4-2

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2019
Program: B. Sc. Engineering (Civil)

Course Title: Professional Practices & Communication   Course Code: CE 403
Time: 1 hour   Full Marks: 40

PART– A

1. In different contract documents different dates of completion of a construction project has been   **(5)**
    stated. If a dispute arises as to when the project has to be completed, mention in order of priority the
    documents you will consider to establish the actual date according to Public Procurement Rules,
    2008.

2. Differentiate between Tender Security and Performance Security.   **(5)**

3. In which ways do the 'Dhaka Metropolitan Building Construction Rules, 2008' supersede the   **(5)**
    earlier set of rules in establishing development control by RAJUK?

4. Calculate maximum allowable area (in *sq. ft.*) per floor of the residential building based on the   **(5)**
    information provided below. Follow chart 1 (attached) for relevant values.

    Size of plot : 5 *katha* (1 *katha* = 720 *sq. ft.*)

    No. of floors to be constructed : 4 + Ground Floor

PART– B

5. Read the following passage and answer the following questions briefly.

    Mr. A is presenting a conference paper on 'present condition of traffic in Dhaka city'. He has
    included traffic survey data only from 9:00 am to 2:00 pm and had limited the the survey to
    Motijheel and Tejgaon area.

    (a) Considering the seven C's, identify in which area there is a lacking in his presentation and   **(5)**
         why?

    (b) Give your suggestions on how he can overcome this lacking and make the presentation more   **(5)**
         effective.

6. Read the following passage and answer the following questions briefly.

    X and Y are students at a university. X belongs to a middle class family from a small town whereas
    Y grew up in a very affluent family in Dhaka. They have been assigned a group project in one of
    their courses. During their discussion, Y dismissed X's opinions as worthless. As a result, the first
    impression that came into X's mind about the people in Dhaka was that they think they are
    intellectually superior and look down on people from outside Dhaka.

    (a) Name the factors that are causing a problem in this case.   **(5)**

    (b) What would you do if you were their classmate and wanted resolve this issue?   **(5)**

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CHART 1 for Question 4

RAJUK approved Floor Area Ratio (FAR) & Maximum Ground Coverage (MGC) for Residential & Commercial (office) building construction

SI. No	Size of Plot		Residential Building			Commercial Building (office)		
	Square Meter	Katha	Width of Road (meter)	FAR	MGC %	Width of Road (meter)	FAR	MGC %
01	134 sqm or less	2 katha or less	6.0	3.15	67.50	6.0	2.50	67.50
02	More than 134 sqm upto 201 sqm	More than 2 katha upto 3 katha	6.0	3.35	65.00	6.0	3.00	65.00
03	More than 201 sqm upto 268 sqm	More than 3 katha upto 4 katha	6.0	3.50	62.50	6.0	3.00	65.00
04	More than 268 sqm upto 335 sqm	More than 4 katha upto 5 katha	6.0	3.50	62.50	6.0	3.50	62.50
05	More than 335 sqm upto 402 sqm	More than 5 katha upto 6 katha	6.0	3.75	60.00	6.0	3.50	62.50
06	More than 402 sqm upto 469 sqm	More than 6 katha upto 7 katha	6.0	3.75	60.00	6.0	3.75	60.00
07	More than 469 sqm upto 535 sqm	More than 7 katha upto 8 katha	6.0	4.00	60.00	6.0	4.50	57.50
08	More than 535 sqm upto 603 sqm	More than 8 katha upto 9 katha	6.0	4.00	60.00	9.0	5.50	57.50
09	More than 603 sqm upto 670 sqm	More than 9 katha upto 10 katha	6.0	4.25	57.50	9.0	6.00	55.00
10	More than 670 sqm upto 804 sqm	More than 10 katha upto 12 katha	9.0	4.25	57.50	9.0	6.50	55.00
11	More than 804 sqm upto 938 sqm	More than 12 katha upto 14 katha	9.0	4.75	55.00	9.0	7.00	52.50
12	More than 938 sqm upto 1072 sqm	More than 14 katha upto 16 katha	9.0	5.00	52.50	9.0	7.50	52.50
13	More than 1072 sqm upto 1206 sqm	More than 16 katha upto 18 katha	9.0	5.25	52.50	9.0	8.00	50.00
14	More than 1206 sqm upto 1340 sqm	More than 18 katha upto 20 katha	9.0	5.25	50.00	9.0	8.50	50.00
15	More than 1340 sqm	More than 20 katha	12.0	5.50	50.00	12.0	9.50	50.00
16	Any Size	Any Size	18.0	6.00	50.00	18.0	Non Restricted	50.00
17	Any Size	Any Size	24.0	6.50	50.00	24.0	Non Restricted	50.00

1 sqm = 10.76 sft.

Course Title: Environmental Engineering IV   Course Code: CE 433
Time- 1 hour   Full marks: 40

Answer all the questions (*20 +20 = 40*).
[Assume reasonable data if any]

1. (a)   According to WHO air quality guidelines, 1 hr standards for CO, NO_2 and SO_2 are 30 mg/m^3,   **[12]**
         400 $\mu g/m^3$ and 350 $\mu g/m^3$ respectively. Compute these concentrations in ppm
         at temperature = $0°C$, and 1 atmosphere pressure.

     (b)   What are the major anthropogenic sources of outdoor air pollutants in urban areas? What are   **[8]**
         primary and secondary air pollutants? Give examples of each type.

2. (a)   Differentiate between point and non-point sources of water pollution. Enlist the sources of   **[9]**
         the following categories of pollutants: "pathogens", "salt", "toxic metals".

                                   OR

         Detail the adverse impacts of the following categories of pollutants:
         "suspended solids", "nutrients", "heavy metals".

     (b)   Relate the principal factors that control eutrophication with the ways to minimize the process.   **[8]**
         Predict the susceptibility of a lake to eutrophication if you have analyzed the water quality to
         find the concentrations of nutrients P = 0.02 mg/L and N = 0.3 mg/L in the lake.

     (c)   Compute the loading of P or rate of addition of P in a lake if the lake is fed by a stream with   **[3]**
         Q_s = 30 m^3/s , P_s = 0.01 mg/L and also receives wastewater with Q_w = 0.5 m^3/s, P_w = 10
         mg/L.

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2019
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering V (Prestressed Concrete) Course Code: CE 415
Time: 1 hr Full Marks: 60

*[Answer **All** the questions. **Assume** value for any missing data]*

1. (a) A pretensioned concrete member 14.0m long is eccentrically prestressed with 900mm² of steel (14) wires which are anchored to the bulkheads with a stress of 1000 MPa. Calculate the loss of prestress at mid span section [**Figure 1**] due to the elastic shortening of concrete at transfer of prestress. Assume n=7.

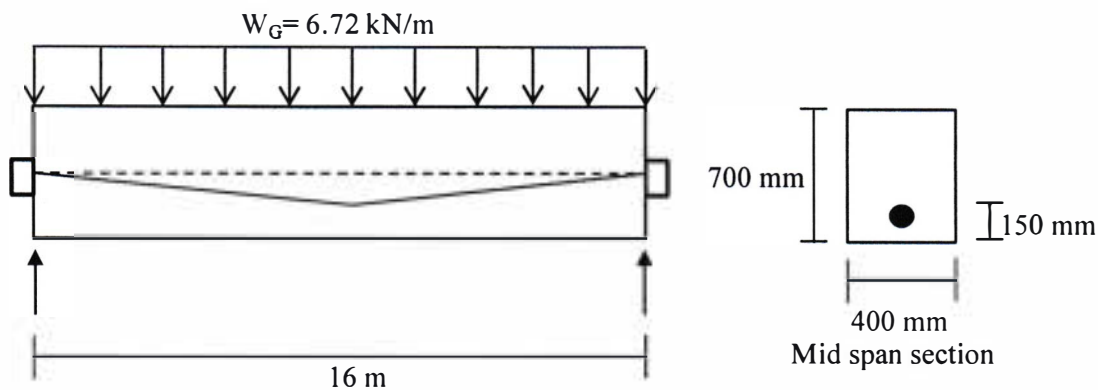W_G= 6.72 kN/m

700 mm

150 mm

400 mm
Mid span section

16 m

Figure 1: Prestressed concrete beam

(b) State the basic principles of prestressed concrete. (6)

2. A pretensioned concrete beam has a section of 250 mm × 450 mm as shown in **Figure 2**. It is (20) eccentrically prestressed with 520 mm² of steel strands which is anchored to the bulkheads at a unit stress of 1400 MPa. The c.g.s. of the strands is 100 mm above the bottom fiber. Assuming n is 7, using the exact method (the elastic theory) and approximate method, analyze the section to obtain the stresses in the concrete immediately after transfer due to the prestress.
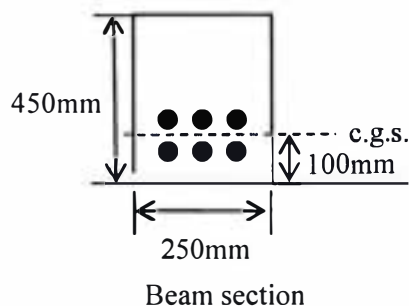
450mm

c.g.s.
100mm

250mm

Beam section

Figure 2: Rectangular beam section

3. (a) Write short notes on- (i) Prestressed Concrete, (ii) Frictional loss of prestressed concrete $\qquad$ (6)

(b) A symmetric I-section of a concrete beam is prestressed using 1850 mm^2 of steel tendon (14) with an effective stress of 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**. Analyze the section to obtain the ultimate moment capacity of the beam.
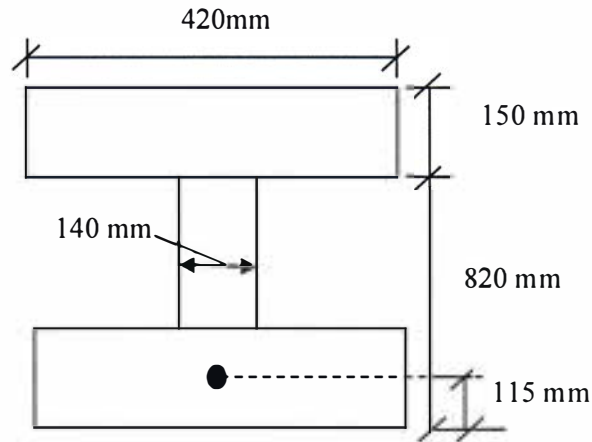
(Given: f_{pu}=1800 MPa, f'_c=48 MPa)

Figure 3: Section of an I-shaped beam

Required Formulae

❖ $f_c = -(F/A) \pm (Fey/I) \pm (My/I)$

❖ $f_c = -(F/A) \pm (M_u y/I)$

❖ $\Delta f_s = n [-(F/A) \pm (Fe^2/I) \pm (Me/I)]$

❖ $\Delta f_s = n f_c$

❖ $f_c = -(F_i/A_t) \pm (F_i ey/I_t)$

❖ $f_c = -(F/A) \pm (Fey/I)$

❖ $f_{ps} = f_{pu} \{1-0.5\rho_p (f_{pu}/f'_c)\}$

❖ $\rho_p = A_{ps}/bd$

❖ $a = (A_{ps} f_{ps}/0.85 f'_c b)$

❖ $w_p = (\rho_p f_{ps}/f'_c) \le 0.3$

❖ $M_u = \emptyset A_{ps} f_{ps}\{d-(a/2)\}$

❖ $\emptyset = 0.9$

University of Asia Pacific
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Midterm Examination Spring 2019
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering III   Course Code: CE 431
Time: 1 hour   Full Marks: 30

Answer All the questions. Assume data if not available.

1. (a) Explain the term "Integrated Solid Waste Management (ISWM)" with its aim. **[4]**

   (b) A cannery (where food/fruits are canned) receives on a given day: **[6]**
      i) 12 tons of raw produce
      ii) 5 tons of cans
      iii) 0.5 tons of cartons
      iv) 0.3 tons of miscellaneous materials.
   As a result of internal activity
      i. 10 tons of product are produced, remainder discharged to a disposal facility
      ii. 4 tons of cans are stored, remainder used
      iii) 3% of cans used are damaged and incinerated, remainder used.
      iv) 75% of miscellaneous materials become paper waste and is disposed of.
   Determine the generation rate of wastes.

2. (a) "Density of solid waste plays an important role in SWM system"—justify the statement. **[4]**
   OR
   Why is it important to know the composition of solid waste?

   (b) Differentiate between hauled-container system and stationery-container system of solid wastes collection with sketch. **[6]**

3. (a) Write short notes on: **[4]**
   Full Cost Accounting in SWM system
   OR
   Containerization in SWM system

   (b) Determine the energy content of 100kg of typical municipal solid waste having following composition: **[6]**

Component	Wet Mass (%)	Composition (Kg)					
		C	H	O	N	S	Ash
Food wastes	40	13	0.5	2.5	0.5	0.03	1.47
Paper	27	5.5	1.3	6.4	0.71	0.09	1.0
Cardboard	15	3.1	0.31	3.2	0.06	0.03	0.8
Plastics	5	3.3	0.35	1.1	--	--	0.15
Garden trimming	8	1.7	0.65	1.85	0.25	0.01	0.54
Wood	5	2.1	0.21	1.35	0.2	--	0.14

Course Title: Structural Engineering X (Concrete Technology)   Course Code: CE 425
Time: 1 hour   Full Marks: 40

Answer all questions

QUESTION 1 [15 MARKS]

For an underground tunnel construction, three types of cement (A, B, and C) have been chosen and technical data sheets are collected to pre-investigate the performance of cement to find suitable cement for that construction. The chemical constituent of cement (A, B, and C) is given in Table 1.

Table 1: Chemical constituent of cement (A, B, and C)

Bulk Oxide Content	Percentage in Cement		
	A	B	C
CaO	60	61	67
SiO_2	18	18	25
Al_2O_3	5	14	4
Fe_2O_3	3	7	3
MgO	1.3	1.1	1.4
SO_3	1	2.5	2
K_2O	0.3	0.2	0.4
Na_2O	0.3	0.3	0.5
LOI	0.2	2.9	1.6

(i) Calculate the silica modulus and alumina modulus of three types of cement.   [3]

(ii) Using Bogue's equation, calculate the major chemical compounds of those cements. If these three cements are used in concrete, explain the expected performance of the concrete mixes with reference to the following: (a) temperature increase in concrete; (b) compressive strength; (c) corrosion resistance of three concretes.   [8]

(iii) Based on the silica modulus, alumina modulus, and Bogue analysis, propose a suitable cement for the tunnel construction and justify your selection.   [4]

QUESTION 2 [5 MARKS]

What are the workability requirements for concrete with congested reinforcement? Explain.   [5]

                                     Or   **Or**

Describe what makes concrete pumpable.   [5]

QUESTION 3 [10 MARKS]

A reinforced concrete (RC) wall of length 5 m, width 0.5 mm, and height 12 m is constructed in the laboratory, see Figure 1. The following necessary data are provided for the RC wall.

Given data:

Concrete type: Blended cement containing less than 70% slag with a retarder
Weight density of concrete = 20 kN/m^3
Concrete temperature at placement = 20 °C
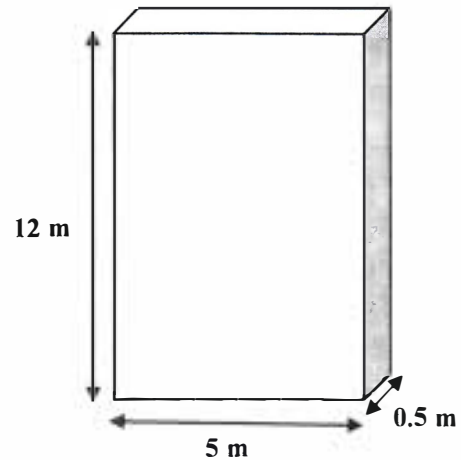Uniform volume supply rate = One 5 m^3 truck every 20 min

Figure 1: RC wall for impact test

Table 1: Values of coefficients C1 and C2

Walls: C1 = 1.0	
Columns: C1 = 1.5	
Concrete:	Value of C2
Ordinary Portland Cement (OPC) without admixture	0.3
OPC with any admixture, except a retarder	0.3
OPC with a retarder	0.45
Blended cement containing less than 70% slag without admixture	0.45
Blended cement containing less than 70% slag without admixture with any admixture, except a retarder	0.45
Blended cement containing less than 70% slag with a retarder	0.6
Blended cement containing more than 70% slag	0.6

(i) Calculate the concrete lateral pressure and draw the pressure envelope as a function of height for formwork design. [10]

QUESTION 4 [10 MARKS]

a. The demand of ready-mixed concrete is increasing rapidly in Bangladesh, explain why? [6]

b. Discuss what are the necessary precautions should be taken to avoid retempering. [4]

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2019
Program: B. Sc. Engineering (Civil)

Course Title: Structural Engineering VI (Design of Steel Structures) Course Code: CE 417
Time: 1 hour Full Marks: 3×10=30

Answer all 03 (Three) questions
[Assume reasonable values for any missing data]

1. (a) State the relative advantages of structural steel compared to R.C.C. **(3)**

   (b) Investigate the tension capacity of the plate (Plate 6×5/8) attached to a gusset plate with six bolts as **(7)** shown in **Figure 1**. Consider **block shear failure mode only** and assume uniform tension stress. The material is A36 (F_u= 58 ksi) and bolts are 3/4- inch diameter with standard holes. Use **AISC-ASD** approach.

   [Given, Nominal strength: $R_n = 0.6F_yA_{gv} + U_{bs}F_uA_{nt}$, $R_n = 0.6F_uA_{nv} + U_{bs}F_uA_{nt}$]
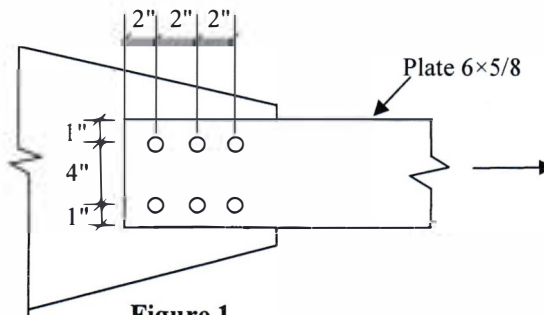

Figure 1

2. (a) (i) Define residual stress. (ii) Draw a qualitative residual stress diagram for a hot rolled W shaped **(1+2)** section.

   (b) From the following table, select the lightest 20 feet long unequal-leg angle tension member to resist **(7)** a service dead load of 25 kips and a service live load 70 kips. Use A36 steel (F_u= 58 ksi). The connection is shown in **Figure 2**. It shall be connected to a gusset plate using six 3/4- inch diameter bolts in two rows as shown. **Neglect block shear failure mode** and follow **LRFD** principle. Assume U=0.8 and preferable L/r ≤ 300.

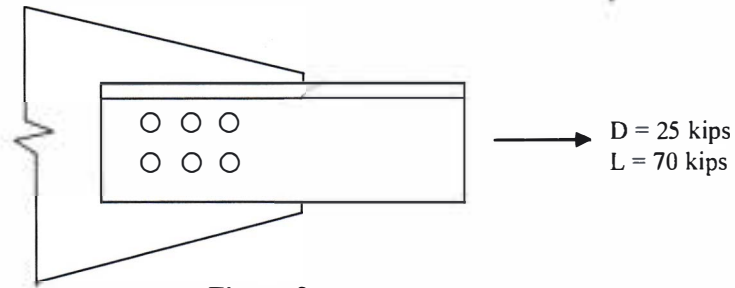| Shape	A_g (inch^2)	r_x (inch)	r_y (inch)	r_z (inch)
L6×4×9/16	5.31	1.90	1.14	0.861
L6×4×1/2	4.75	1.91	1.14	0.864
L6×4×7/16	4.18	1.92	1.15	0.867
L6×4×3/8	3.61	1.93	1.16	0.870

Figure 2

3. (a) Draw a column strength curve and indicate regions of short, intermediate and long columns. **(3)**

   (b) Determine the allowable compressive load carrying capacity of the column shown in **Figure 3**. The **(7)** column consists of W14×53 section with A992 (F_y = 50 ksi) steel, and is assumed to be pinned at top and fixed at bottom. Also the column has weak direction support (braced) at mid-height so that lateral deflection is prevented in x direction. Use **AISC-ASD** approach.

   Given that, A_g = 15.6 inch², r_x = 5.89 inch, r_y = 1.92 inch.

   $$F_{cr} = [0.658^{F_y/F_e}]F_y \text{ for } \frac{kL}{r} \leq 4.71\sqrt{\frac{E}{F_y}}$$

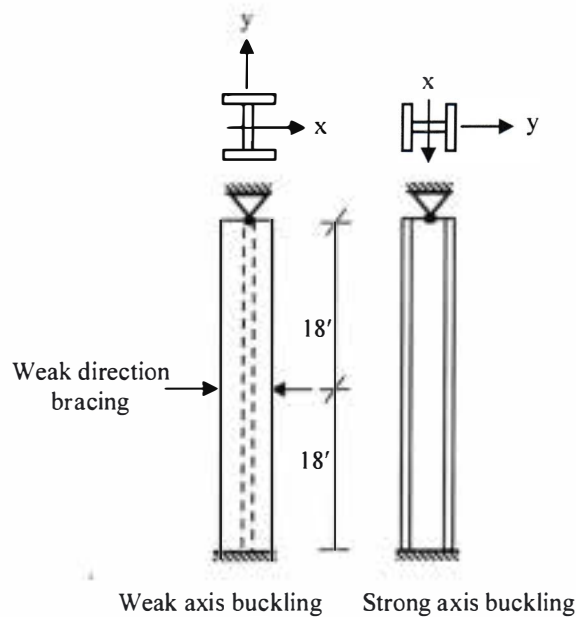 $$F_{cr} = 0.877\, F_e \text{ for } \frac{kL}{r} > 4.71\sqrt{\frac{E}{F_y}}$$

Weak axis buckling   Strong axis buckling

Figure 3