University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2022
Program: B.Sc. Engineering (Civil)

Course Title: Professional Practices and Communication | Course Code: CE 403
Time: 2 Hours | Credit Hours: 2.00 | Full Marks: 100

Answer all the questions.

1. Presume that you are a member of the Tender Evaluating Committee (TEC) for a bridge construction project. How will you assess the Tenderers as Responsive, Substantially Responsive and Non-Responsive? What will be your action to the Substantially Responsive Tenderers? **[7+3]**

2. (i) Specify the attributes of a good specification. **[4]**

   (ii) Suppose that one of your colleagues has prepared the technical specifications for a set of wooden tables. However, he failed to mention the type of timber to be used. Anticipate the list of problems that may arise due to this. **[6]**

3. (i) Summarize the salient features of Bangladesh Labour Law (BLL) regarding Women Workers. **[5]**

   (ii) Which measures should be taken by the management to ensure Occupational Safety and Health? Discuss briefly. **[5]**

4. Do you think that "Engineering" is a profession? Justify your answer with reference to the attributes of profession. **[20]**

5. The Project Engineer of East-West Road Construction Project was invited to a dinner by the contractor of the same East-West Road Construction Project. After the dinner was over, Project Engineer was offered a one-week long seminar at Thailand. The cost of participants in this seminar would be borne by the contractor.

   Assume that you are the Project Engineer of the above mentioned East-West Road Construction Project. Will you participate in a one-week long seminar at Thailand? Predict the possible ethical issues associated with this event. **[30]**

6. Suppose that you are a Structural Engineer working for a consulting firm. You designed a shopping complex building as per the requirements of the client. The work has been completed under your supervision. After five years the owner decided to add two more stories and come to you to prepare the design. While reviewing the previous design you found that the building will be unsafe for constructing additional floors due to poor underground soil condition. Your supervisor influences you to prepare the design and warns you that otherwise you will be fired from the job.

What should you do in such a situation? Explain based on engineering ethics. **[20]**

.....

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2022
Program: B. Sc. in Civil Engineering

Course Title: GIS and Remote Sensing | Course Code: CE 531
Time: 2 Hours | Full Marks: 100

Section A
Answer the following questions.

1. Answer the following questions. [Not more than two sentences]. **[15*1=15]**
   (a) Which format of GIS data is essential for terrain analysis?
   (b) In a situation you are not being able to perform the spatial analysis tools, what sort of action you have to take to do so?
   (c) You know that CLIP is one of the Geo-processing tools. But why cannot do it for raster formatted GIS data? What function you have to use for doing clipping in case the file format is in raster version?
   (d) You are intended to complete the clipping for your raster formatted file. After checking the environmental settings still, you are not getting a result for your particular area. What option you need to check before doing the clipping in case you want to get the result exactly in your study zone?
   (e) Write down the path which may lead you towards saving a new shape file.
   (f) Name one of the considering area under Remote Sensing application
   (g) Differentiate between fields and records of attribute data.
   (h) Why it is important to do projection?
   (i) You are unable to open the excel file in your GIS interface .what should be the steps you have to take to resolve the issue?
   (j) What is the name of the extension file while you are doing image classification?
   (k) For which type of sample distribution IDW will work best?
   (l) Digital elevation model is Easy to relate to other raster data .Explain the statement.
   (m) Explain briefly interpolation technique.
   (n) Among the different interpolation techniques, which method has maximum benefits?
   (o) Please explain the projection property Equivalence
2. (a) Sketch the Components of Remote sensing elements. [5]
   (b) Discuss the application of Remote sensing [5]

Section B

Answer the following questions

3. (a) You have been Provided with the total cases of Covid-19 patient in overall Bangladesh. Create a Shape file by incorporating this information. Show the variations throughout the whole country using layer properties. Create and export a map of Bangladesh Covid-19 situation. [15]

   (b) From the map of Dhaka division Covid-19 cases what do you think which of the Thana is having maximum affected case? What are the tools you are going to use to extract this information? Government has taken steps to lockdown the area. Use a tool from your ArcGIS tool box for protecting the zone. [15]

   [Hints: You have to create a shape file from the given Dhaka city Covid-19 cases map]

4. (a) Find out the bank shifting pattern of "Jamuna". [15]
   Year 1 = 1980+ last one digit of your registration ID
   Year 2 = 1990- last one digit of your registration ID

   (b) Create DEM (Digital Elevation Model) map using inverse distance weighting (IDW) method of a country that start with the first letter of your name using Google Earth. Display the DEMs you have created. [10]

   (c) Derive the slope gradient from the DEM you have created in 3(b). Improve the display; change the number of classes to 12. What type of raster operation is the calculation of slope gradient? [5]

5. Separate the Jamuna river using unsupervised classification [15]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2022
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering X | Course Code: CE 425
Time: 2 hours | Credit Hour: 2 | Full Marks: 100

QUESTION 1 [10 MARKS]

Using schematic diagram and chemical reaction, explain the mechanisms involved in concrete deterioration by sulfate attack. **[10]**

QUESTION 2 [20 MARKS]

(a) Outline the main purposes of non-destructive tests. **[7]**

(b) What is the purpose of using UPV test in concrete? **[5]**

(c) Explain the working principle of UPV test. **[8]**

QUESTION 3 [18 MARKS]

(a) "No-fines concrete can recharge the underground water level and reduce the flood problem." Justify this statement. **[8]**

(b) List the benefits of using steel fibers in concrete. **[10]**

QUESTION 4 [12 MARKS]

Using a neat sketch, illustrate how does the autogenous healing process work. **[12]**

QUESTION 5 [10 MARKS]

"The alkaline environment of concrete protects embedded steel from corrosion." Justify this statement. **[10]**

QUESTION 6 [10 MARKS]

Using a neat sketch, explain the effect of porosity and pore connectivity on the permeability of concrete. **[10]**

QUESTION 7 [20 MARKS]

A square reinforced concrete column will be constructed for a project. The following necessary data are provided for the column and its formwork.

Given data:

Size of the column: Height = 4 m; Cross section = 1 m x 1 m

Form height = 4.5 m.

Concrete type: Blended cement containing less than 70% slag with a retarder

Density of concrete = 2550 kg/m^3

Concrete temperature at placement = 25 °C

Uniform volume supply rate = One 2.5 m^3 truck every 30 min

Table 1: Values of coefficients C1 and C2

Walls: C l = 1 .0	
Columns: C l = 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 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

(a) Calculate the concrete lateral pressure and draw the pressure envelope as a function of height for form work design. **[12]**

(b) Explain the effect of rate of placing of concrete on the lateral pressure of formwork. **[8]**

Formula:

$$P_{max} = D\left[C_1\sqrt{R} + C_2 K\sqrt{H - C_1\sqrt{R}}\right] \quad \text{and} \quad D \times h$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2022
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering VI | Course Code: CE 417
Time: 2 hours | Credit Hour: 2 | Full Marks: 100

QUESTION 1

(a) How does the failure mode of a long column differ from that of a short column? Explain in your own words. **[5]**

(b) What is lateral torsional buckling? How does the lateral torsional buckling affect steel member strength? **[3+3]**

(c) In what situation, slot and plug welds are used? Discuss briefly. **[4]**

(d) Explain all of the welding symbols (location, size, length, type and any other specification of welding) shown in **Figure 1**. **[10]**

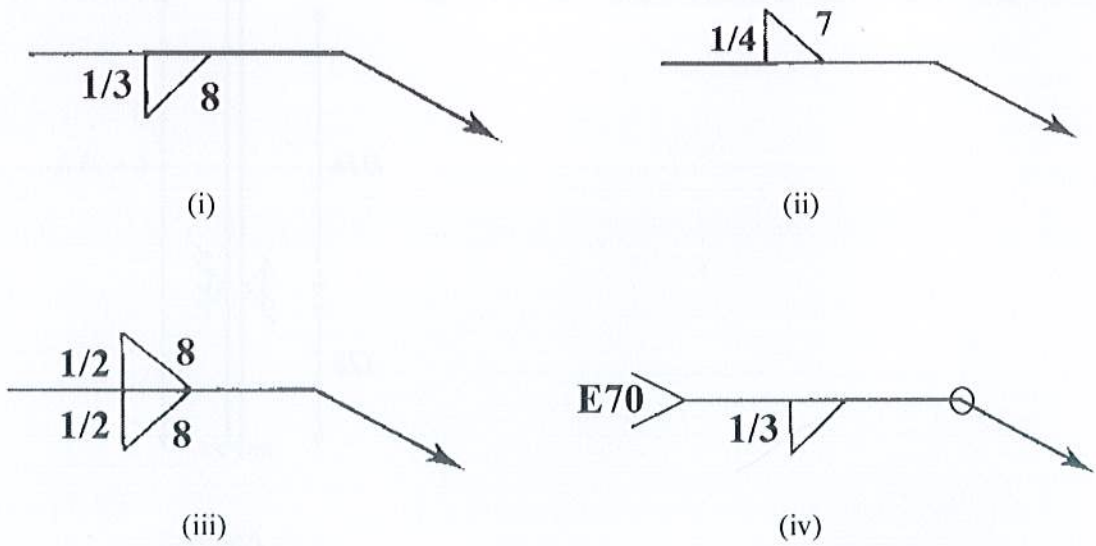


Figure 1

QUESTION 2

Select the lightest W section (from **Table 1**) to carry a service superimposed dead load of 1.1 kip/ft and a service live load of 1.3 kip/ft on a simply supported span of 16ft. Adequate lateral support is provided. Use Grade A36 steel; and follow the **AISC-LRFD** approach.

Note: Beam self-weight is not negligible and hence it must be accounted for. **[20]**

Table 1

Shape	b_f (in)	t_f (in)	I_x (in^4)	I_y (in^4)	Z_x (in^3)	Z_y (in^3)
W 14x38	6.77	0.515	385	26.7	61.5	12.1
W 14x34	6.75	0.455	340	23.3	54.6	10.6
W 14x30	6.73	0.385	291	19.6	47.3	8.99
W 14x26	5.03	0.420	245	8.91	40.2	5.54
W 14x22	5.0	0.335	199	7.0	33.2	4.39

QUESTION 3

A column is made up by a W14X38 steel section having F_y = 60 ksi (**Figure 2**). The top and bottom supports of the column are pinned and fixed, respectively. Along the strong axis direction, lateral pinned support is also provided as shown in the figure. Calculate the allowable compressive load carrying capacity (P) of the column. **[15]**

Section properties of W14x38:

D (in)	t_w (in)	b_f (in)	t_f (in)	A (in^2)	Z_x (in^3)	Z_y (in^3)	r_x (in)	r_y (in)	r_{ts} (in)
14.1	0.310	6.77	0.515	11.2	61.5	12.1	5.87	1.55	1.82

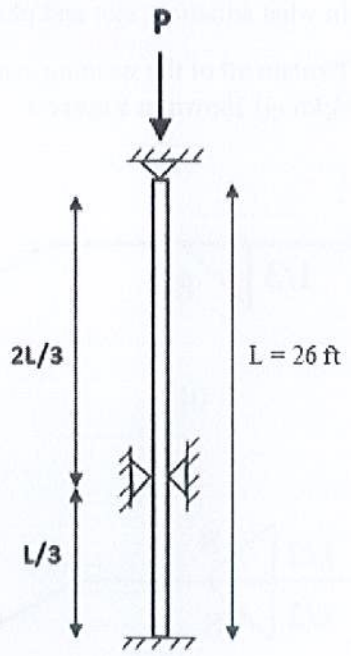


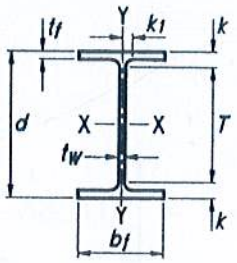
Figure 2

QUESTION 4

Determine the allowable moment capacity of W14x90 section of A572 Grade 60 steel for the beam shown in **Figure 3.** The beam has no lateral bracings in between support points A and D. Use the **AISC-LRFD** method. What will be the design moment capacity of the beam if lateral bracings are provided at Points B and C? Compare these two design moment capacities. Assume C_b = 1. **[15+10]**

Section properties of W14x90:

D (in)	t_w (in)	b_f (in)	t_f (in)	S_x (in^3)	Z_x (in^3)	r_x (in)	r_y (in)	r_{ts} (in)	h_o (in)	T (in)	J (in^4)
14.0	0.44	14.5	0.71	143	157	6.14	3.7	4.1	13.3	10.0	4.06



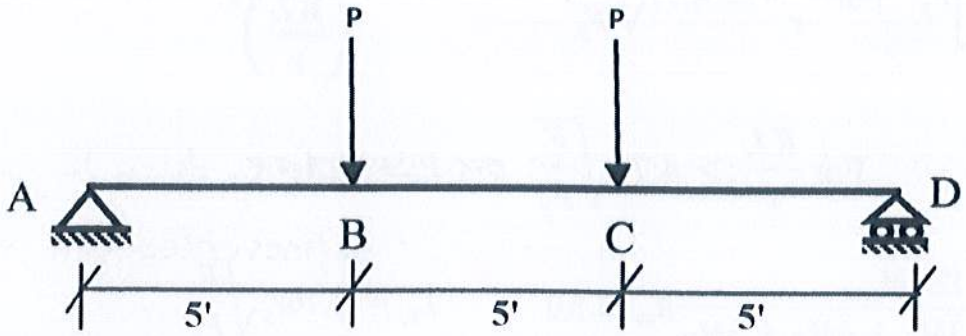


Figure 3

QUESTION 5

By following the elastic vector method, determine the service load capacity P for the welded bracket connection shown in **Figure 4**. The fillet weld size is 1/2 inch, and **E60** electrode is used for the welding. Use the **AISC-ASD** method for the calculation, and assume the plate thickness does not affect the result. **[15]**

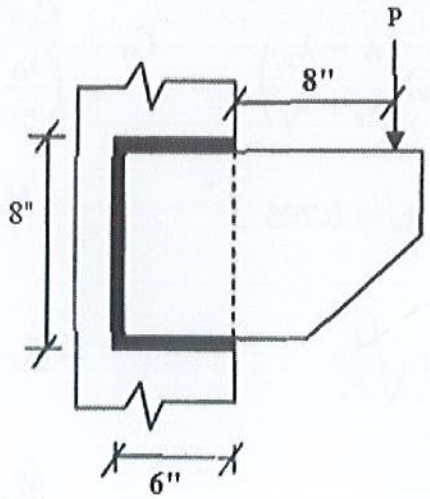


Figure 4

Formula

$$F_{cr} = \left[0.658^{\frac{F_y}{F_e}}\right]F_y \quad \text{For } \frac{KL}{r} \le 4.71\sqrt{\frac{E}{F_y}} \qquad F_e = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2}$$

$$F_{cr} = 0.877F_e \qquad \text{For } \frac{KL}{r} > 4.71\sqrt{\frac{E}{F_y}} \qquad P_n = F_{cr}A_g$$

$$C_b = \frac{12.5M_{max}}{2.5M_{max} + 3M_A + 4M_B + 3M_C}R_m \le 3.0 \qquad L_p = 1.76r_y\sqrt{\frac{E}{F_y}}$$

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

$$M_n = C_b\left[M_p - (M_p - 0.7F_y S_x)\left(\frac{L_b - L_p}{L_r - L_p}\right)\right] \le M_p$$

$$M_n = M_p - (M_p - 0.7F_y S_x)\left(\frac{\lambda - \lambda_p}{\lambda_r - \lambda_p}\right) \qquad F_{cr} = \frac{C_b\pi^2 E}{\left(\frac{L_b}{r_{ts}}\right)^2}\sqrt{1 + 0.078\frac{Jc}{S_x h_o}\left(\frac{L_b}{r_{ts}}\right)^2}$$

$$k_c = \frac{4}{\sqrt{h/t_w}}, \text{ where } 0.35 \le k_c \le 0.763 \qquad M_n = F_{cr}S_x \le M_p$$

$$\lambda_r = 0.56\sqrt{\frac{E}{F_y}} \qquad \lambda_r = 1.49\sqrt{\frac{E}{F_y}} \qquad \lambda_{pf} = 0.38\sqrt{\frac{E}{F_y}} \qquad \lambda_{rf} = 1.0\sqrt{\frac{E}{F_y}}$$

$$f'_x = \frac{P_x}{A} \qquad f'_y = \frac{P_y}{A} \qquad M_n = \frac{0.9Ek_c S_x}{\lambda^2}$$

$$f''_x = \frac{Ty}{I_p} \qquad f''_y = \frac{Tx}{I_p}$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2022
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Pollution and Its Control | Credit Hour: 2.0 | Course Code: CE 433
Time: 2 hours | Full Marks: 100

Answer all the questions (30+20+25+25). The numbers inside the brackets indicate marks.

1 (a) List the factors that affect waste assimilation capacity. (10)
(b) Name the sources of groundwater pollution, marine water pollution, and air pollution with example. (10)
(c) Write down the assumptions of Fixed Box Model. (10)

2 (a) Briefly discuss the "Love canal" tragedy. (10)
(b) Discuss the marine pollution prevention and control measures. (10)

3 (a) The concentration of SO_2 in a stack is 700 ppm. The flow velocity through the stack is 30 ft/s. The stack diameter is 4 ft. What is the SO_2 flow rate in kg/yr? Density of SO_2 is 2.59×10^{-3} lbmol/ft^3. 1 lbmol = 453.6 mol (5)
(b) A city has the following description: W = 6 km, L = 20 km, u = 4 m/s, H = 1500 m. The upwind, or background, concentration of carbon monoxide is 6 μg/m^3. The emission rate per unit area is 4×10^{-6} g/s.m^2. Using Fixed Box Model, what will be the concentration of carbon monoxide over the city? If this meteorological condition occurs 40% of the time and for the remaining 60% time, the mixing height is 4000 m and wind velocity is 5 m/s, what will be the concentration of carbon monoxide over the city? (10)
(c) Estimate the emissions using Table 4.2 from a 600 MW power plant at full load, burning a typical Pittsburgh seam coal. The thermal efficiency is 40%. The boiler of the power plant is assumed to be PC, wall-fired, wet bottom type. Heating value of coal is 13600 BTU/lb. Ash content = 8%, Sulfur content = 1.7%. 1 MW = 3413000 BTU/hr. (10)

4 (a) Industry A discharges to river 12000 m^3/day treated wastewater including 2.5 mg/l Cr, whereas Industry B discharges to same river 60 m^3/day raw wastewater including 5 mg/l Cr. Compare the pollution load of the industries. Which industry should be controlled according to this profile? (5)
(b) Compute the efficiency-diameter relation for a cyclone separator that has W = 0.7 ft, V_c = 55 ft/s, and N = 5, for both the block and mixed flow model, assuming Stokes' law. Here, $\mu = 1.8 \times 10^{-5}$ kg/m.s, ρ = 2000 kg/m^3. Comment on your result based on the efficiency. (10)
(c) A plant emits 100 g/s of SO_2 from a stack that has an effective stack height H = 100 m. The wind is blowing at a speed of 4 m/s, and the stability category is C. Estimate the ground-level concentrations directly below the centerline of the plume at distance 2, 5, and 10 km downwind. Comment on the result. Use Figure 6.9. (10)

TABLE 4.2
Emission factors for bituminous and subbituminous coal combustion without control equipment

Furnace type[b]	Emission factor, lb/ton of coal burned[a]				
	All particles[c]	PM_{10}^{c}	$SO_x^{d,e}$	NO_x^{f}	CO
PC, wall-fired, dry bottom	10A	2.3A	38S	21.7	0.5
PC, wall-fired, wet bottom	7A	2.6A	38S	34	0.5
PC, tangential fired, dry bottom	10A	2.3A	38S	14.4	0.5
Cyclone	2A	0.26A	38S	33.8	0.5
Spreader stoker	66	13.2	38S	13.7	5
Hand-fired	15	6.2	31S	9.1	275

Source: Tables 1.1-3 and 1.1-4 of EPA Emission Factors Book [7]. Section 1.1 of that document (Bituminous and Subbituminous Coal Combustion) is 46 pages long and has 19 tables, 6 figures, and 77 literature citations.

[a] To obtain emission factors in kg/MT, divide table values by 2.

[b] The various furnace types are described in [7] and in combustion books. PC means pulverized coal.

[c] The letter A on some particulate and PM_{10} values indicates that the weight percentage of ash in the coal should be multiplied by the value given. Example: If the factor is 10A and the ash content is 8%, the particulate emissions before the control equipment would be $10 \cdot 8$ or 80 lb of particulate per ton of coal.

[d] S = the sulfur content, which plays the same role as A in the preceding footnote.

[e] SO_x is expressed as SO_2. It includes SO_2, SO_3, and gaseous sulfates.

[f] NO_x is expressed as NO_2. It includes NO and NO_2.

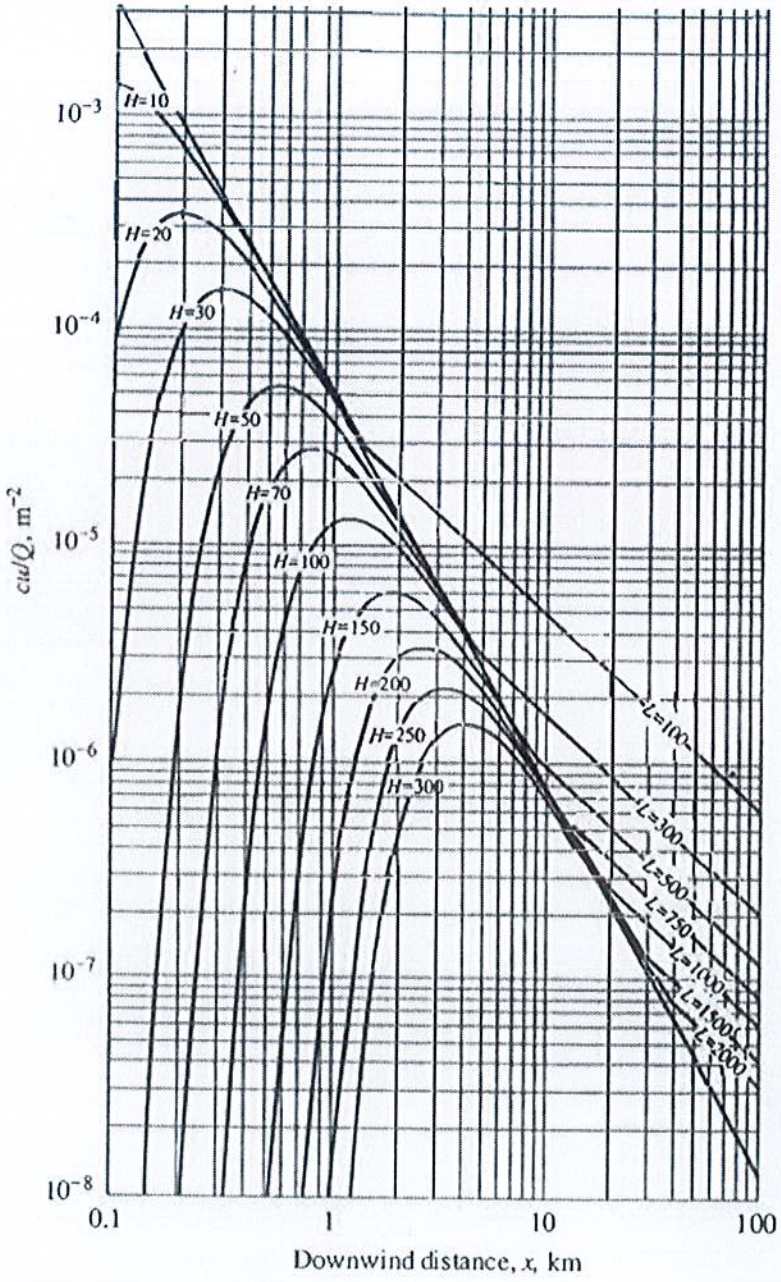


FIGURE 6.9
Ground-level cu/Q, directly under the plume centerline, as a function of downwind distance from the source and effective stack height, H, in meters, *for C stability only.* (From Turner [7].) Here L is the atmospheric mixing height, also in meters.

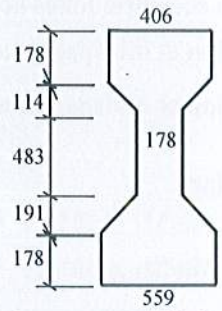
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2022
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering V (Prestressed Concrete) Credit Hour: 2 Course Code: CE 415
Time: 2 hours Full Marks: 100

Answer all questions. Assume reasonable values for any missing data

1.(a) Make a preliminary design for section of a prestressed-concrete beam to resist a girder moment of 60kN-m and a total moment of 400kN-m. The effective prestress for steel is 850MPa, and allowable stress for concrete under working load is -12MPa. The depth of the beam 'h' in millimeters is given by an empirical formula $h = 50\sqrt{M_T}$, where M_T is in kip-ft. (1 kip-ft = 1.36 kN-m)
You are required to sketch the section including the dimensions of the flange and web. An I-section is preferred for the solution to this problem, with depth of flanges and width of web not exceeding 100mm.
(b) Discuss the practicality of using inverted T-sections for lower ratios of M_G/M_T. **[15+5]**

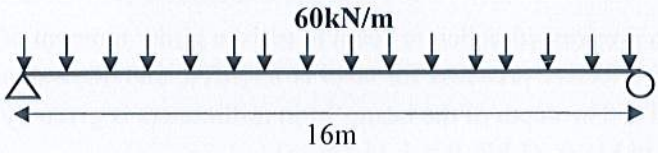
2. Design a composite prestressed concrete structural system for a simply supported 30m span. The beams will be Type III standard sections as shown below, with a **150mm** thick composite slab.
Design loads for the structure: dead load of the girder w_G = 9kN/m, dead load of the slab w_S = 3kPa and live load w_L= 3.2kPa.
Given: f'_{ci} (beams) = 32MPa, f'_c (beams) = 42MPa, f'_c (slabs) = 28MPa
I(beams) = 522x10^{8}mm^4, c_b(beams) = 515mm, c_t(beams) = 628mm.
Design for unshored beams in construction following the ACI Code for the critical section at midspan, assuming total loss of prestress is **20%** for this section. Your design should include the following:
(a) the pretensioned strand arrangement within the beams using **12mm** dia. bars, where total prestressing strand area A_{ps} is 1% of the total gross area of the beam.
(b) the maximum spacing of the beams for this structural system based on stresses at service load, $\mathbf{f_{top}}$ **= -18MPa** & $\mathbf{f_{bottom}}$ **= 3.30MPa**. Assume initial prestressing stress, f_0 = **1050MPa**. **[20]**

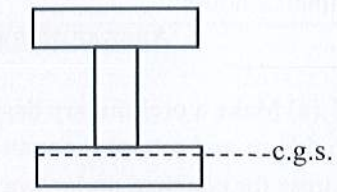


[Effective width of the slab, b = $16t_{slab}$+b', where b' is the top width of the beam. Modified effective width, b_{mod} = 0.81b]

3. Determine the bearing plate area required to transmit a prestressing force of 1650kN to a concrete beam at transfer. Cross-section of the rectangular beam is 450mm (width) x 1000mm (depth). During service condition this force is reduced to 1250kN. At the time of post-tensioning assume that f_{ci}' is approximately 27MPa and at service load after losses f_c' = 36MPa. Assume 120mm diameter circular hole for passing of the tendon through the plate. **[20]**

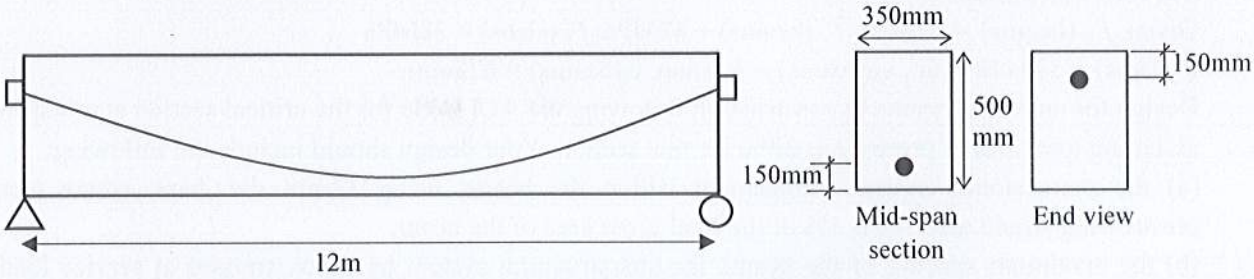
4.(a) Check the shear strength for a simply supported beam at a section which is h/2 from the support. The symmetric I-shaped noncomposite section spans 16m and the c.g.s. is 135mm from the bottom fiber all throughout the beam. The longitudinal and cross section of the beam is shown below.
Given, F_{se} = 1971kN, f_c' = 48MPa, w_D = 6.5kN/m (beam weight).
(b) List some factors affecting the transfer length for prestressing steel. Draw a schematic graph of deflection with time history of concrete beams prestressed near the bottom. **[15+5]**





b_w= 160mm, t_f = 160mm,
b_f = 420mm, h = 900mm

5. The beam shown below is posttensioned with 800mm^2 of high tensile steel to an initial prestress of 1000MPa immediately after prestressing. The self-weight of the beam in the form of a distributed load is 3kN/m. Compute the initial deflection at midspan due to prestress and the beam's self-weight, assuming E_c = 27GPa. Also estimate the deflection after 1 month, assuming the modulus of elasticity for concrete has reduced to 21GPa with an effective prestress of 850MPa remaining at that time. **[20]**



[The parabolic tendon with forces acting on the concrete can be replaced by a uniform load $w = \frac{8Fh}{L^2}$, and two eccentric loads acting at the ends on the beam.
Deflection at midspan of a simply supported beam due to uniform load, $\Delta = \frac{5wL^4}{384EI}$
Deflection at midspan of a simply supported beam due to end moments, $\Delta = \frac{ML^2}{8EI}$]

Formulae

- $M_G/M_T \leq 30\%$, $F = \frac{M_L}{0.5h}$
- $M_G/M_T \geq 30\%$, $F = \frac{M_T}{0.65h}$
- $v_{cw} = 0.29\sqrt{f_c'} + 0.3f_{pc} + \frac{V_p}{b_w d}$
- $v_u = \frac{V_u}{\Phi b_w d}$, $\Phi = 0.85$
- $M_{cr} = \frac{I}{y_t}(0.5\sqrt{f_c'} + f_{pe})$
- $V_{ci} = 0.05 b_w d\sqrt{f_c'} + \frac{V_i M_{cr}}{M_{max}}$

Average bearing stress on concrete

- At service load: $f_{cp} = 0.6f_c\sqrt{(\frac{A_b'}{A_b})}$, not greater than f_c'
- At transfer load: $f_{cp} = 0.8f_{ci}'\sqrt{\left(\frac{A_b'}{A_b}\right) - 0.2}$, not greater than $1.25f_{ci}'$