A-2

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

Course title: Environmental Engineering VII | Course code: CE 439
Time: 120 minutes | Full marks: 50

There are SIX (6) questions. Answer question no. 01 (COMPULSORY) and any THREE (3) from the rest.

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

   B) Provide the template of "Form 3 (application for environment clearance certificate)" included in Environmental Conservation Rules, 1997. 6

2. A) Explain the criteria for the determination of the need and level of EIA process? 6

   B) According to Article 7 of the Bangladesh Environmental Conservation Rules (1997), write the procedures to obtain environmental clearance certificate for a cement factory. 6

3. Write the name of your own group work's project.

   One of the following projects: a) Dhaka-Chittagong Expressway; b) Matarbari Coal-Fired Power Project; c) Skyscraper project in Purbachal New Town; d) Water supply, sewerage and solid waste management in Purbachal New Town; e) Savar Leather Industrial Park.

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

   B) Graphically show the time versus impact significance of these four impacts at different phases of your specific project. Draw three different figures for three selected impacts. 10

   (Examples of different phases of the project are: *before the project started*, *at planning/initiation phase*, *at implementation/construction phase* and *at operational phase/after construction phase* etc.)

4. A) What are the imposed requirements on proponents for impact mitigation? 3

B) During preparation of *Terms of Reference* (TOR) for a full EIA, what issues should be considered? 4

C) Provide examples of four main types of social impacts that might originate from one of the following projects (select your group work's project): 5

a) Dhaka-Chittagong Expressway; b) Matarbari Coal-Fired Power Project; c) Skyscraper project in Purbachal New Town; d) Water supply, sewerage and solid waste management in Purbachal New Town; e) Savar Leather Industrial Park.

5. A) What are the different components of Environmental Management Plan (EMP) and explain how to address those EMP components. 6

B) Government is proposing to construct a new export processing zone (EPZ) in an area covering 267 Acres. After completion, the EPZ will have 250 industrial plots. The area proposed for the new EPZ is located in a rural area mainly used for agriculture and there is a river nearby. 6

For this project, write the benefits of public participation during EIA process for the following stakeholder groups (write five benefits for each stakeholder group):

- The proponent/supporter
- The decision-maker
- Affected communities

6. A) Produce an impact characteristics summary table for the three major impacts of your own group work's project. 5

One of the following projects: a) Dhaka-Chittagong Expressway; b) Matarbari Coal-Fired Power Project; c) Skyscraper project in Purbachal New Town; d) Water supply, sewerage and solid waste management in Purbachal New Town; e) Savar Leather Industrial Park.

B) Explain different steps of EIA review. 3

C) Graphically explain three different steps of Environmental Auditing. 4

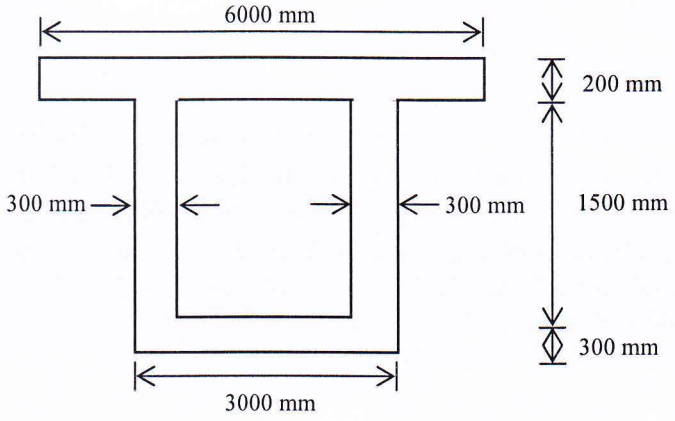
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2016
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering V | Course Code: CE 415
Time: 2 Hours | Full Marks: 50

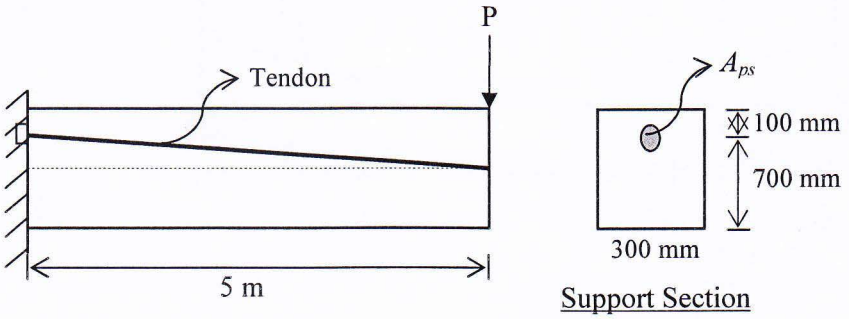
Answer any **Four (04)** out of **Five (05)** questions
Symbols have their usual meanings
Assume reasonable value for any missing data

1. (a) Make a preliminary design for the cantilever beam to resist total load of 560 KN-m in which M_G = 320 KN-m at support section. Given, f_{se} = 860 MPa and $f_c = -12$ MPa. Assume depth of section = $45\sqrt{M_T}$ (05)

   (b) Calculate values of $\mathbf{k_t}$ and $\mathbf{k_b}$ of the section as shown in the following figure. ($7\frac{1}{2}$)



2. (a) Calculate the value of '**P**' that will produce first crack at support section of the cantilever beam as shown in the following figure. Assume 20% loss of prestress. (08)
   Given, A_{ps} = 780 mm^2, f_o = 1100 MPa, f'_{ci} = 30 MPa, f'_c = 40 MPa and f_r = 4 MPa and Unit weight of reinforced concrete = 25 KN/m^3.

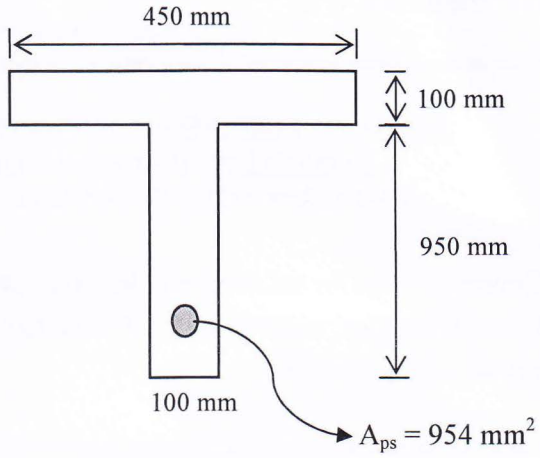


Support Section

   (b) Draw the stress distribution diagram in concrete for several locations of compressive force by the elastic theory. ($4\frac{1}{2}$)

3. Make a final design of the section obtained from the preliminary section as shown in the following figure. The simply supported beam is subjected to a total moment $M_T = 560$ KN-m in which $M_G = 320$ KN-m at midspan. No tension is allowed in the section. ($12\frac{1}{2}$)

Given $f_{se} = 840$ MPa, $f_c = -12$ MPa, $f_b = -13$ MPa, $f_t = -12$ MPa, $f_o = 1025$ MPa, $F = 820$ KN and $A_{ps} = 954$ mm^2.

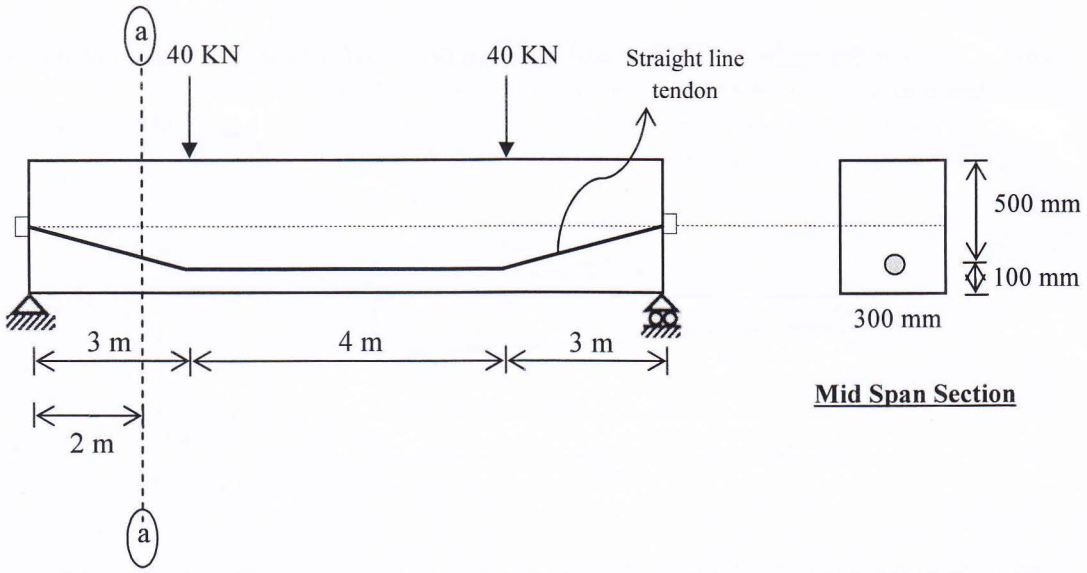


Preliminary section

4. A posttensioned bonded concrete beam has a prestress of 1600 KN in the steel immediately after prestressing. The beam carries two live loads of 40 KN each in addition to its own self-weight. Assuming 15% loss of prestress, calculate extreme fiber stresses at **section (a-a)** ($12\frac{1}{2}$)

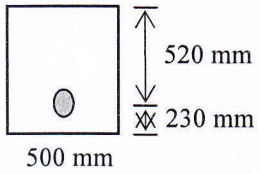
a) Under the initial condition with full prestress and no live load.
b) and under the final condition with full live load.

Given unit weight of reinforced concrete = 25 KN/m^3.
[Section (a-a) is at 2 m from left support]



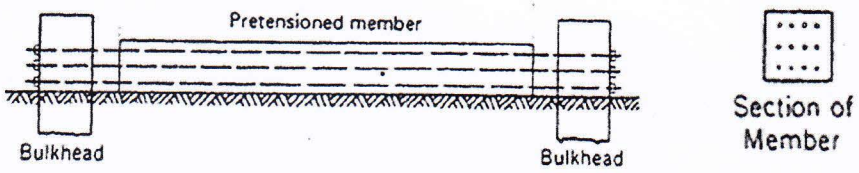
Mid Span Section

5. (a) A prestressed concrete rectangular beam 500 mm by 750 mm has a simple span of 6.0 m and is loaded by a uniform load of 40 KN/m excluding its own weight. The prestressing tendon produces an effective prestress of 1600 KN and parabolically curved. Calculate extreme fiber stress at midspan using method of load balancing (3rd concept). (06)



Section at midspan

(b) A straight pretensioned concrete member 10 m long, with a cross section of 500 mm by 500 mm is concentrically prestressed with 780 mm^2 of steel wires which are anchored to the bulkheads with a stress of 1025 MPa. If E_{ci} = 33000 MPa and E_s = 200000 MPa compute the loss of prestress due to the elastic shortening of concrete at the transfer of prestress. (04)



(c) Differentiate between pretensioning and posttensioning. ($2\frac{1}{2}$)

List of useful Formulae

$F = M_T/(0.65h)$, if M_G is greater than 20% of M_T

$F = M_L/(0.5h)$, if M_G is less than 20% of M_T, where $M_L = M_T - M_G$

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

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

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

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

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

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

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

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

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

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 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) Show the flow diagram of Industrial Waste Management Process. Mention the four stages of Life Cycle Assessment (LCA). (5)

(b) What are the commonly adopted environmental controls in a modern landfill? (3)

(c) Determine the break-even time for a stationary container system with a separate transfer and transport system for transporting wastes collected from a Municipal area to a landfill site. **Use graph paper for the plot.** (12)
Assume the following data while calculating:
Transportation cost:
Stationary container system using an 18 m^3 compactor: BDT 2000/ hr
Tractor-trailer transport unit with a capacity of 120 m^3: BDT 2500/ hr
Other costs:
Transfer station operating cost: BDT 40/m^3
Extra cost for unloading facilities: BDT 5/m^3
Other data:
Density of wastes in compactor = 350 kg/ m^3
Density of wastes in transport unit = 160 kg/ m^3

2. (a) What is a transfer station? Compare the solid waste collection system with and without transfer station on our country's context. Provide a qualitative plot showing the cost versus distance curves for direct haul system and for a system with transfer station. (2+6)

(b) Show the pattern of solid waste recycling process in urban area of Bangladesh. (4)

(c) Estimate the theoretical volume of methane (CH_4), carbon-di-oxide (CO_2) and Ammonia (NH_3) that would be expected from anaerobic digestion of per ton of waste having the composition $C_{40}H_{100}O_{30}N$. The density of CH_4, CO_2 and NH_3 at standard temperature and pressure (STP) are 0.7167 kg/m^3, 1.9783 kg/m^3 and 0.696 kg/m^3 respectively. (8)

3. (a) What is leachate and what is it composed of? How can leachate be controlled? Mention the components of leachate management and discuss the treatment options for leachate. (7)

(b) Explain putrescible and non-putrescible types of solid waste. What are the factors on which the quantity of solid waste depends on? (6)

(c) A pharmaceutical company dumps waste every day @ a rate of 50 tons per day into Turag river except Friday. Also, there is no waste collection system available in the surrounding residential area that generates 0.1 tons per capita per day with 2000 people and the ultimate destination for this waste is Turag river. If a waste collection vehicle to be bought for collecting the residential waste costs 60,000 BDT requiring 2 crew members with 10 BDT/hour wage rate @8 working hours/day for 7 days a week, calculate the cost of the total waste collection system for one year (no amortization required; consider yearly operational cost to be 6,000 BDT) if it is to be implemented in the area. Also calculate the total amount of waste that the river is receiving every month when there is no collection system available. (7)

4 (a) Provide examples on how source reduction can be achieved in developing countries. How can you achieve it in your daily life (provide at least 2 examples)? Provide some examples of on-site recyclable and recoverable materials. (7)

(b) Briefly describe the stages of recycling process in developing countries. (5)

(c) Consider you are an Engineer who works for an industry in Bangladesh that has a lot of toxic chemicals (hazardous) waste to dispose of as part of the manufacturing process. Being established in a developing country, list the general problems that you will expect in the treatment and disposal of this special category of waste. Also state what option would you choose for disposal of this waste? Lastly, as part of your assignment, what are the factors that you would have to consider if the company asks you to cite a landfill site for this type of waste? (8)

5 (a) Show in a schematic diagram/flowchart, the different ways that humans can be exposed to hazardous waste. (5)

(b) Why is collection process the largest cost element in solid waste management system? Which steps/elements are included in the consideration of economic costs of the solid waste collection? (2+5)

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

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

6 (a) What are the most important properties to be known if the solid wastes are to be used as fuel? (3)

(b) 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. Answer according to the steps given below:

i) What are the steps or factors that you will consider while selecting the area? (4)

ii) Choose the type of method of landfilling. (1)

iii) Mention a leachate management system for the landfill. (2)

iv) State the advantages/disadvantages of the site that you chose and the method that you selected for the area. (3)

v) Calculate the required landfill capacity for the current year for a population size of 30,00,000 with per capita waste generation rate of 5.0 lb/capita/day and compacted density of 40 lb/ft^3. Assume that the daily cover consists of 10% of the landfill volume. (4)

vi) State certain options on how you can make the landfill environmentally friendly. (3)

Given Formula:

$$C_aH_bO_cN_d + \frac{4a-b-2c+3d}{4}H_2O \rightarrow \frac{4a+b-2c-3d}{8}CH_4 + \frac{4a-b+2c+3d}{8}CO_2 + d\,NH_3$$

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

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

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

Course Title: Environmental Engineering IV | Course Code: CE 433
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 drawbacks of Streeter-Phelps oxygen-sag curve? (5)

   (b) A municipal wastewater treatment plant discharges 0.17 m^3/s of treated effluent having BOD_5 of 40.0 mg/L and DO of 2 mg/L into a stream that has a flow of 0.50 m^3/s and a BOD_5 of 3 mg/L and DO of 8 mg/L. The temperature of the river is 25°C. The deoxygenation constant k_d is 0.23/day at 20°C. The stream has a depth of 2.6 m and the average stream velocity is 0.2 m/s. (15)
   a. Find the critical distance downstream at which DO is a minimum.
   b. Find the minimum DO.

2. (a) What is "Eutrophication"? Discuss the principal factors controlling this process. (2+5)

   (b) Explain the simple phosphorus model for lakes with a sketch. (5)

   (c) What are the limiting nutrients? It was found in a sample from a lake that N/P>l5.Which one is the limiting nutrient between these two nutrients? (3)

   (d) Briefly describe the layers in a stratified lake using figure. Which type of lake becomes more vulnerable to summer stratification? (5)

3. (a) Explain the different particle deposition mechanisms. (6)

   (b) Differentiate between point sources and non-point sources. (4)

   (b) On March, 31, 2015, the following air quality data have been recorded at CAMS (Continuous Monitoring Stations/Systems) in Dhaka. (10)
   $PM_{2.5}$ = 190 μg/m^3 (24 hr)
   PM_{10} = 280 μg/m^3 (24 hr)
   O_3 = 0.095 ppm (8 hr)
   Calculate Air Quality Index (AQI) for that day. Also, prepare the AQI report.

4 (a) Define "Adiabatic Lapse Rate". Derive an expression for the determination of adiabatic lapse rate. (2+5)

(b) Bangladesh national ambient air quality standard for CO is 10 mg/m^3 (8-hr avg). Express the standard in ppm. (4)

(c) What is meant by the term "Air to Fuel Ratio"? Explain the effects of air-fuel ratio on pollution with relevant figure. (9)

5 (a) Show in detail with figure what happens to gases when they are emitted from a stack by comparing the ambient lapse rate (Λ) and adiabatic lapse rate (Γ) for all the following scenarios of plumes: i) Looping, ii) Coning, iii) Fanning, iv) Lofting, v) Fumigating and vi) Trapping (12)

(b) What are the assumptions of a point source "Gaussian Plume Model" for Atmospheric diffusion? A power plant consumes 300 tons of coal (containing 5% sulfur) each day. Assuming 15% of this sulfur is emitted as SO_2, estimate the emission rate of SO_2 (in g/sec) from the power plant. (2+6)

6 (a) Mention the vehicular pollution control strategies. Discuss the features of a catalytic converter and the effect of air-fuel ratio on conversion efficiency in a catalytic converter. (8)

(b) A stack emitting 100 g/s of NO has an effective stack height of 150 m. The wind speed is 4 m/s at 10 m, and it is a clear summer day with Stability class B. Estimate the ground level NO concentration: (12)

i) Directly downwind at a distance of 2 km
ii) At a point downwind where NO is maximum
iii) At a point located 2 km downwind and 0.1 km off the downwind axis.

Given Formula:

Formulae:

$$I_P = \frac{I_{Hi} - I_{Lo}}{BP_{Hi} - BP_{Lo}}\left(C_P - BP_{Lo}\right) + I_{Lo}$$

$$u = u_0\left(\frac{z}{z_0}\right)^p$$

$$\sigma_y = a.x^{0.894} \quad ; \quad \sigma_z = c.x^d + f$$

$$c_{max} = \frac{Q}{u}\left(\frac{C_u}{Q}\right)_{max}$$

$$C\ (x,0,0) = \frac{Q}{\pi u \sigma_y \sigma_z} \exp\left(\frac{-H^2}{2{\sigma_z}^2}\right)$$

$$C\ (x,y,0) = \frac{Q}{\pi u \sigma_y \sigma_z} \exp\left(\frac{-y^2}{2{\sigma_y}^2}\right) \exp\left(\frac{-H^2}{2{\sigma_z}^2}\right)$$

$BOD_m \cdot V_m = BOD_w \cdot V_w + BOD_d \cdot V_d$ $\qquad$ $BOD_t = L_0\ (1 - e^{-kt})$

$$P = \frac{S}{Q + \upsilon_s \cdot A}$$

$$D = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t} - e^{-k_r t}\right) + D_0 e^{-k_r t}$$

$$k_r = \frac{3.9u^{1/2}}{H^{3/2}} \qquad t_c = \frac{1}{k_r - k_d} \ln\left[\frac{k_r}{k_d}\left(1 - \frac{D_0\left[k_r - k_d\right]}{k_d \cdot L_0}\right)\right]$$

$$D_{\max} = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t_c} - e^{-k_r t_c}\right) + D_0 e^{-k_r t_c}$$

$DO_{(sat)} = 14.62 - 0.39\ T + 0.007714\ T^2 - 0.0000646\ T^3$

$k_{d\ (at\ T°C)} = k_{20°C} \cdot (1.047)^{T-20}$, $k_{r\ (at\ T°C)} = k_{r20°C} \cdot (1.024)^{T-20}$

Breakpoints							AQI	Category
O_3 (ppm) 8-hr	O_3 (ppm) 1-hr (i)	$PM_{2.5}$ (µg/m³) 24-hr	PM_{10} (µg/m³) 24-hr	CO (ppm) 8-hr	SO_2 (ppm) 24-hr	SO_2 (ppm) Annual		
0.000-0.064	---	0.0-15.4	0-54	0.0-4.4	0.000-0.034	(ii)	0-50	Good
0.065-0.084	---	15.5-40.4	55-54	4.5-9.4	0.035-0.144	(ii)	51-100	Moderate
0.085-0.104	0.125-0.164	40.5-65.4	155-254	9.5-12.4	0.145-0.224	(ii)	101-150	Unhealthy for sensitive group
0.105-0.124	0.165-0.204	65.5-150.4	255-354	12.5-15.4	0.225-0.304	(ii)	151-200	Unhealthy
0.125-0.374	0.205-0.404	150.5-250.4	355-424	15.5-30.4	0.305-0.604	0.65-1.24	201-300	Very unhealthy
(iii)	0.405-0.504	250.5-350.4	425-504	30.5-40.4	0.605-0.804	1.25-1.64	301-400	Hazardous
(iii)	0.505-0.604	350.5-500.4	505-604	40.5-50.4	0.805-1.004	1.65-2.04	401-500	Hazardous

(i) In some cases, in addition to calculating the 8-hr ozone index, the 1-hr ozone index may be calculated and the maximum of the two values is reported

(ii) NO_2 has no short term air quality standard and can generate an AQI only above 200

(iii) 8-hr O_3 values do not define higher AQI values (≥ 301). AQI values of 301or higher are calculated with 1-hr O_3 concentrations.

Surface wind speed[a] (m/s)	Day solar insolation			Night cloudiness[e]	
	Strong[b]	Moderate[c]	Slight[d]	Cloudy ($\geq$ 4/8)	Clear ($\leq$ 3/8)
< 2	A	A–B[f]	B	E	F
2–3	A–B	B	C	E	F
3–5	B	B–C	C	D	E
5–6	C	C–D	D	D	D
> 6	C	D	D	D	D

[a]Surface wind speed is measured at 10 m above the ground.
[b]Corresponds to clear summer day with sun higher than 60° above the horizon.
[c]Corresponds to a summer day with a few broken clouds, of a clear day with sun 35–60° above the horizon.
[d]Corresponds to a fall afternoon, or a cloudy summer day, or clear summer day with the sun 15–35° above the horizon.
[e]Cloudiness is defined as the fraction of sky covered my clouds.
[f]For A–B, B–C, or C–D conditions, average the values obtained for each.
Note: A, Very unstable; B, moderately unstable; C, slightly unstable; D, neutral; E, slightly stable; F, stable. Regardless of windspeed, class D should be assumed for overcast conditions, day or night.
Source: Turner (1970).

TABLE 7.7 WIND PROFILE EXPONENT p FOR ROUGH TERRAIN[a]

Stability class	Description	Exponent, p
A	Very unstable	0.15
B	Moderately unstable	0.15
C	Slightly unstable	0.20
D	Neutral	0.25
E	Slightly stable	0.40
F	Stable	0.60

[a] For smooth terrain, multiply p by 0.6; see Table 7.8 for further descriptions of the stability classifications used here.
Source: Peterson (1978).

Table 4. Constants in empirical relationships for σ_y and σ_z

Stability class	a	$x \leq 1$ km			$x \geq 1$ km		
		c	d	f	c	d	f
A	213	440.8	1.941	9.27	459.7	2.094	-9.6
B	156	106.6	1.149	3.3	108.2	1.098	2.0
C	104	61	0.911	0	61	0.911	0
D	68	33.2	0.725	-1.7	44.5	0.516	-13.0
E	50.5	22.8	0.678	-1.3	55.4	0.305	-34.0
F	34	14.35	0.740	0.35	62.6	0.180	-48.6

From stability class and H:
- find x_{max}
- $(C_{max}u/Q)_{max}$.

Then Calculate:
$C_{max} = \frac{Q}{u}\left(\frac{C_{max}u}{Q}\right)_{max}$

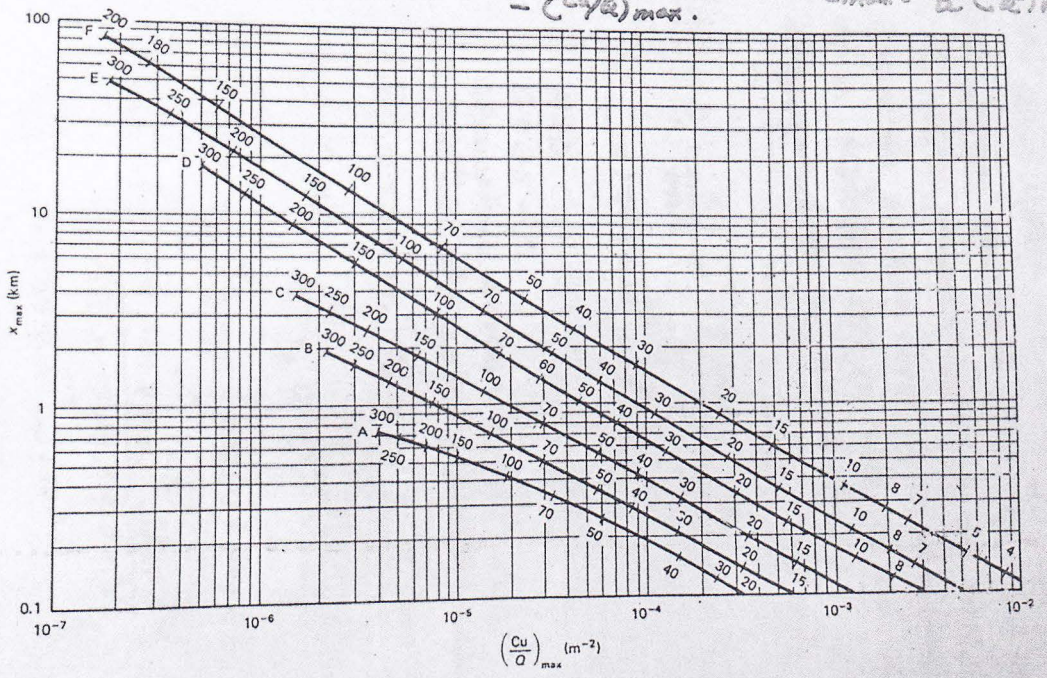


Figure 7.30 To determine the peak downwind plume concentration, enter the graph at the appropriate stability classification and effective stack height (numbers above the lines, in meters) and then move across to find the distance to the peak, and down, to find a parameter from which the peak concentration can be found (Turner, 1970).

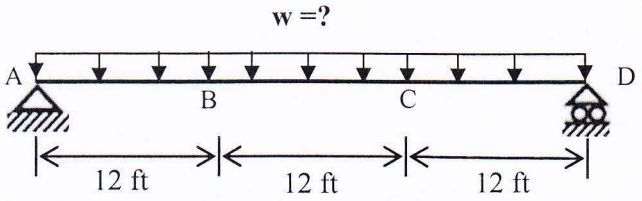
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2016
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering VI (Design of Steel Structures) | Course Code: CE 417
Time: 2 Hours | Full Marks: 50

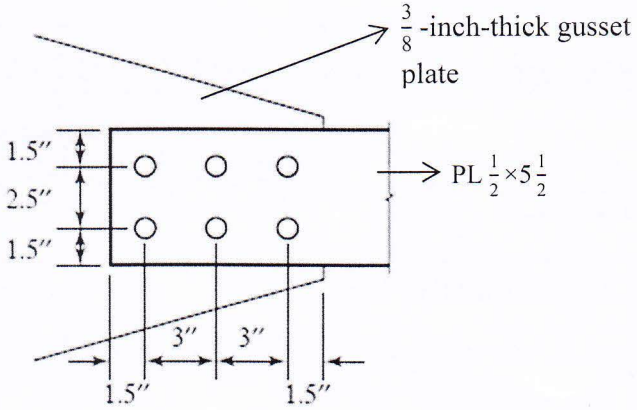
Answer any **Five (05)** out of **Seven (07)** questions

1. Select the lightest **W24** section of A992 steel for a simply supported beam of 30 ft. The beam has continuous lateral support and must support a uniform service live load of 4.5 kip/ft. Choose the section which is also adequate for shear and deflection. The maximum permissible live load deflection is $L/240$. Use **AISC-LRFD** method. (10)

2. The beam in the following figure is a W12×50 section. It is laterally supported at A, B, C and D. What is the maximum permissible value of w? Use A572 grade 50 steel. Neglect self-weight of the beam and follow **AISC-ASD** method. (10)

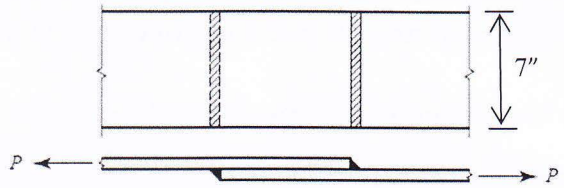


3. (a) The tension member shown in figure is a PL $\frac{1}{2}\times 5\frac{1}{2}$ of A36 steel. It is connected to $\frac{3}{8}$-inch-thick gusset plate (also A36 steel) with 3/4-inch-diameter bolts. (05)
   i. Check all spacing and edge-distance requirements.
   ii. Compute the nominal strength in bearing.



   (b) A plate 1/2 × 4 of A36 steel is used as a tension member to carry a service dead load of 6 kips and a service live load of 18 kips. It is to be attached to a 3/8-inch gusset plate. Design a welded connection using **AISC-ASD** method. (05)

4. (a) Determine the maximum service dead and live load that can be applied if the live load to dead load ratio is 2.5. Each component is PL 5/8 × 7 of A242 steel (F_y = 50 ksi and F_u = 70ksi). The weld is a 5/16-inch fillet weld, E70 electrode. Use **AISC-ASD** method. (07)



(b) List possible defects in weld connections. (03)

5. (a) Two C15×50 sections (A_g = 14.7 in^2 and thickness of web, t_w = 0.716 in) are to be connected to a 1 inch thick gusset plate to transmit DL= 80 kips and LL= 240 kips. Evaluate required numbers of ¾ inch A325 bolts (thread excluded) and show arrangement of connections in a neat sketch. Assume four lines of bolts across web. (08)

(b) What is shear lag? (02)

6. (a) Show that shape factor of a beam with rectangular section is 1.5 . (02)

(b) Write short note on moment gradient factor. (02)

(c) Write down the classification of columns. (02)

(d) Explain limit state design philosophy. Which AISC design method adapted limit state design process? (04)

7. Select the lightest section of A 36 steel for a 20 feet column to carry an axial load of 170 kips. Use **AISC-ASD** method. Assume Fixed-Pinned ends of the column in both axes. Probable Column sizes with sectional properties are given below. (10)

Size	A_g (in^2)	r_x (in)	r_y (in)
W 10×39	11.5	4.27	1.98
W 10×45	13.3	4.32	2.01
W 12×40	11.7	5.13	1.94

Formulae for CE 417

Beam LTB formula's

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

Critical Buckling Stress:

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

$F_{cr} = [0.877 F_e]$

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

Nominal shear in beam:

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

$R_n = m A_b F_{nv}$

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

For weld metal

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

For base metal

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

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

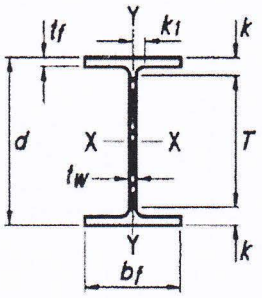
W Shapes
Dimensions

Question 1

Shape	Area, A	Depth, d		Web: Thickness, t_w		Web: $\frac{t_w}{2}$	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k_{des}	Distance: k_{det}	Distance: k_1	Distance: T	Distance: Workable Gage
	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 Question 1(continued...)
Properties

Nominal Wt.	Compact Section Criteria: $\frac{b_f}{2t_f}$	Compact Section Criteria: $\frac{h}{t_w}$	Axis X-X: I	Axis X-X: S	Axis X-X: r	Axis X-X: Z	Axis Y-Y: I	Axis Y-Y: S	Axis Y-Y: r	Axis Y-Y: Z	r_{ts}	h_o	Torsional Properties: J	Torsional Properties: C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
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



Question 2

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 2 (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

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

Course Title: Environmental Engineering VI | Course Code: CE 437
Time: 2 hours | Full Marks: 50

There are Five (5) questions. Question no. 1 is compulsory. Answer Question no. 1 and any Three (3) from the rest. Overall marks distribution: 20+10×3=50.

1. (a) Define waste materials. Explain the changes in industrial management perspectives of post World War II era. **[5]**

   (b) Explain the following international protocols for environmental pollution control and management: (i) Montreal Protocol on ozone layer depleting substances; and (ii) Rio Declaration. **[5]**

   (c) With necessary diagram explain the zones of pollution that may occur in a natural lake/river. **[10]**

2. (a) What is the role of ISO in terms of pollution management? **[5]**

   (b) Write short notes on: (i) ISO 14001; (ii) ISO 14031; and (iii) ISO 14067 **[5]**

3. (a) A municipal wastewater treatment plant discharges 0.20 m^3/s of treated effluent having BOD_5 of 30.0 mg/L and DO of 3 mg/L into a stream that has a flow of 0.60 m^3/s and a BOD_5 of 5 mg/L and DO of 7 mg/L. The temperature of the river is 25°C. The deoxygenation constant k_d is 0.23/day at 20°C. The stream has a depth of 2 m and the average stream velocity is 0.35 m/s. The saturation value of DO at 25°C is given as 8.26 mg/L **[7]**

   a. Find the critical distance downstream at which DO is a minimum.
   b. Find the minimum DO.

   Use the following equations.

$$L_0 = \frac{BOD_{5,mix}}{1-e^{-kt}}$$

$$k_r = \frac{3.9\sqrt{u}}{H^{3/2}}$$

$$t_c = \frac{1}{k_r - k_d}\ln\left\{\frac{k_r}{k_d}\left[1-\frac{D_0(k_r-k_d)}{k_d L_0}\right]\right\}$$

$$D = \frac{k_d L_0}{k_r - k_d}\left(e^{-k_d t} - e^{-k_r t}\right) + D_0 e^{-k_r t}$$

   (b) Explain the different life cycle stages that are observed in a natural lake. **[3]**

4. (a) Explain the mechanisms of Pre D and Post D reactors for achieving nitrogen removal from wastewater. **[5]**

   (b) What is the main difference between vertical flow and floating treatment wetlands in terms of pollutant removal from wastewater? **[5]**

5. (a) How pollutant removal from wastewater is achieved employing Rotating Biological Contactor (RBC) systems? **[5]**

(b) With necessary flow diagram explain the production processes in a tannery industry. **[5]**

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

Course Title: Concrete Technology | Course Code: CE 425
Time: 2 hours | Full Marks: 80

Part 1: Answer any 5(Five) out of 6(Six) questions (1 – 6)

Question 1:

a. What do you mean by fresh concrete? What should be the criteria of fresh concrete? [4]
b. What do you mean by the workability of concrete? Write down four factors that affect the workability of fresh concrete? [3]
c. What is cement paste-aggregate transition zone? How does the aggregate size influence on this zone? [3]

Question 2:

a. What are additives and admixtures? What are the reasons of using admixtures in concrete? [4]
b. Why the air entrainment admixture is used in concrete? What are the main benefit(s) of using calcium chloride, plasticizer, super-plasticizer and retarder admixtures in concrete? [6]

Question 3:

a. What do you mean by permeability? What are the factors affecting the permeability of concrete? [4]
b. What will occur to concrete when the concrete is exposed to high initial temperature? How does the heating result in concrete drying? How does the heating weaken the cement paste-aggregate bond? [4]
c. What are the impacts of micropores and macropores on strength, permeability, drying shrinkage and creep? [2]

Question 4:

a. What are the criteria of pumpable concrete? [2]
b. What do you mean by 'bond' and 'bond strength'? How do you measure the bond between steel and concrete? Why the bond between the interface of steel and concrete is very crucial? [5]
c. What are the reasons of concrete cracks? [2]
d. What is autogenous healing? [1]

Question 5:

a. What is Self-Consolidating (-Compacting) Concrete (SCC)? Where are the two main differences between SCC and conventional/ordinary concrete? [3]
b. What do slump flow, J-Ring test and visual stability index indicate? [3]
c. What are the three main properties of SCC? Give a short description of each property. [3]
d. Write down the names of various types of slump. [1]

Question 6:

a. What are three main properties of high performance concrete (HPC)? Give three examples of high performance concrete. Write down four characteristics of HPC. What are the three main limitations of HPC? [6]

b. What are the mechanisms of Alkali-Silica Reactivity (ASR)? What are the main factors affecting ASR? How do the structures of silica influence on ASR? [4]

Part 2: Answer any 3(Three) out of 4(Four) questions (7 – 10)

Question 7:

a. What is No-fines concrete? What considerations are required to prepare a good No-fines concrete? [3]

b. What are the recommended specifications for No-fines concrete? [3]

c. What is aerated concrete? Describe the preparation process of aerated concrete. [4]

Question 8:

a. Define lightweight aggregate concrete? How foamed slag is produced [3]

b. How sand to total aggregate ratio affects the economy and mechanical properties of concrete? [3]

c. In what situations non-destructive tests are effective? [4]

Question 9:

a. What is carbonation of concrete? How can carbonation be minimized? [3]

b. What is chloride induced corrosion? Explain the process of chloride induced corrosion with chemical reactions. [4]

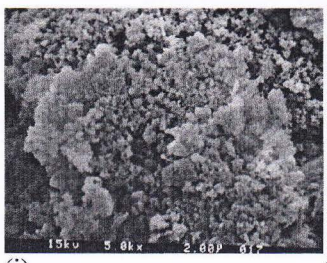
c. What is salt ponding test? What are the benefits of rapid chloride penetration test over salt ponding test? [3]

Question 10:

a. Explain nodulization process and clinkering reactions of at different temperature. [4]

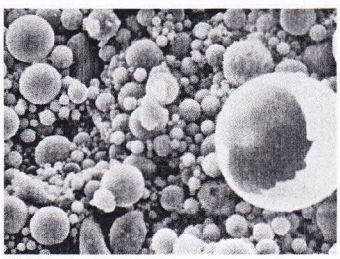
b. How pozzolanic reaction occurs in Portland composite cement? [3]

c. Name the following cement particle from Scanning Electron Microscopic (SEM) images: [3]



(i)

(ii)



(iii)

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

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

Answer any 6 of the following 8 Questions. *The figures are not drawn to scale.* Any missing data can be assumed reasonably.

[1] **(a)** Assume that a single-storey factory building is located in Chittagong, the soil condition is medium hard, the frame type is intermediate moment resisting frame. Determine its damped and undamped natural frequency, natural periods and show the periods in a neat sketch. Given, mass, m = 10000 Kg, stiffness, k = 800000 $\frac{N}{m}$, damping ratio is 5%, and the building height is 8 m. **(10)**

(b) Assume that Equivalent Static Analysis needs to be done for a 7-storied (residential) reinforced concrete building located in Dinajpur, the soil condition is hard. The height of each floor of the building is 3.5 m. Determine the Base Shear as per BNBC 2006, each floor weighs about 35000 Kg, damping ratio is 4% and all columns size are same 0.51m X 0.51m. Use appropriate sketch if necessary. **(10)**

[2] **(a)** What's the difference between P-wave and S-wave? Which one is more dangerous and why? Determine the magnitude of an earthquake by using two different empirical formulas. Assume that the amplitude of the seismograph is 68 mm and epicentral distance is 85 km. **(7)**

(b) Assume that two different materials have ductility factor 5 and 20. Explain with appropriate sketch which one you would select and why for an earthquake resisting design. **(5)**

(c) Draw a typical one-bay-one-storey frame and show the BNBC 2006 detailing requirements of reinforcement in concrete structures for lateral loads. **(8)**

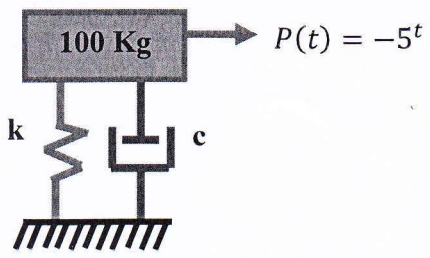
[3] An overhead water tank has mass of 30000 Kg that has the column height 15 m, diameter of the column is 2.5 m and modulus of elasticity is 28000 MPa. Assume the beam is rigid. Determine the followings

(a) The undamped, damped natural frequency and natural periods of the overhead tank. Assume the damping ratio is 3.5%. Explain natural period with an appropriate sketch. **(10)**

(b) Determine the dynamic magnification factor (DMF) of the overhead tank. Draw a qualitative plot of DMF versus $\frac{\omega}{\omega_n}$ and explain when magnification may occur. **(10)**

[4] A damped single-degree-of-freedom (SDOF) system is subjected to external force as shown in Figure 1. Derive and solve the equation of motion of the system and determine the displacement, velocity and acceleration for time steps t = 0.1 and 3 sec. Given, stiffness, $k = 9000\ N/m$, the system has 5% damping, the initial conditions are given as $t = 0$, $x_0 = 0.02$ m, $\dot{x}_0 = 0.2\frac{m}{sec}$. **(20)**

Figure 1



[5] Use the Constant Average Acceleration method to determine the displacement, velocity and acceleration numerically for the following time step t = 0.2 sec. Assume the system mass, spring coefficient, damping and initial conditions are given in Question [4]. Given, $dt = 0.1\ sec.$ **(20)**

[6] Derive the equations of motion of the system shown in Figure 2. Also solve the Eigenvalue Problem to determine the Eigenfrequencies and Mode Shapes by considering $k_1 = 4\frac{N}{m}$, $k_2 = k_3 = 8\frac{N}{m}$. Assume every floor is having 5% damping if necessary. **(20)**

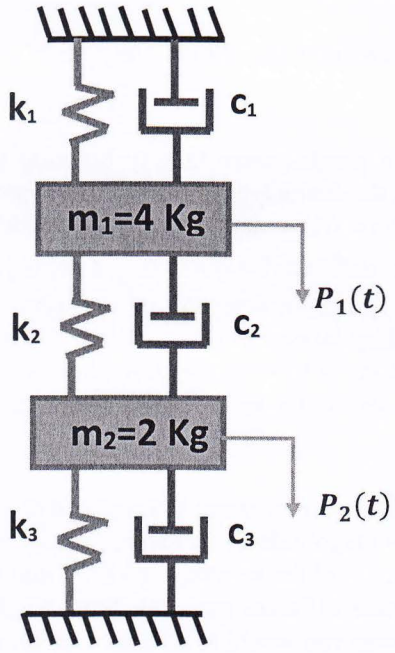


Figure 2

[7] Use the frequencies and mode shapes found in Question [6] to determine the Modal Mass, Stiffness, Damping matrices and Forces vector for the time-steps t = 0.2 and 0.3 sec of the above system. Given, $P_1 = 5^t$ N, $P_2 = t^2 + 5^t$ N. **(20)**

[8] Use the modal mass, stiffness, damping matrices and forces vector obtained in Question [7] to determine accelerations for the following time-step t = 0.2 sec by employing the Constant Average Acceleration method. Given, $t = 0,\ \boldsymbol{x_0} = \mathbf{0},\ \dot{\boldsymbol{x}}_0 = \mathbf{0}, dt = 0.1\ sec.$ **(20)**

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

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

Answer all questions.

1. (a) Briefly describe negative face of engineering ethics. 2.5
   (b) Read the following passage and give answer with explanation from Engineering ethical point of view 7.5

Engineer A, a licensed electrical engineer, works for a state university on construction and renovation projects. Engineer A's immediate manager is an architect, and next in the chain of command is an administrator (Administrator), a man with no technical background. Administrator, without talking to the engineers, often produces project cost estimates that Administrator passes on to higher university officials. In cases where it becomes evident that actual costs are going to exceed these estimates, Administrator pressures the engineers to reduce design features.

One such occasion involves the renovation of a warehouse to convert storage space into office space. Among the specifications detailed by Engineer A is the installation of emergency exit lights. These are mandated by the building code. As part of his effort to bring down actual costs, Administrator insists that the specification for emergency lights be deleted.

What are Engineer A's obligation under this circumstances?

2. (a) Write down the 7c's of communication and briefly describe 3 (three) of them. 5
   (b) What should be done to make the verbal messages effective? 5

3. (a) What are the things you should consider for giving a good presentation? 6
   (b) In making presentation slides (ppt), what things you should consider most? 4

4. (a) Write down the 10 (ten) mistakes that a student should avoid while writing a research paper? 6
   (b) What things you should consider for writing a good title? 4

5. (a) What are the components need to be considered for preparing a thesis? 2
   (b) What are the points need to be considered for writing a good abstract? 6
   (c) What does citation mean? Why is citation important? 2