
10	Uncrushed	150	180	205	225
	Crushed	180	205	230	250
20	Uncrushed	135	160	180	195
	Crushed	170	190	210	225
40	Uncrushed	115	140	160	175
	Crushed	155	175	190	205



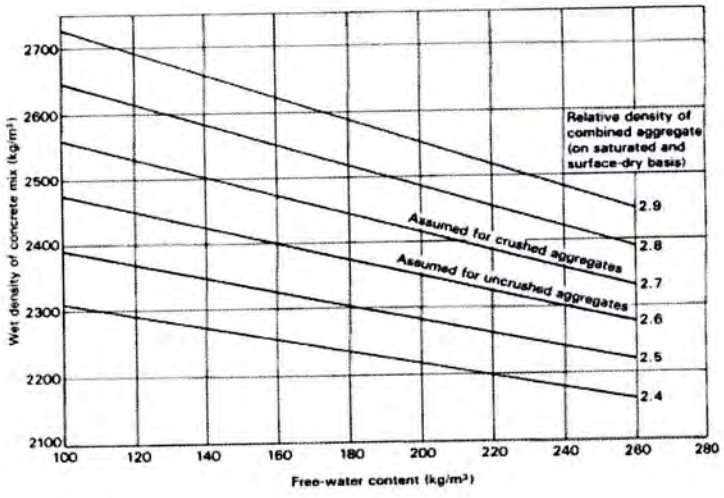


Figure 5 Estimated wet density of fully compacted concrete

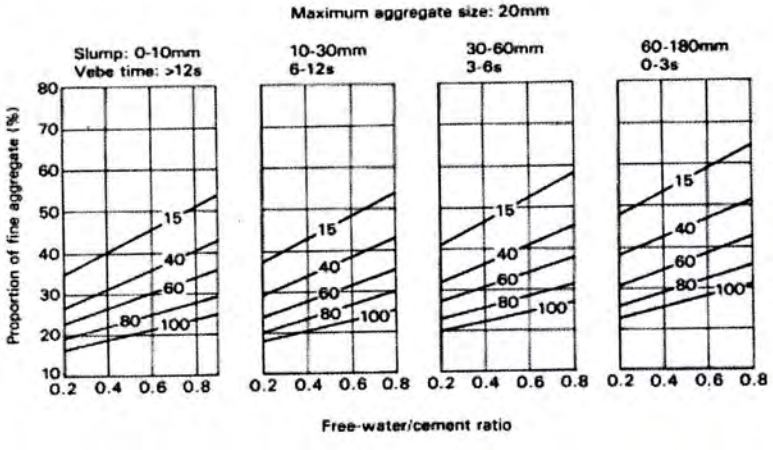


Figure 6 (continued)

Table 9 Approximate free-water contents required to give various levels of workability

Part A: Portland cement concrete

Slump (mm)		0–10	10–30	30–60	60–180
Vebe time (s)		>12	6–12	3–6	0–3
Maximum size of aggregate (mm)	Type of aggregate	Water content (kg/m³)			
10	Uncrushed	150	180	205	225
	Crushed	180	205	230	250
20	Uncrushed	135	160	180	195
	Crushed	170	190	210	225
40	Uncrushed	115	140	160	175
	Crushed	155	175	190	205

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

Course Title: Environmental Engineering VII | Course Code: CE 439
Time: 2 hour | Full Marks: 50

There are Six (6) questions. Answer any Five (5).

1. (a) Explain EIA inputs to the project cycle. [5]
   (b) Develop a simple checklist for a road project. The checklist should include adverse and beneficial impacts of the project on environmental components. [5]

2. (a) Illustrate the prediction techniques applicable in EIA. [5]
   (b) Explain the aim, scope and use of existing information of the JNCC (Joint Nature Conservation Committee, United Kingdom) Phase 1 habitat survey method. [5]

3. (a) Enlist the legislative and administrative documents for environmental protection in Bangladesh. [5]
   (b) What are the advantages and disadvantages of chemical and biological methods for water samples analyses? [5]

4. (a) What is the importance of social impacts in EIA according to UNEP (1996)? [2]
   (b) With a diagram show the linkages between socio-economic impacts for a power station. [4]
   (c) How the demand for local services can be predicted for in-migrant employees of a major development project? [4]

5. (a) Enlist the review criteria of an EIA report. [4]
   (b) How EIA report quality control is being achieved? [4]
   (c) What are the main points of the Introduction chapter of an EIA report to be reviewed? [2]

6. (a) What do you mean by compliance monitoring and environmental effects monitoring? [5]
   (b) Explain the role of environmental monitoring program in EIA by the three major information feedback loops. [5]

W Shapes
Dimensions

(Question 7a)

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.
W24×370[h]	109	28.0	28	1.52	1 1/2	3/4	13.7	13 5/8	2.72	2 3/4	3.22	3 5/8	1 9/16	20 3/4	5 1/2
×335[h]	98.4	27.5	27 1/2	1.38	1 3/8	11/16	13.5	13 1/2	2.48	2 1/2	2.98	3 3/8	1 1/2		
×306[h]	89.8	27.1	27 1/8	1.26	1 1/4	5/8	13.4	13 3/8	2.28	2 1/4	2.78	3 3/16	1 7/16		
x279[h]	82.0	26.7	26 3/4	1.16	1 3/16	5/8	13.3	13 1/4	2.09	2 1/16	2.59	3	1 7/16		
×250	73.5	26.3	26 3/8	1.04	1 1/16	9/16	13.2	13 1/8	1.89	1 7/8	2.39	2 13/16	1 3/8		
×229	67.2	26.0	26	0.960	15/16	1/2	13.1	13 1/8	1.73	1 3/4	2.23	2 5/8	1 5/16		
×207	60.7	25.7	25 3/4	0.870	7/8	7/16	13.0	13	1.57	1 9/16	2.07	2 1/2	1 1/4		
×192	56.3	25.5	25 1/2	0.810	13/16	7/16	13.0	13	1.46	1 7/16	1.96	2 3/8	1 1/4		
×176	51.7	25.2	25 1/4	0.750	3/4	3/8	12.9	12 7/8	1.34	1 5/16	1.84	2 1/4	1 3/16		
×162	47.7	25.0	25	0.705	11/16	3/8	13.0	13	1.22	1 1/4	1.72	2 1/8	1 3/16		
×146	43.0	24.7	24 3/4	0.650	5/8	5/16	12.9	12 7/8	1.09	1 1/16	1.59	2	1 1/8		
×131	38.5	24.5	24 1/2	0.605	5/8	5/16	12.9	12 7/8	0.960	15/16	1.46	1 7/8	1 1/8		
×117[c]	34.4	24.3	24 1/4	0.550	9/16	5/16	12.8	12 3/4	0.850	7/8	1.35	1 3/4	1 1/8		
×104[c]	30.6	24.1	24	0.500	1/2	1/4	12.8	12 3/4	0.750	3/4	1.25	1 5/8	1 1/16		
W24×103[c]	30.3	24.5	24 1/2	0.550	9/16	5/16	9.00	9	0.980	1	1.48	1 7/8	1 1/8	20 3/4	5 1/2
×94[c]	27.7	24.3	24 1/4	0.515	1/2	1/4	9.07	9 1/8	0.875	7/8	1.38	1 3/4	1 1/16		
×84[c]	24.7	24.1	24 1/8	0.470	1/2	1/4	9.02	9	0.770	3/4	1.27	1 11/16	1 1/16		
×76[c]	22.4	23.9	23 7/8	0.440	7/16	1/4	8.99	9	0.680	11/16	1.18	1 9/16	1 1/16		
×68[c]	20.1	23.7	23 3/4	0.415	7/16	1/4	8.97	9	0.585	9/16	1.09	1 1/2	1 1/16		

W Shapes
Properties

(Question 7a continued…)

Nominal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
370	2.51	14.2	13400	957	11.1	1130	1160	170	3.27	267	3.92	25.3	201	186000
335	2.73	15.6	11900	864	11.0	1020	1030	152	3.23	238	3.86	25.0	152	161000
306	2.94	17.1	10700	789	10.9	922	919	137	3.20	214	3.81	24.9	117	142000
279	3.18	18.6	9600	718	10.8	835	823	124	3.17	193	3.76	24.6	90.5	125000
250	3.49	20.7	8490	644	10.7	744	724	110	3.14	171	3.71	24.5	66.6	108000
229	3.79	22.5	7650	588	10.7	675	651	99.4	3.11	154	3.67	24.3	51.3	96100
207	4.14	24.8	6820	531	10.6	606	578	88.8	3.08	137	3.62	24.1	38.3	84100
192	4.43	26.6	6260	491	10.5	559	530	81.8	3.07	126	3.60	24.0	30.8	76300
176	4.81	28.7	5680	450	10.5	511	479	74.3	3.04	115	3.57	23.9	23.9	68400
162	5.31	30.6	5170	414	10.4	468	443	68.4	3.05	105	3.57	23.8	18.5	62600
146	5.92	33.2	4580	371	10.3	418	391	60.5	3.01	93.2	3.53	23.7	13.4	54600
131	6.70	35.6	4020	329	10.2	370	340	53.0	2.97	81.5	3.49	23.5	9.50	47100
117	7.53	39.2	3540	291	10.1	327	297	46.5	2.94	71.4	3.46	23.4	6.72	40800
104	8.50	43.1	3100	258	10.1	289	259	40.7	2.91	62.4	3.42	23.3	4.72	35200
103	4.59	39.2	3000	245	10.0	280	119	26.5	1.99	41.5	2.40	23.6	7.07	16600
94	5.18	41.9	2700	222	9.87	254	109	24.0	1.98	37.5	2.40	23.4	5.26	15000
84	5.86	45.9	2370	196	9.79	224	94.4	20.9	1.95	32.6	2.37	23.3	3.70	12800
76	6.61	49.0	2100	176	9.69	200	82.5	18.4	1.92	28.6	2.34	23.2	2.68	11100
68	7.66	52.0	1830	154	9.55	177	70.4	15.7	1.87	24.5	2.30	23.1	1.87	9430

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
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 are the beneficial consequences of source reduction that are related to climate change? Mention the key concepts of on-site processing. (3+3)

(b) What are the indicators that can be used to measure the performance of a recycling scheme? (3)

(c) Solid wastes from Tejgaon residential area need to be collected considering low collection cost, minimum crew size and with no provision of scheduled services. Mention which mode of collection would be appropriate, justify. (3+8)
Again, Tejgaon Industrial area is to be collected using a stationary container collection system. The containers have 10 cubic metre of volume. Determine the appropriate truck capacity for the given conditions:

- Container utilization factor = 0.7
- Average number of containers at each location = 2
- Collection-vehicle compaction ratio = 2.5
- Container unloading time = 0.15h/container
- Average drive time between container location = 0.15h
- One way haul distance = 30 km
- Speed limit = 88 km/h
- Time from garage to first container locations = 0.40h
- Time from last container location to garage = 0.30h
- Number of trips to disposal site per day = 3
- Length of working day = 8h

2. (a) Why is maintenance important for vehicles? Compare the different ways of maintenance of collection vehicles. Why is collection process the largest cost element in solid waste management system? (2+6 +2)

(b) A summary table for the chemical components of a solid waste sample is given below. Determine approximate chemical formulas with and without sulfur. Also calculate the energy content of the waste using Dulong's formula. (10)

Component	Moisture	Carbon	Hydrogen	Oxygen	Nitrogen	Sulfur	Ash
Mass (kg)	45.60	28.7	3.32	16.4	1.72	0.16	4.1

3. (a) Discuss the significance, risk and cost components of recycling process. (7)

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

(c) Consider the chemical formula of the waste that you obtained without sulfur in 2(b). Calculate the requirement of air for the organic waste for composting. (8)

4. (a) Show the pathways that the humans can be exposed to hazardous waste. (4)

(b) What are the factors to consider while establishing a transfer station? Explain when the transfer station option becomes more cost effective in comparison with direct haul. (3+3)

(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 400 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 60 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. Assume 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. Also plot the result showing the fixed cost and the variable cost varying over time. (10)

5. (a) List the categories of hazardous waste with examples. (5)

(b) Define industrial waste with example. Show in a flow chart what are the components/elements that an industrial management scheme/model should have. (3+4)

(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

6. (a) Mention different ways of gas extraction/recovery methods from landfill. (5)

(b) Mention the general categories of contaminants in a landfill that need to be treated and (6)

also list down the methods of treating the respective contaminants from leachate.

(c) Design a sanitary landfill that will be built in a flat area which will be used ultimately for construction purpose after 20 years i.e. the land is being taken through lease by the Govt. Solve the following problems:

i) Some refuse in the landfill consist of garden trimming (30% by weight) and glass waste (45% by weight). If the uncompacted bulk density of garden waste and glass waste are 4.56 and 18.65 lb/ft^3 respectively and compaction in the landfill is 48 lb/ft^3 , estimate the percent volume reduction during compaction of the waste. (4)

ii) Calculate the required landfill capacity for the Year, 2017 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)

Given Formula:

Energy Content (KJ/Kg) = 338.2C+1430 (H-O/8) + 95.4S

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

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

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

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

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

Table : Typical values for haul constant coefficients m and n

Type of haul	Speed limit km/h	m h/trip	n h/km
Communal	88	0.016	0.011
Block	72	0.032	0.014
Kerbside	56	0.034	0.018
Door-to-door	40	0.05	0.025

Table: Typical data for computing equipment and labour requirements for hauled- and stationary-container collection

Collection			Pick up loaded container and deposit empty container, h/trip	Empty contents of loaded container, h/container	At-site time q, h/trip
Vehicle	Loading method	Compaction ratio, z			
Hauled container (Tilt-frame)	Mechanical	2.0–4.0	0.5		0.129
Stationary container (Compactor)	Mechanical	2.0–4.0		0.05	0.15

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
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 are the beneficial consequences of source reduction that are related to climate change? Mention the key concepts of on-site processing. (3+3)

(b) What are the indicators that can be used to measure the performance of a recycling scheme? (3)

(c) Solid wastes from Tejgaon residential area need to be collected considering low collection cost, minimum crew size and with no provision of scheduled services. Mention which mode of collection would be appropriate, justify. (3+8)
Again, Tejgaon Industrial area is to be collected using a stationary container collection system. The containers have 10 cubic metre of volume. Determine the appropriate truck capacity for the given conditions:

- Container utilization factor = 0.7
- Average number of containers at each location = 2
- Collection-vehicle compaction ratio = 2.5
- Container unloading time = 0.15h/container
- Average drive time between container location = 0.15h
- One way haul distance = 30 km
- Speed limit = 88 km/h
- Time from garage to first container locations = 0.40h
- Time from last container location to garage = 0.30h
- Number of trips to disposal site per day = 3
- Length of working day = 8h

2. (a) Why is maintenance important for vehicles? Compare the different ways of maintenance of collection vehicles. Why is collection process the largest cost element in solid waste management system? (2+6 +2)

(b) A summary table for the chemical components of a solid waste sample is given below. Determine approximate chemical formulas with and without sulfur. Also calculate the energy content of the waste using Dulong's formula. (10)

Component	Moisture	Carbon	Hydrogen	Oxygen	Nitrogen	Sulfur	Ash
Mass (kg)	45.60	28.7	3.32	16.4	1.72	0.16	4.1

3. (a) Discuss the significance, risk and cost components of recycling process. (7)

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

(c) Consider the chemical formula of the waste that you obtained without sulfur in 2(b). Calculate the requirement of air for the organic waste for composting. (8)

4. (a) Show the pathways that the humans can be exposed to hazardous waste. (4)

(b) What are the factors to consider while establishing a transfer station? Explain when the transfer station option becomes more cost effective in comparison with direct haul. (3+3)

(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 400 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 60 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. Assume 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. Also plot the result showing the fixed cost and the variable cost varying over time. (10)

5. (a) List the categories of hazardous waste with examples. (5)

(b) Define industrial waste with example. Show in a flow chart what are the components/elements that an industrial management scheme/model should have. (3+4)

(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

6. (a) Mention different ways of gas extraction/recovery methods from landfill. (5)

(b) Mention the general categories of contaminants in a landfill that need to be treated and (6)

also list down the methods of treating the respective contaminants from leachate.

(c) Design a sanitary landfill that will be built in a flat area which will be used ultimately for construction purpose after 20 years i.e. the land is being taken through lease by the Govt. Solve the following problems:

i) Some refuse in the landfill consist of garden trimming (30% by weight) and glass waste (45% by weight). If the uncompacted bulk density of garden waste and glass waste are 4.56 and 18.65 lb/ft^3 respectively and compaction in the landfill is 48 lb/ft^3 , estimate the percent volume reduction during compaction of the waste. (4)

ii) Calculate the required landfill capacity for the Year, 2017 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)

Given Formula:

Energy Content (KJ/Kg) = 338.2C+1430 (H-O/8) + 95.4S

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

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

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

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

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

Table : Typical values for haul constant coefficients m and n

Type of haul	Speed limit km/h	m h/trip	n h/km
Communal	88	0.016	0.011
Block	72	0.032	0.014
Kerbside	56	0.034	0.018
Door-to-door	40	0.05	0.025

Table: Typical data for computing equipment and labour requirements for hauled- and stationary-container collection

Collection			Pick up loaded container and deposit empty container, h/trip	Empty contents of loaded container, h/container	At-site time q, h/trip
Vehicle	Loading method	Compaction ratio, z			
Hauled container (Tilt-frame)	Mechanical	2.0–4.0	0.5		0.129
Stationary container (Compactor)	Mechanical	2.0–4.0		0.05	0.15

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2016
Program: B.Sc. in Civil Engineering

Course Title: Structural Engineering V | Course Code: CE 415
Time: 2 (Two) hours | Full Marks: 100

There are 6 (Six) questions in this section. Answer any 5(Five).

Assume reasonable values for any missing data. Symbols used have their usual meanings.

1. (a) Describe briefly the different sources of prestress loss in a prestressed concrete member. **2**

   (b) Make a final design for the section of a prestressed-concrete AASHTO-PCI I- Girder to resist a total moment (M_T) of 750 kN-m including girder self-weight moment allowing no tension in the concrete both at transfer and under working load. Assume a trial depth of the section is $42\sqrt{(M_T)}$ in mm (where M_T is in kN-m). I-Girder beam is simply supported and having a span of 15 m. Prestressing will be done with Grade 1860 MPa #9 (diameter 9.53 mm) low-relaxation seven-wire strand. Find out the prestressing force which is needed to be applied at initial stage and the number of strand required for prestressing. Also, show a possible strand layout following ACI code. Assume 20% loss of prestress due to elastic shortening. **18**

   Given: $E_s = 2 \times 10^5$ MPa; $E_c = 2.5 \times 10^4$ MPa; $f_{ci}' = 34$ MPa; $f_c' = 40$ MPa; Relaxation losses = 3%; $f_{pi}=0.75\, f_{pu}$

2. (a) Compare with brief Pre-stressed concrete with Reinforced Concrete with respect to serviceability, safety and economy. **3**

   (b) The cross section of a precast pretensioned single-tee beam is shown in **Fig. 1**. The beam is simply supported and having a span of 25 m. The low-relaxation prestressing strands were tensioned to a stress of 1400 MPa in the pretensioning bed, prior to casting of the concrete. The strands have constant eccentricity along the span of the beam. Compute the camber at mid-span before the application of live load and long term deflection (final) under the effect of a concentrated live load of 60 kN at mid-span of the beam. Use the multipliers of PCI design handbook. **17**

   Given: $E_s = 2 \times 10^5$ MPa; $E_c = 2.5 \times 10^4$ MPa; $f_c' = 35$ MPa; Relaxation losses = 3%; CG of section (from bottom), $y_b = 710.9$ mm; $I = 2.99 \times 10^{10}$ mm^4

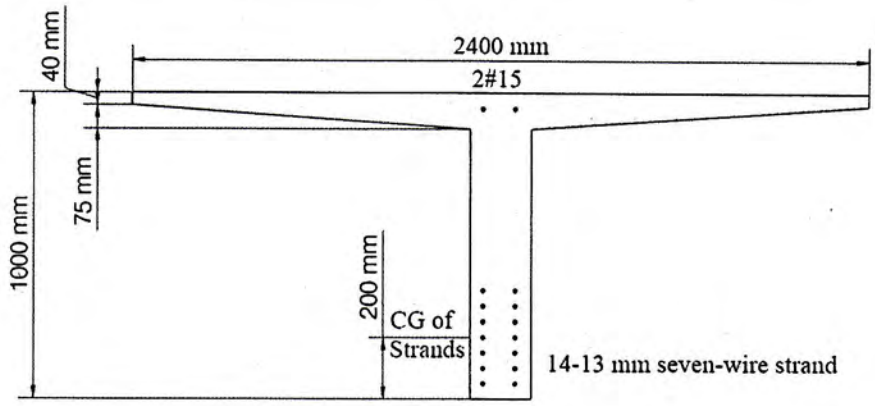


Fig. 1

3. (a) Describe briefly the different stages of loading to which a prestressed concrete member is often subjected. **3**

   (b) Draw four layouts of tendons for post-tensioned simply supported beam. **2**

   (c) A beam having an inverted T cross section is to be designed to carry a service live load of 17 kN/m and superimposed dead load of 6 kN/m in addition to its own weight, on a 12 m cantilever span as shown in **Fig. 2**. The member will be post-tensioned using two 65 mm tendons each composed of 12#13 low relaxation seven wire strands (f_{po}=0.75 f_{pu}). Concrete strength at 28 days is specified to be 30 MPa. Prestress losses can be estimated as $P_i = 0.95\ P_o$ and $P_e = 0.90\ P_o$. Calculate the fiber stresses after long-term losses have occurred (total load and P_e) in the concrete at the support and at the free end. Are these stresses acceptable (ACI code)? **15**

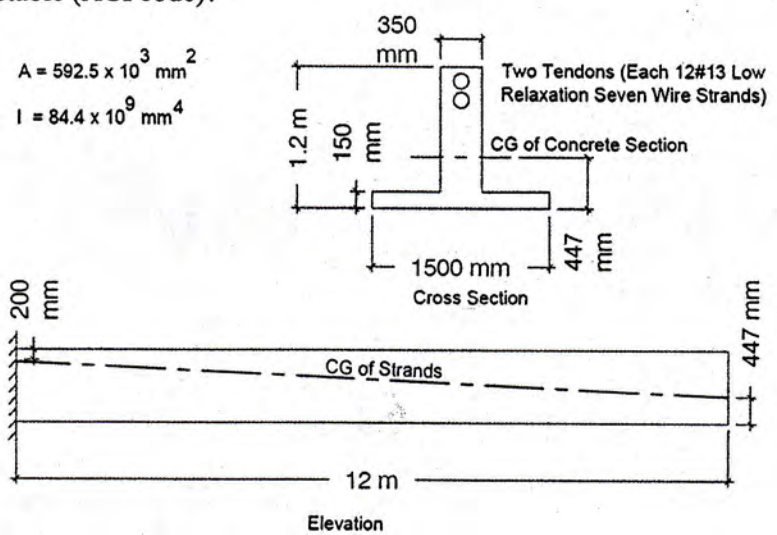


Fig. 2

4. (a) What is the basic difference between the internal couple of a prestressed and that of a reinforced beam section? **3**

   (b) Define length of transfer in Pretensioned concrete. Write down the factors that affect the length of transfer. **4**

   (c) Calculate the ultimate capacity of the beam shown in **Fig. 2**. If the capacity is **13**

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

Course Title: Environmental Engineering VIII (GIS and Remote Sensing) Course Code: CE 531
Time: 2 hour Full marks: 100

There are 6 (six) questions. Answer any 5 (five) of them (20*5=100)

1. a. What are the different data sources for GIS? Compare them based on data acquisition methods and equipment used. (4)
   b. Name the methods for digitizing spatial information. Describe the Heads-up digitizing process. Which method is an easy-to-use tool to convert a raster to a vector data, and why? (10)
   c. Discuss the following digitizing errors in brief: (6)
      i. Undershoot iii. Dangles
      ii. Spurious polygons iv. Polygon closure error
   How can you minimize these errors?

2. a. What is metadata? Describe the parameters in designing a spatial database. Compare the following: (10)
      i. File geodatabase and ArcSDE geodatabase
      ii. Feature attribute table and Standalone table
   b. How does object-based database differ from relational database? Which one is most popular for GIS model, and why? (4)
   c. Discuss about projection properties. Write down the parameters for the classification of map projection. Why is it necessary to know the different projection systems? Name the two projection systems mostly used in Bangladesh. (6)

3. a. Describe the following three spatial interpolation methods: (12)
      i. Natural neighborhood interpolation
      ii. Spline interpolation
      iii. Kriging method
   b. How does the kriging method overcome the limitation of IDW? Name the factors that influence your choice of spatial data interpolation method. (6)
   c. Name the five spatial data analysis tools. (2)

4. a. How is the overlay method used for raster and vector data analysis? (10)
   b. What do you understand by TIN? How can you develop TIN model? Write down the advantages and disadvantages of TIN model. (10)

5. a. Based on the knowledge developed in this course, describe **one** application of GIS technology in **any one** of the following Civil Engineering areas (provide detail methodology of the tools/techniques you'll be using in the application) (10)
      i. Construction Engineering iii. Geotechnical Engineering
      ii. Environmental Engineering iv. Transportation Engineering
   b. What is address geo-coding? Describe the geo-coding process. Name two applications of geo-coding process. (10)

6. Write short notes on any 4 (four) of the following: (4*5)

a. Geo-referencing
b. UTM
c. Reclassification
d. DEM
e. Thematic map

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

Course Title: Professional Practice and Communication — Course Code: CE 403
Time: 2 hour — Full marks: 100

There are 6 (six) questions. Answer any 5 (five) of them (20*5=100)

1. a. What are the 7Cs of communication? Out of them, explain conciseness, concreteness and clarity of communication with examples. (12)
   b. Describe barriers in communication from the aspects of communicator and receiver. (5)
   c. How can you improve listening skill? (3)

2. a. How can you say a 'Research title' good or bad? Explain with examples. (5)
   b. What are the do's and don'ts in writing a proposal? (6)
   c. What do you understand by 'Democratic and Participatory' leadership style followed in a meeting? (5)
   d. Name more commonly used different contract formats. (4)

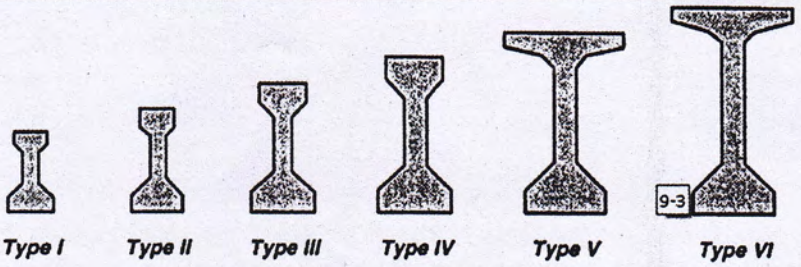
3. a. Write down the chronological procedures followed in solicited major proposals. (10)
   b. What do you mean by RFP? What information it should include? (6)
   c. What does citation mean? Why is citation important? (4)

4. a. What is your understanding about professional ethics? (4)
   b. Explain preventive ethics and aspirational ethics. (12)
   c. What are the characteristics of reasonable care model. (4)

5. a. Name the six dispute resolution methods. (3)
   b. Describe arbitration and litigation as methods of dispute resolution. How do these two methods differ from others? (12)
   c. What are the criteria you should consider for giving a good presentation? (5)

6. Write short notes on any 4(four) of the following: (5*4)
   a. Egocentrism
   b. Participant roles in meeting
   c. Supererogation model
   d. Fiduciary risk
   e. Memo

Properties, Dimensions and Maximum Spans for AASHTO-PCI I-Girders



Type I Type II Type III Type IV Type V Type VI

Beam Properties and Basic Dimensions

Type	Area	Centroid to Btm	Moment of Inertia	Height	Width		
					Top Flange	Web	Bottom Flange
	(in.^{2})	(in.)	(in.^{4})	(in.)	(in.)	(in.)	(in.)
I	276	12.59	22,750	28	12	6	16
II	369	15.83	50,980	36	12	6	18
III	560	20.27	125,390	45	16	7	22
IV	789	24.73	260,730	54	20	8	26
V	1,013	31.96	521,180	63	42	8	28
VI	1,085	36.38	733,320	72	42	8	28

Standard Prestressing Tendons (A23.3-04 Clause N3.1.1)

	Grade f_{pu} (MPa)	Size Designation	Nominal Dimensions	
			Diameter (mm)	Area (mm²)
Seven Wire Strand	1860	9	9.53	55
	1860	11	11.13	74
	1860	13	12.70	99
	1860	15	15.24	140
	1760	16	15.47	148
Pre-Stressing Wire	1550	5	5.00	19.6
	1720	5	5.00	19.6
	1620	7	7.00	38.5
	1760	7	7.00	38.5
Deformed Prestressing Bars	1080	15	15.0	177
	1030	26	26.5	551
	1100	26	26.5	551
	1030	32	32.0	804
	1100	32	32.0	804
	1030	36	36.0	1018

Table 5.8.2 Suggested simple span multipliers to be used as a guide in estimating long-term cambers and deflections for typical prestressed components

	Without composite topping	With composite topping
At erection:		
(1) Deflection (downward) component—apply to the elastic deflection due to the component weight at release of prestress	1.85	1.85
(2) Camber (upward) component—apply to the elastic camber due to prestress at the time of release of prestress	1.80	1.80
Final:		
(3) Deflection (downward) component—apply to the elastic deflection due to the component weight at release of prestress	2.70	2.40
(4) Camber (upward) component—apply to the elastic camber due to prestress at the time of release of prestress	2.45	2.20
(5) Deflection (downward)—apply to elastic deflection due to superimposed dead load only	3.00	3.00
(6) Deflection (downward)—apply to elastic deflection caused by the composite topping	—	2.30