University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering V | Credit Hours: 2.0 | Course Code: CE 415
Time: 2 hours | Full Marks: 100

[Answer **any 4 (four)** of the following **5 (five)** questions]

1.a) Identify and estimate total losses for the beam shown in ***Figure 1(a)*** according to ACI-ASCE committee 423 method. Mid-span section of the beam is shown in ***Figure 1(b)***. 20
w_{sw}= 8.33 kN/m. f_i= 1650 MPa. Additional superimposed load, w_s= 15 kN/m when erected at 30 days and sustained for 3 years.
Given: f_{ci}'= 32 MPa; f_c'= 42 MPa; f_{pu}= 2200 MPa; A_{ps} = 2040 mm^2; Relative humidity 75%; E_s= 200000 MPa; V/S= 3.

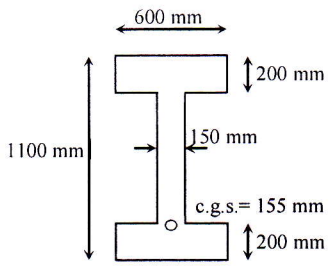


Figure 1(b)

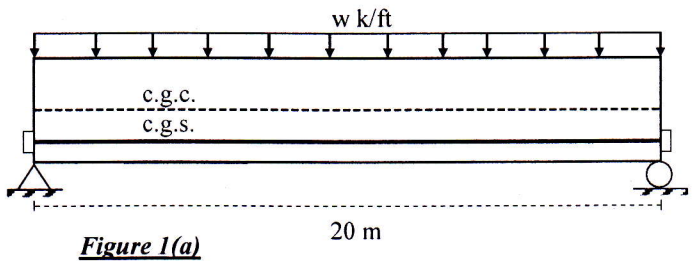


Figure 1(a)

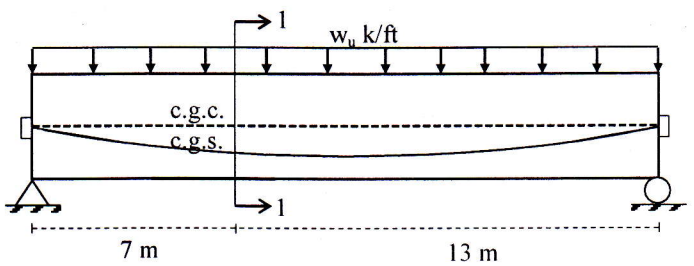


Figure 1(c)

b) Sketch typical layout of posttensioned beams. 5

2.a) The I-shaped beam shown in ***Figure 1(a)*** has f_c'= 42 MPa. Calculate ultimate resisting moment of section shown in ***Figure 1(b)*** for design following ACI Code. 12

b) Discuss briefly the stages of loading in prestressed concrete with distinguishing characteristics of each stage. 8

c) Show distribution of shears along span according to ACI analysis for shear strength. 5

3.a) Check shear strength for section 1-1 for the beam shown in ***Figure 1(c)*** according to the simpler expression by ACI commentary. Beam section at 1-1 is shown in ***Figure 1(b)***. Given: w_u=75 kN/m. 15

3.b) A concrete beam, shown in ***Figure 2(a)***, is posttensioned with 980 mm^2 of high tensile steel to an initial prestress of 1035 MPa immediately after prestressing. Calculate initial deflection at mid-span, where c.g.s= 125 mm. Given: E_c= 27500 MPa; w_{sw}= 4.1 kN/m. 10

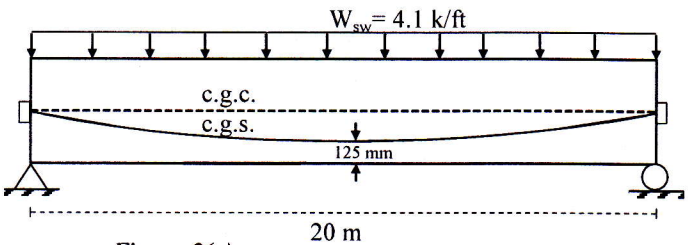
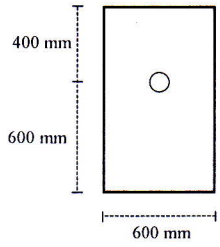


Figure 2(a)



End section

Figure 2(b)

4.a) Make a preliminary design for the prestressed concrete beam to resist a total moment of 750 kN-m. Assume the depth of the section as 1020 mm. Initial prestress for steel is 1100 MPa and effective prestress is 910 MPa, allowable stress for concrete under working load is -13 MPa. 7
Given: M_G= 80 kN-m

b) Make final design for the preliminary section obtained in ***4.(a)*** allowing and considering tension in concrete. Given: f't= 2.2 Mpa; f'b= 1.5 Mpa; ft= -13 Mpa; fb= -13.5 Mpa; F_o= 970 kN. 18

5.a) The midspan section of a composite beam is shown in ***Figure 3***. The precast stem is posttensioned with an initial force 875 kN. The effective prestress after losses is taken as 750 kN. Moment due to weight of the precast section is 270 kN-m at midspan. After it is erected in place, the top slab is cast in place producing moment of 65 kN-m. After the slab concrete has hardened, the composite section is to carry a maximum live load moment of 400 kN-m. 15
Calculate stresses at various stages and show stress distributions for the section.
Given: c.g.s.= 75 mm from base.

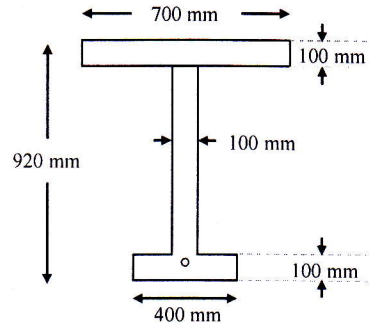


Figure 3

b) Write short notes on: 10
i) Transfer length for prestressing steel
ii) Basic differences between reinforced concrete and prestressed concrete.

List of formulae:

$$\#\, f_c = -\frac{F}{A} \pm \frac{Fey}{I} \pm \frac{My}{I} \qquad \#SH = 8.2 \times 10^{-6}\, K_{sh} E_s \left(1 - 0.06\frac{V}{S}\right)(100 - RH)$$

$$\#\, RE = [\, K_{re} - J(SH + CR + ES]C \qquad \#\, f_{ps} = f_{pu}\left\{1 - 0.5\rho_p \left(\frac{f_{pu}}{f'_c}\right)\right\} \qquad \#\, \rho_p = \frac{A_{ps}}{bd}$$

$$\#\, a = \frac{A_{ps}\, f_{ps}}{0.85 f'_c b} \qquad \#\, \omega_p = \frac{\rho_p f_{ps}}{f'_c} \leq 0.30 \qquad \#\, M_u = \phi A_{ps}\, f_{ps}\left(d - \frac{a}{2}\right)$$

$$\#\, A_{pf} = \left\{0.85 f'_c (b - b_w) h_f\right\} \Big/ f_{ps} \qquad \#\, \omega_{pw} = \frac{\rho_w f_{ps}}{f'_c} \leq 0.30$$

$$\#\, M_u = \phi\left[A_{pf}\, f_{ps}\left(d - \frac{h_f}{2}\right) + A_{pw}\, f_{ps}\left(d - \frac{a}{2}\right)\right]$$

$$\#\, \mathrm{F} = \frac{\mathrm{M_T}}{0.65\mathrm{h}} \text{ ; if } \mathrm{M}_G \text{ is greater than 20\% of } \mathrm{M}_T$$

$$\#\, \mathrm{F} = \frac{\mathrm{M_L}}{0.5\mathrm{h}} \text{; if } \mathrm{M}_G \text{ is less than 20\% of } \mathrm{M}_T, \mathrm{M}_L = \mathrm{M}_T - \mathrm{M}_G$$

$$\#\, \mathrm{A_c} = \frac{\mathrm{F_0 h}}{\mathrm{f_b c_t}} \qquad \#\, \mathrm{A_c} = \frac{\mathrm{Fh}}{\mathrm{f_t c_b}} \qquad \#\, \mathrm{A_c} = \frac{\mathrm{F_o}}{\mathrm{f_b}}\left(1 + \frac{\mathrm{e} - \left(\mathrm{M_G}/\mathrm{F_0}\right)}{\mathrm{k_t}}\right) \qquad \#\, \mathrm{A_c} = \frac{\mathrm{F_o h}}{\mathrm{f_b c_t} - \mathrm{f'_t c_b}}$$

$$\#\, \mathrm{A_c} = \frac{\mathrm{Fh}}{\mathrm{f_t c_b} - \mathrm{f'_b c_t}} \qquad \#\, \mathrm{F} = \frac{\mathrm{M_T} - \mathrm{f'_b A k_t}}{\mathrm{e} + \mathrm{k_t}} \qquad \#\, \mathrm{k} = \frac{\mathrm{r}^2}{\mathrm{c}}$$

$$\#\, \mathrm{V}_{ci} = 0.05\sqrt{\mathrm{f'_c}}\, \mathrm{b}_w \mathrm{d} + \mathrm{V}_d + \mathrm{V}_i \frac{\mathrm{M}_{cr}}{\mathrm{M}_{max}}$$

$$\#\, \mathrm{M}_{cr} = (I/y_b)(0.5\sqrt{\mathrm{f'_c}} + \mathrm{f}_{pe} - \mathrm{f}_d \qquad \#\, \mathrm{V}_{ci} = 0.05 \mathrm{b}_w \mathrm{d}\sqrt{\mathrm{f'_c}} + \mathrm{V}_i\, \mathrm{M}_{cr}/\mathrm{M}_{max}$$

$$\#\, \mathrm{M}_{cr} = (I/y_b)(0.5\sqrt{\mathrm{f'_c}} + \mathrm{f}_{pe} \qquad \#\, f_{pe} = \frac{F}{A} + \frac{Fey_b}{I}$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering III | Course Code: CE 431
Time: 2 hours | Full marks: 100

Answer all the questions from question no. 1-5. (5 X 20 = 100)
(Assume any missing data)

1. (a) What are the resources that could be recovered through recycling of organic waste? (4)

(b) Mention the factors that you will consider while planning for a recycling scheme for your community. Show your proposed recycling pattern in a flow chart. (3+5)

(c) What are the key concepts of on-site processing and collection? Discuss with examples how you can implement each of these concepts at your home. (2+6)

2. (a) With examples, explain the difference between resource recovery by material separation and resource recovery by material conversion. (5)

OR

Compare the suitability of the methods "anaerobic digestion" and "composting" for waste treatment with respect to cost, energy and management options.

(b) 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 $C_{60}H_{194.3}O_{37.8}N$. Also estimate the percentage composition (volume fractions of each gas) of the resulting gas mixture. 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. (10)

(c) Show and discuss the different stages of anaerobic digestion method. (5)

OR

List down and briefly discuss the environmental factors affecting both anaerobic digestion and composting.

3. (a) Compare 'heuristic' versus 'deterministic' approaches of collection routing. (4)

OR

Compare 'preventive maintenance' versus 'breakdown maintenance' of collection vehicles.

(b) What are the major environmental impacts and economic costs associated with the solid waste collection systems? (7)

OR

If you recommend a "transfer station" for a solid waste management system that you are

involved in developing, provide reasons both in favor of and against the decision. Also mention the factors that you have to consider while planning and designing transfer station.

(c) The annualized cost of purchasing, fueling and maintaining a compactor truck is given by the following expression: (9)
Annualized cost ($/yr) = 25000 + 4000V
Where, V is the truck volume in cubic yards. Suppose these trucks require two person crews, with labor charged at $24 per hr each (including benefits). Perform an economic analysis of the collection system, in which a 14.4 yd^3 truck collects refuse from 340 households each day. Each household generates 60 lbs of refuse per week. The trucks and crew work 5 days per week and curb-side pickup is provided once a week for each house. What is the cost per ton of refuse collected and what is the cost per household?

4. (a) Differentiate between putrescible and non-putrescible categories of solid waste with examples of household waste. List down the factors on which the quantity of solid waste depends on. (3+4)

OR

Why is it important to know the composition of solid waste? Which factors would you consider if you have to forecast future waste quantities?

(b) Provide a brief description on any two physical **OR** chemical properties of solid waste. (5)

(c) A Municipal Solid Waste sample of 100 kg was collected to analyze the physical properties. Estimate the overall moisture content, total and overall energy contents of the waste. (8)

Component	% by Mass	Moisture Content (%)	Energy Content (KJ/Kg)
Paper	31.5	4.2	16900
Plastics	10.2	2.3	31300
Wood	4.6	18.7	19800
Textiles	8.8	9.5	18100
Leather	7.6	10.2	16800
Rubber	5.2	1.9	23400
Metals	12.1	1.3	27000
Food waste	13.6	82	4200
Miscellaneous	6.4	3.4	600

5. (a) List the problems associated with hazardous waste treatment and disposal. Briefly discuss how you would attempt to solve the problems in Bangladesh. (4+5)

OR

Define "Life Cycle Assessment" with example. If you want to establish an industry, what are the factors you should consider for effective recycle, reuse, collection and disposal of industrial waste?

(b) Mention the advantages and the disadvantages of sanitary landfill. (4)

OR

Sketch the profiles of gases that are generated along the different stages of digestion in a landfill.

(c) The following four soil layers are laid between the base of a landfill and the underlying aquifer. How long will it take for leachates to migrate to the aquifer? (7)

Layers of soil	Depth (m)	Porosity (%)	Permeability (m/s)
Layer A	5.0	45	2.5×10^{-8}
Layer B	2.0	42	1.9×10^{-7}
Layer C	3.0	40	5.3×10^{-6}
Layer D	1.0	35	3.8×10^{-5}

Given Formula:

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

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

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

Where, A = Annual cost (BDT/yr)
P = Purchase price, (BDT)
i = interest rate, discount rate (yr^{-1})
n = amortization period (yr)

Average interstitial velocity, $v_p = k/\alpha$

Equivalent permeability, $K_e = \frac{\sum d_i}{\sum \frac{d_i}{k_i}}$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B. Sc. Engineering (Civil)

Course Title: GIS and Remote sensing | Course Code: CE 531
Time: 2.00 Hours | Full Marks: 70

Section A
Answer any 3 (three) including question number 1(one)
[Marks:10+2*10=30]

1. Write down the correct answer in your answer script. **[1*10=10]**

(i) ***GIS stands for***
(a)Geographic Information System
(b)Generic Information System
(c)Geological Information System
(d)Geographic Information Sharing

(ii) ***GIS deals with which kind of data***
(a)Numeric data
(b)Binary data
(c)Spatial data
(d)Complex data

(iii) ***Which of the following statements is true about the capabilities of GIS***
(a)Data capture and preparation, presentation
(b)Data management, including storage and maintenance
(c)Data manipulation and analysis
(d) All of the above

(iv) ***By 'spatial data' we mean data that has***
(a)Complex values
(b)Positional values
(c)Graphic values
(d)Decimal values

(v) ***What is 'Metadata'?***
(a)It is 'data about data'
(b)It is 'meteorological data'
(c)It is 'oceanic data'
(d)It is 'contour data'

(vi) ***A (geographic) field is a geographic phenomenon for which, for every point in the study area***
(a)A value can be determined
(b)A value cannot be determined
(c)A value is not relevant
(d)A value is missing

(vii) ***The following are the examples of 'geographic fields'***
(a)Air temperature
(b)Barometric pressure
(c)Elevation
(d)All of the above

(viii) ***Fields can be***
(a)Discrete only
(b)Continuous only
(c)Discrete or continuous
(d)None of the above

(ix) ***Examples of 'continuous fields' are***
(a)Air temperature
(b)Barometric pressure
(c)Soil salinity
(d) All of the above

(x) ***DBMS stands for***
(a)Database Management System
(b)Database Monitoring System
(c)Database Manufacturing System
(d)Database Mixing Station

2. **(a)** What does GIS do? Discuss briefly "People" as one component of GIS. **[3+2]**
(b) List five areas of GIS Application. List Five GIS web sites that you have visited. **[3+2]**

3. **(a)** What do you understand by Projected Coordinate Systems .What are the Projection properties? **[2+3]**
(b) Mention some of the GIS Projections. What are the common Projection systems in Bangladesh? **[3+2]**

4. **(a)** What do you understand by data Acquisition? Compare among different data acquisition methods. **[2+3]**
(b) What are the differences between 'Nominal Data Values' and 'Ordinal Data Values'? What are the differences between 'Vector Data' and 'Raster Data' ? **[2+3]**

Section B
Answer any 4 (four) including question number 2
*([Marks:10+3*10=40]*

1. **(a)** Road map of ward 35 has been given. Prepare a shape file of Tertiary road from the given file. To reduce traffic jam over the roads, you are being asked to extend the width of the tertiary road by 5m on each side. Will it cause any disturbance to the existing structure? **[6]**

(b) Create a shape file where there will be only those structures which are 10 km within the religious points. **[4]**

2. Geo reference the Image and then Digitize it along with the roads. railways, rivers, Thana boundaries and mentioned points on the image. **[4+6]**

3. **(a)** Prepare and Export map from the digitized image of question number 2. **[5]**

(b) Bangladesh waterways shape file is given. Categorize the different types of waterways, change the width and color of different types. Export the data. [5]

4. (a) Thana bd shape file is given. Convert it to District bd shape file and then place network tower in every single district. [4]

(b) Soil pattern of Bangladesh (shape file) is given. What are the common soil types of Comilla District and Rajshahi District . Select the Comilla district soil pattern and create a map of the district. [3+3]

5. (a) Point shape file is given. Find out the total number of banks all over the country. [4]

(b) From the point shape file, select the Sony Cinema hall. Select the places which are within 500 m from Sony Cinema hall. Create a new shape file of Schools from that and label the name of the schools. Is there any intersecting river around this area? [6]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering VIII (GIS and Remote Sensing) Course Code: CE 531
Time: 2 hour Full marks: 60

Part A: There are 2 (two) questions. Answer any 1 (one) of them (15x1=15)

1. a. Describe different types of geo-database. Name the parameters that need to be considered in designing a database. How you can apply the concept of address matching in any of your projects? (6+2 +1)
   b. Compare between the following: (3x2)
      i. Linear and non-linear interpolation
      ii. Global and local interpolation
      iii. IDW and Kriging method

2. a. What is spatial analysis? Briefly discuss about different spatial analysis techniques. (1+5)
   b. Write short notes on the following: (3x3)
      i. Geo-coding
      ii. 3D GIS
      iii. Reclassification

Part B: There are 3 (three) questions. Answer all of them (12+18+15=45)

Use ArcGIS software to solve these problems. Use "Spring 2017_MS" data folder.

3. You have been provided an image of airports in Bangladesh. The table below shows the coordinates of four airports: Dhaka, Chittagong, Sylhet, and Jessore. (12)

Airports	X	Y
Dhaka	90.33	23.72
Chittagong	91.97	22.27
Sylhet	91.87	24.90
Jessore	88.60	24.48

Using this information, **create a point shp. file database** with the following attributes of the airports. **Save the shp. file as 'airports.shp'**. Provide screenshots for major steps you followed.

Shape	Airports	Status
Point	Dhaka	International
Point	Chittagong	International
Point	Sylhet	International
Point	Jessore	Domestic

4. A new clinic is to be established in **Ward 36**. Which location is most suitable for the new clinic? **Prepare a map** highlighting the possible locations for the clinic, and provide screenshots for major steps.

Assume that the clinic will be:

i. within 20 m distance from primary road
ii. within 10 m distance from secondary road
iii. within 100 m distance from banks
iv. the selected location is not covered by existing clinics/health services (consider 130 m as service area coverage for existing clinics)
v. not within 100 m distance from dustbin
vi. not within 15 m distance from commercial use buildings
vii. not within 15 m distance from mixed use buildings

(18)

5. a. You have been provided with the shp. files of **Ward 49** (Dhanmondi area). Perform the following tasks:

i. Create a map of the buildings according to no. of stories as: less than 4 storied, 4 to 6 storied, and more than 6 storied. (10)

ii. Create a map of the buildings according to building use (like residential, commercial, mixed, etc)

Also, provide answer to the following queries. Provide the expressions you used, and screenshots as your answer.

iii. Identify the buildings that are 6 storied only and of commercial use
iv. Identify the buildings that are more than 6 storied and of mixed use
v. Identify the buildings that are more than 6 storied and of mixed use and having building area within 400 to 1000 sq m.

b. Find out the accessibility of the education centers and health services for **Ward 20.** Consider the accessibility criteria as follows: (5)

i. distance from primary road is 10 m
ii. distance from secondary road is 20 m

Provide screenshots as your answer. Also provide recommendations to improve accessibility of these services in Ward 20.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering IV — Course Code: CE 433
Time- 2 hours — Full marks: 100

Answer all the questions from questions 1-5. (5 X 20 = 100)
(Assume any missing data)

1. (a) List down the sources of indoor air pollution. Classify air pollutants on the basis of origin, chemical composition and state of matter. (5+5)

(b) On March, 2017, the following air quality data have been recorded at the Continuous Monitoring Stations/Systems (CAMS) in Dhaka. (10)

$PM_{2.5}$ = 190 $\mu g/m^3$ (24 hr)
PM_{10} = 280 $\mu g/m^3$ (24 hr)
CO = 13.5 ppm (24 hr)
SO_2 = 0.297 ppm (24 hr)

Calculate Air Quality Index (AQI) for that day. Also, prepare the AQI report.

2. (a) Explain typical diurnal variation of nitric oxide (NO), nitrogen di-oxide (NO_2) and ozone (O_3). (6)

(b) Sketch the simplified atmospheric nitrogen photolytic cycle. Bangladesh ambient air quality standard for carbon monoxide (CO) is 40 mg/m^3 (1 hour). Express the standard in ppm. (8)

(c) Compare the profiles of adiabatic and environmental lapse rates during stable, neutral, and unstable atmospheric conditions using figures. Also show the resulting plumes types for the mentioned conditions. (6)

OR

(a) Briefly describe any two particle deposition mechanisms in human respiratory systems. (6)

(b) Cars travelling at 60 mph speed at 90 m a part are emitting 10 g/mile of carbon monoxide. The wind speed is 4.0 m/s perpendicular to the road. Estimate ground level concentration of CO at a distance 300 m downwind. Consider atmosphere to be adiabatic (neutral atmosphere). (8)

(c) Considering fumigating plumes, lofting plume and inversion layers, discuss how (6)

comparison of lapse rates can help predicting the gaseous emission from a stack.

3 (a) Explain any one process of gaseous pollutant removal. What is the significance of air/fuel ratio? (5)

(b) What are the main approaches for vehicular pollution control? (5)

(c) A highway has 15 vehicles per second passing a given spot, each emitting 3.7 g/mile of CO. The wind is perpendicular to the highway and blowing at 5 mph (2.2 m/s) on a heavy overcast day (Stability class D). Estimate the ground level CO concentration 1km from the highway. (10)

OR

(a) Discuss the effect of air/fuel ratio on fuel power, economy and pollution with schematic diagram. (5)

(b) Provide oxidation and reduction reactions in a "2-way" and a "3-way" catalytic converters. (5)

(c) A stack emitting 70 g/s of CO 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 (Stability class –B). Estimate the ground level CO concentration directly downwind at a distance of 3 km. Also estimate the concentration at a point downwind where CO concentration is maximum. (10)

4 (a) What is "Eutrophication"? Discuss the principal factors that influence eutrophication. How could eutrophication be controlled? (2+5 +3)

(b) Consider a lake with 200×10^6 m^2 of surface area for which the only source of Phosphorus is the effluent from a wastewater treatment plant. The effluent flow rate is 0.45 m^3/s and its phosphorus concentration is 10.0 mg/L (= 10.0 g/m^3). The lake is also fed by a stream having 30 m^3/s of flow with no phosphorus. Phosphorus settling rate is estimated to be 10 m/year, (10)

(a) Estimate the average phosphorus concentration in the lake.
(b) What level of phosphorus removal at the treatment plant would be required to keep the average lake concentration below 0.010 mg/L?

5 (a) With a schematic figure, show the zones of pollution and the change in aquatic ecology in a stream due to wastewater disposal. (5)

(b) Define critical DO with a schematic diagram. (5)

(c) Define CBOD and NBOD with a figure. The ultimate CBOD (L_0) in a river due to discharge of wastewater is 24.6 mg/L at 25°C. The deoxygenation and the reaeration constants at 20°C are 0.23/day and 0.4/day respectively. If the time required (t_c) for dissolved oxygen to reach at its minimum is 2.45 days, find the critical DO or DO_{min}. (Equations attached) (10)

OR

(a) Sketch the Streeter Phelps DO Sag curve showing all the elements. (5)

(b) Discuss the significance of critical DO. (5)

(c) Why is COD always greater than BOD? For a BOD test, initial DO = 8.5 mg/L, after 5 days, DO = 4.5 mg/L. If dilution factor = 50 and k = 0.2/day, calculate (i) BOD_5, ii) ultimate CBOD and iii) BOD remaining after 5 days. Again BOD_5 a wastewater sample is 350 mg/L at 20°C. If k= 0.23/day at 20°C, calculate BOD_5 at 25 °C. (10)

Given Formula:

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

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

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

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

$$C(x, z) = \frac{Q_L}{\sqrt{(2\Pi)u\sigma_z}}\{\exp\left[-\frac{(z-H)^2}{2\sigma_z 2}\right] + \exp\left[-\frac{(z+H)^2}{2\sigma_z 2}\right]\}$$

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

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

$$D_c = \frac{k_d}{k_r}L_0 e^{-k_r t_c}$$

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

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

$$DO_{min} = DO_{sat} - D_c$$

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

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

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

Breakpoints							AQI	Category
O_3 (ppm) 8-hr	O_3 (ppm) 1-hr (i)	$PM_{2.5}$ ($\mu g/m^3$) 24-hr	PM_{10} ($\mu g/m^3$) 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.

$$F = gr^2 v_s \left(1 - \frac{T_a}{T_s}\right) \quad ; \quad \Delta h = \frac{1.6 F^{1/3} x_f^{2/3}}{u}$$

$x_f = 120\ F^{0.4}$ if $F \geq 55\ m^4/s^3$

$x_f = 50\ F^{5/8}$ if $F < 55\ m^4/s^3$

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	$x \leq 1$ km			$x \geq 1$ km		
	a	c	d	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

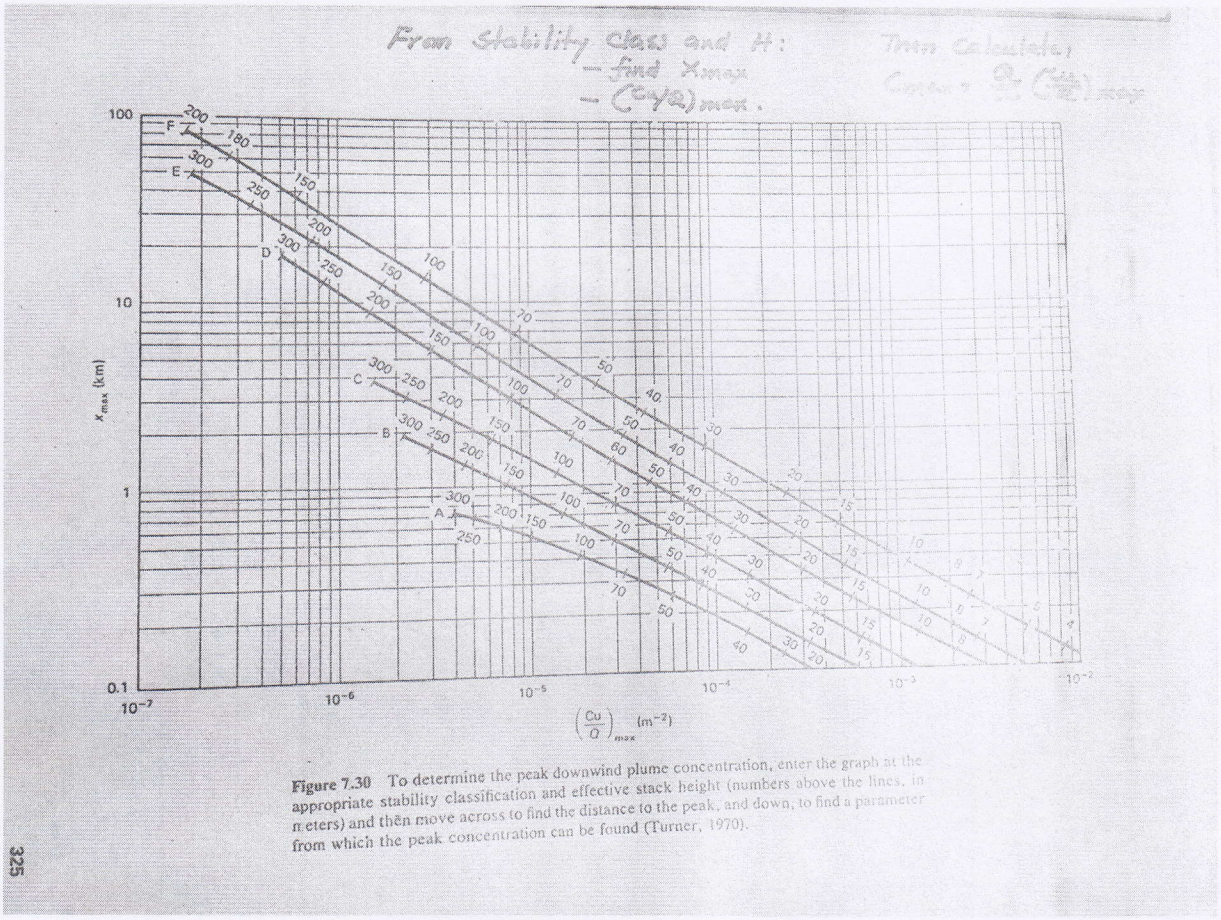


Figure 7.30 To determine the peak downwind plume concentration, enter the graph at the appropriate stability classification and effective stack height (numbers above the lines, in meters) and then move across to find the distance to the peak, and down, to find a parameter from which the peak concentration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

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

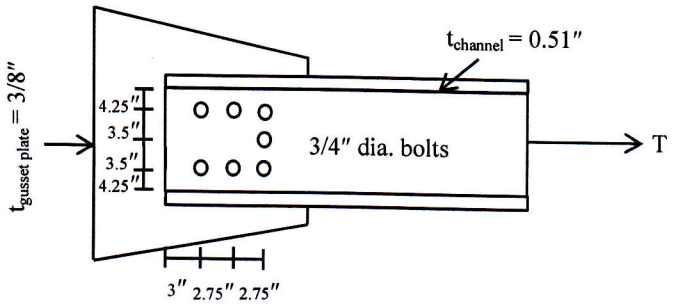
Course Title: Structural Engineering VI
Time: 2 hours

Course Code: CE 417
Full Marks: 120

[Answer any **Six** (06) out of the following **Eight** (08) questions]

1. (a) Mention five differences between steel and concrete structures (5)

   (b) Determine the service load capacity in tension for a C12x30 (A992 Grade Steel) as shown in the following **Figure** using AISC-ASD approach. [From AISC manual, A_g = 8.82 in^2, $\bar{x}$ = 0.674 in., $t_{channel}$ = 0.51 in. (Consider all the limit states).] (15)

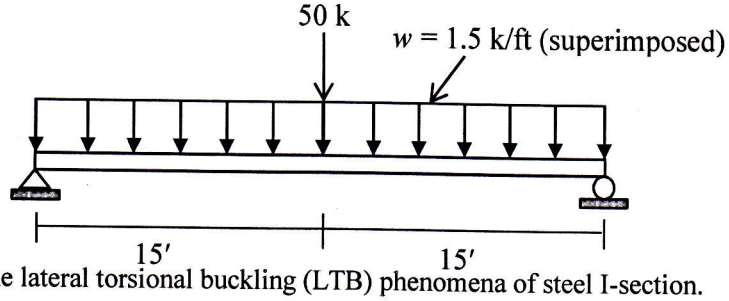


2. (a) List the fabrication sequence of steel members in rolling mills. (5)

   (b) Select the lightest W section of A992 steel for a column of **30 ft** length to carry compressive forces of **68 kips** dead load and **142 kips** live load in a braced frame structure. Member is assumed pinned at top and bottom. In addition, it has weak direction support at mid-height so that deflection is prevented in x direction. Use **AISC-LRFD** method. Properties of the sections are given below: (15)

Size	*Ag (in^2)*	*r_x (in)*	*r_y (in)*
W 10x33	9.71	4.19	1 .94
W 10x45	13.3	4.32	2.01
W 12x40	11.7	5.13	1.94

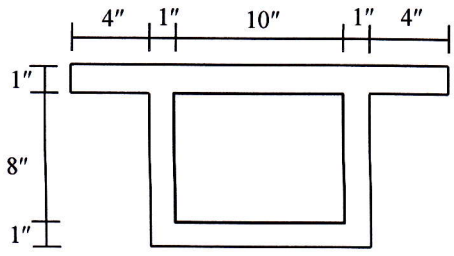
3. (a) A W16X31 section of A992 steel is used as simply supported beam of 30 feet span with loading condition as shown in the following **Figure**. Compression flange of the section is embedded in a concrete floor slab. Using AISC-ASD method, determine the moment capacity of the beam. (Use dimensions from attached table) (15)



   (b) Explain the lateral torsional buckling (LTB) phenomena of steel I-section. (5)

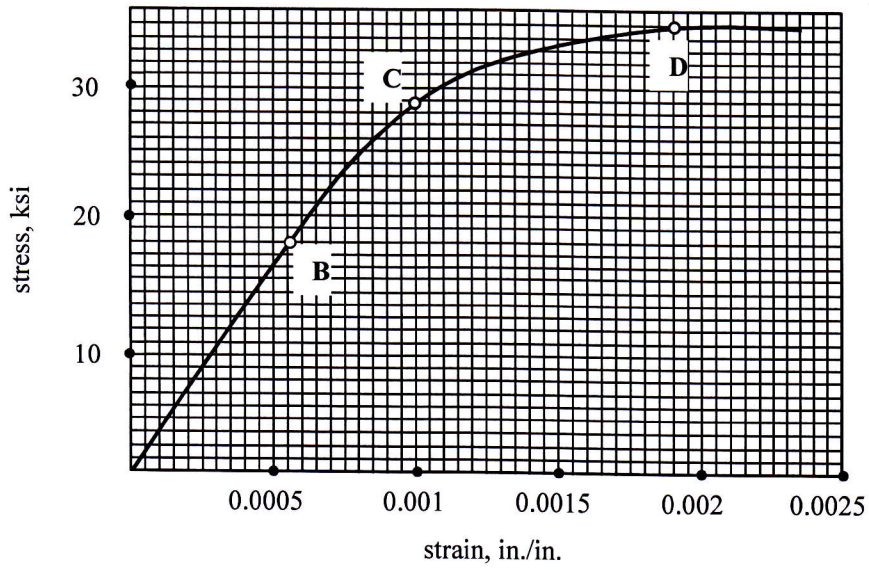
4. (a) List different types of steel beam. Briefly discuss their functions. (5)

(b) For the beam section shown in the following **Figure**, (15)
Calculate: i) Yield Moment ii) Plastic Moment iii) Shape factor



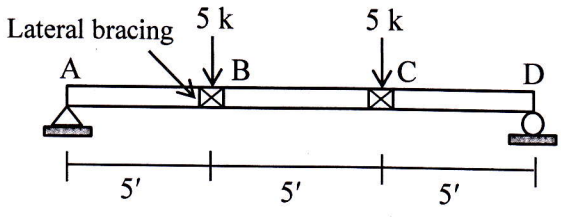
5. (a) What is residual stress? Explain its sources. (5)

(b) The following stress-strain response incorporates the effect of residual stress in a compression member. Up to point **B**, the stress-strain relation is linear. After **D**, the curve is flat. Develop the equations of **BC** and **CD**. (Equation for the nonlinear portion of the graph is $F = k_1\varepsilon^2 + k_2\varepsilon + k_3$.) (15)



6. (a) Discuss different methods used to provide lateral support in flexural members. (6)

(b) Determine the moment gradient factor, C_b for segment AB and BC of the following beam. (14)



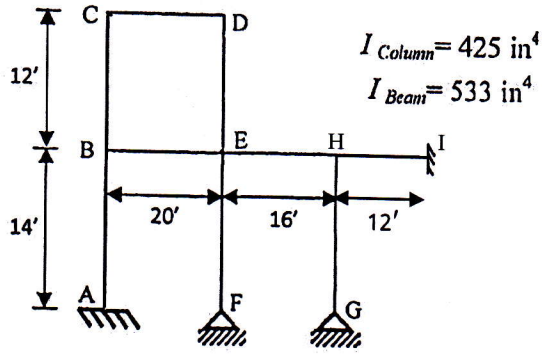
7. (a) Briefly explain: i) Compact section (6)
ii) Non-compact section
iii) Slender section.

(b) Determine the elastic shear stress distribution of a W12X58 beam subjected to a service load shear force of 250 kips. Also compute the portion of the shear carried by the flange and web. (14)

W12X58	Depth, d (in.)	Flange (in.)		Web thickness, t_w (in.)	I (in^4)
		Width, b_f	Thickness, t_f		
	12.2	10.00	0.640	0.360	475

8. (a) Write down the assumptions taken into account in using alignment chart. (5)

(b) Calculate effective length for members BC, DE and GH shown in the following **Figure**. Use the alignment chart. (15)



Critical Buckling Stress:

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

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

Block shear capacity: Nominal strength

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

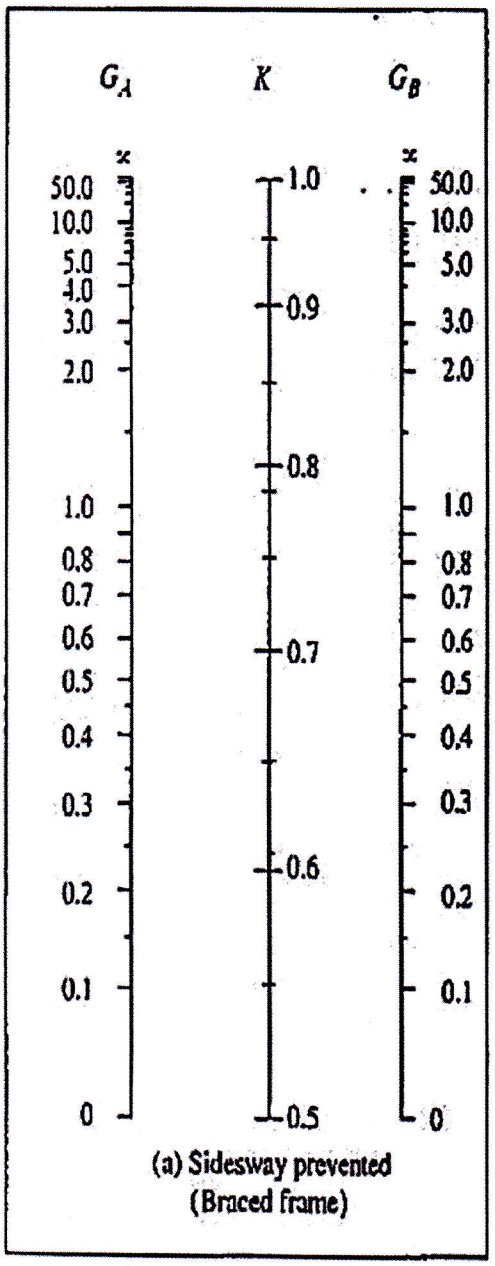
$R_n = 0.6F_uA_{nv} + U_{bs}F_uA_{nt}$

$$C_b = \frac{12.5M_{max}}{2.5M_{max} + 3M_A + 4M_B + 3M_C} R_m \leq 3.0$$

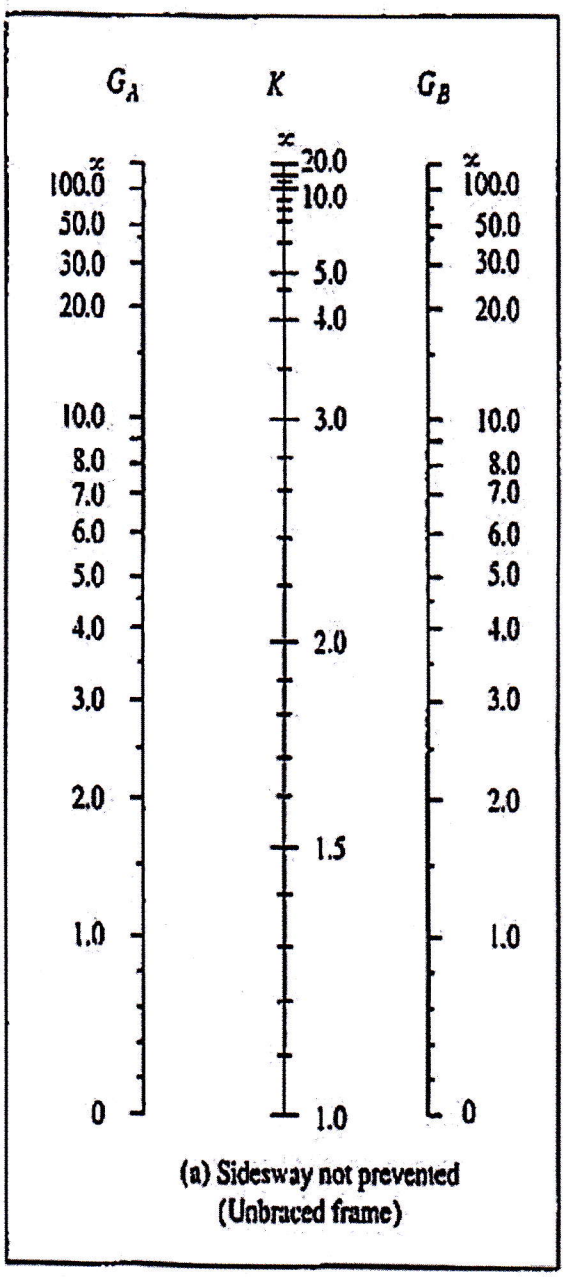
Beam LTB formula's

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

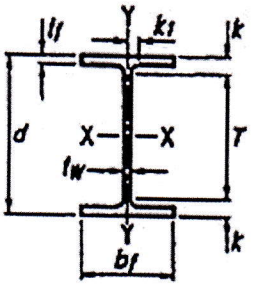
Alignment Chart



(a) Sidesway prevented
(Braced frame)



(a) Sidesway not prevented
(Unbraced frame)



Question 3(a)

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.
W16×100	29.5	17.0	17	0.585	9/16	5/16	10.4	10 3/8	0.985	1	1.39	1 7/8	1 1/8	13 1/4	5 1/2
×89	26.2	16.8	16 3/4	0.525	1/2	1/4	10.4	10 3/8	0.875	7/8	1.28	1 3/4	1 1/16	↓	↓
×77	22.6	16.5	16 1/2	0.455	7/16	1/4	10.3	10 1/4	0.760	3/4	1.16	1 5/8	1 1/16	↓	↓
×67[c]	19.7	16.3	16 3/8	0.395	3/8	3/16	10.2	10 1/4	0.665	11/16	1.07	1 9/16	1	↓	↓
W16×57	16.8	16.4	16 3/8	0.430	7/16	1/4	7.12	7 1/8	0.715	11/16	1.12	1 3/8	7/8	13 5/8	3 1/2[g]
×50[c]	14.7	16.3	16 1/4	0.380	3/8	3/16	7.07	7 1/8	0.630	5/8	1.03	1 5/16	13/16	↓	↓
×45[c]	13.3	16.1	16 1/8	0.345	3/8	3/16	7.04	7	0.565	9/16	0.967	1 1/4	13/16	↓	↓
×40[c]	11.8	16.0	16	0.305	5/16	3/16	7.00	7	0.505	1/2	0.907	1 3/16	13/16	↓	↓
×36[c]	10.6	15.9	15 7/8	0.295	5/16	3/16	6.99	7	0.430	7/16	0.832	1 1/8	3/4	↓	↓
W16×31[c]	9.13	15.9	15 7/8	0.275	1/4	1/8	5.53	5 1/2	0.440	7/16	0.842	1 1/8	3/4	13 5/8	3 1/2
×26[c,v]	7.68	15.7	15 3/4	0.250	1/4	1/8	5.50	5 1/2	0.345	3/8	0.747	1 1/16	3/4	13 5/8	3 1/2

Question 3(a) (Continued..)

W Shapes

Properties

W16 – W14

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}
100	5.29	24.3	1490	175	7.10	198	186	35.7	2.51	54.9	2.92	16.0	7.73	11900
89	5.92	27.0	1300	155	7.05	175	163	31.4	2.49	48.1	2.88	15.9	5.45	10200
77	6.77	31.2	1110	134	7.00	150	138	26.9	2.47	41.1	2.85	15.8	3.57	8590
67	7.70	35.9	954	117	6.96	130	119	23.2	2.46	35.5	2.82	15.7	2.39	7300
57	4.98	33.0	758	92.2	6.72	105	43.1	12.1	1.60	18.9	1.92	15.7	2.22	2660
50	5.61	37.4	659	81.0	6.68	92.0	37.2	10.5	1.59	16.3	1.89	15.6	1.52	2270
45	6.23	41.1	586	72.7	6.65	82.3	32.8	9.34	1.57	14.5	1.88	15.6	1.11	1990
40	6.93	46.5	518	64.7	6.63	73.0	28.9	8.25	1.57	12.7	1.86	15.5	0.794	1730
36	8.12	48.1	448	56.5	6.51	64.0	24.5	7.00	1.52	10.8	1.83	15.4	0.545	1460
31	6.28	51.6	375	47.2	6.41	54.0	12.4	4.49	1.17	7.03	1.42	15.4	0.461	739
26	7.97	56.8	301	38.4	6.26	44.2	9.59	3.49	1.12	5.48	1.38	15.3	0.262	565

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

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

There are Five (5) questions. Question no. 1 is compulsory. Answer Question no. 1 and any Three (3) from the rest.

1. (a) Explain screening and scoping processes of EIA. Develop a simple checklist showing the typical impacts associated with a road construction project. **[4+5]**
   (b) Explain the impact origin of earthworks and poorly paved service road that were observed during the construction of a power generation plant at Ashugonj. Prescribe the preventive approaches undertaken for minimizing such impacts. **[6]**
   (c) Explain two approaches for evaluating an EIA report. **[5]**

2. (a) Explain habitat loss and disturbance that are associated with project construction near a forest ecosystem. **[1.5+1.5]**
   (b) Summarize the potential hydrological impacts and sources of such impacts due to construction of the following river engineering schemes: (i) surface water hydraulics; (ii) channel morphology/sediments. **[3.5+3.5]**

3. (a) Explain the criteria of JNCC (Joint Nature Conservation Committee, UK) phase 1 and phase 2 field surveys. **[3+3]**
   (b) Describe the desirable characteristics and criteria for selecting environmental indicators of a monitoring program. **[2+2]**

4. (a) Explain the review criteria of an EIA report. Summarize the checklists for reviewing anticipated impacts, mitigation measures and environmental monitoring plan sections of an EIA report. **[2+3]**
   (b) Summarize specific objectives, specific questions, valued environmental components and environmental indicators for monitoring environmental quality of an estuary. **[5]**

5. (a) Differentiate difference between critique and formal review of an EIA report. **[5]**
   (b) Explain compliance and environmental effects monitoring. Summarize monitoring requirements for effective pollution control. **[3+2]**

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering X | Course Code: CE 425
Time: 2 hours | Full Marks: 100 (10 X 10)

Answer any 10(Ten) out of 12(Twelve) questions

Question 1:

a. What is cement hydration? Explain the process of formation of Alite and Belite in the clinkering reaction. [6]
b. How pozzolanic reaction occurs in Portland Composite Cement? [4]

Question 2:

a. Discuss specifications of various Grades of Ground Granulated Blast-Furnace Slags (GGBS). [3]
b. 'The ball bearing effect of GGBS in cement improves the workability and pumpability of concrete' Do you agree or disagree with this statement? Justify your answer. [3]
c. Explain the side-effects of using $CaCl_2$ as an accelerating admixture. [4]

Question 3:

a. What are additives and admixtures? What are the reasons of using admixtures in concrete? [6]
b. Write the factor that controls the effectiveness of admixture. [4]

Question 4:

a. What is Self-Consolidating (-Compacting) Concrete (SCC)? What are the two main differences between SCC and conventional/ordinary concrete? [4]
b. What do V-funnel, L-box test and visual stability index indicate? [3]
c. What type of concrete you would recommend for reduction of water clogging in Dhaka city. How will it help in reducing the water clogging? [3]

Question 5:

a. What do you understand by Non-destructive testing? Identify the situations where non-destructive tests are useful. [5]
b. Name the common tools used for visual inspection tests. [2]
c. Write short note on: (i) Rebound hammer test, (ii) cover-meter test [3]

Question 6:

Using the formulae below, calculate the Bogue compound contents of the following Portland cements. [10]

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

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.

Question 7:

a. What consideration a civil engineer should take for sustainable development of concrete construction works in Bangladesh? [6]
b. 'Use of composite cement will not contribute in the reduction of carbon emission' Do you agree or disagree? Please justify your answer. [4]

Question 8:

a. Compare durability with strength of concrete? Relate the performance of concrete with durability? [6]
b. Compare theories of permeation, absorption and diffusion of concrete [4]

Question 9:

a. Categorize different types of cracks in concrete. [4]
b. Explain plastic shrinkage of concrete. Devise a plan to minimize the plastic shrinkage cracks in concrete. [6]

Question 10:

a. Explain the mechanism of corrosion process of embedded steel in concrete. [6]
b. Illustrate the carbonation attack into concrete. [4]

Question 11:

a. Judge the applicability of sprayed concrete in the context of Bangladesh. [4]
b. Compare briefly the major differences between normal and sprayed concrete. [6]

Question 12:

a. Explain the factors influencing formwork pressure. [3]

b. Evaluate the pressure at every 1 m height of the following V-shaped column. [7]

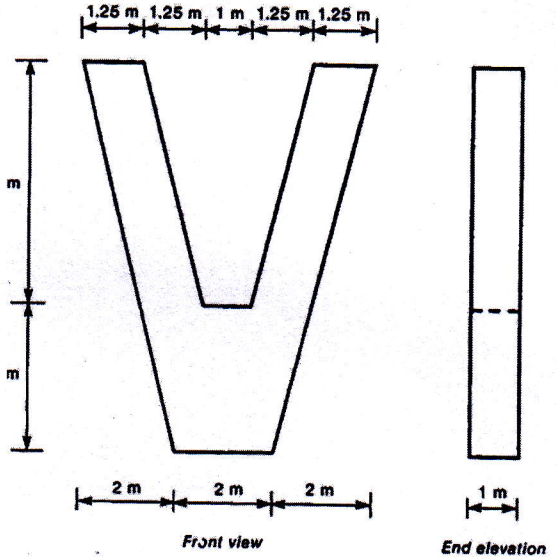
Given:

For column element $C_1 = 1.5$, $C_2 = 0.3$,

Wet density of concrete = 25 kN/m^3,

Concrete temperature at placing = 10° C,

Uniform supply rate of one 6 m^3 truck per hour.



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017 (Set 2)
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering IX (Earthquake Resistant Design and Retrofitting) Credit Hours: 2.0 Course Code: CE 423

Time: 2 hours Full Marks: 70 (= 7 × 10)

PART A

[Answer **any 2 (Two)** of the following 3 questions]

1. Draw appropriate sketches (with proper labels) to show the details of
   (i) Two areas of application of Magnetorheological Damper (MRD)
   (ii) Seismic Detailing of Shear Walls with Coupling Beams
   (iii) Plan view and specifications of Modified (Reduced) steel beam sections
   (iv) Code-specified openings in Brick masonry Walls
   (v) Longitudinal and plan view of Flat slab reinforcement requirements.
2. Draw appropriate sketches (with proper labels) to show details of the following seismic safety measures
   (i) For Partition walls and Fridge
   (ii) Addition of RC Wing Walls
   (iii) Concrete Jacketing of RC Beams
   (iv) Two methods of Soil/Foundation Retrofit
   (v) 'Earthquake-Proof' Beds and 'Triangle of Life'.
3. Draw appropriate sketches (with proper labels) to show the
   (i) Effect of concrete confinement for circular and rectangular columns
   (ii) Seismic detailing of RC beams at Beam-Column joint
   (iii) Seismic detailing at discontinuity for soft-storied RC columns
   (iv) New BNBC Response Spectra for different Damping Ratios
   (v) Average displacement and Shear strain developed between of fault planes.

PART B

[Answer **any 5 (Five)** of the following 7 questions]

[Given: $f_c' = 4.4$ ksi, $f_y = 55$ ksi, $E_c = 4500$ ksi for all questions]

4. The p-wave of an earthquake (of magnitude 7.0) travels through rock of shear modulus 20 GPa, Poisson's ratio = 0.10 to reach an observer in 10 seconds. Estimate the
   (i) Hypocentral distance of the observer and PGA of the earthquake [Davenport (1972)], as well as its intensity [Bolt (1993)]
   (ii) Arrival time of the s-wave as well as warning time for the observer [Given: $\rho_{Soil} = 2400$ kg/m^3].

5. Fig. 1 shows two objects , each weighing 3333 k, supported on 11′-high RC square Column a (size 33″×33″) and circular Column b (33″-diameter) subjected to design earthquake ground motion in Sylhet. Calculate the
   (i) Time period, elastic base shear force using proposed new BNBC (for soil S_B, $\xi = 5\%$) and elastic deformation of both columns
   (ii) Inelastic base shear for Column a, assuming Ductility Ratio $\mu = \varepsilon_{50c}/\varepsilon_0$ (with clear cover = 1.5″ and #3 ties @S_t = 15″), using Kent-Park equations for confined concrete.

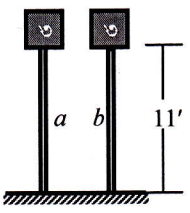


Fig. 1

6. Fig. 2 shows Column b (mentioned in Question 5) supported on 33 massless Base Isolation Springs with Shear Modulus $G = 100$ psi, Bearing Area $A = 100$ in^2, Height $h = 5$″.
   (i) Calculate the lateral stiffness of the Base Isolation system
   (ii) Determine the 1st natural frequency and modal shape of the system.
   (iii) Use BNBC 93 (for $S = 1.2$, $\xi = 5\%$) to calculate base shear (for design earthquake in Sylhet) and elastic peak deformations for 1st mode of vibration of the Base-Isolated system.

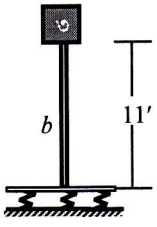


Fig. 2

7. A 11″-thick flat plate area is supported on (33″ × 33″) interior RC column [with steel ratio = 0.033]. If axial force on the column is 3333 k and unbalanced moment is half its ultimate moment, calculate the
   (i) Unbalanced moment to be transferred by shear (M_{uv})
   (ii) Punching shear stress (v_p) around the column, considering the effects of V_u and M_{uv}.
   (iii) Allowable punching shear stress (v_{all}) for storey height of 10′and storey drift 1″.
   (iv) Bent-bar shear reinforcements required around the column.

8. For the floor plan of a 3-storied steel frame (with 10′-high columns) shown in Fig. 3(a), with member sections shown in Fig. 3(b), and beam load w_u = 3.3 k/ft
   (i) Calculate the shear force capacities V_{beam} and V_{col}
   (ii) Compare the moment capacities M_{pb}* and M_{pc}*.

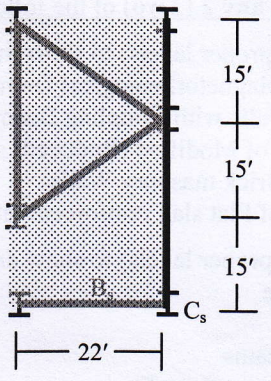


Fig. 3(a)

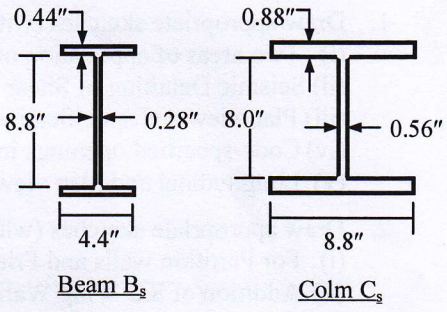


Fig. 3(b)

9. For the floor plan of a 3-storied brick masonry building in Sylhet (with 11′-high stories) shown in Fig. 4
   (i) Calculate the
      - Lateral stiffness and maximum horizontal deflection due to seismic base shear V_b = 120 k
      - Maximum shear stress in the solid walls, considering direct shear and torsional shear

      (assuming structural weight is concentrated at the slab)
      [Given: $E_{Masonry}$ = 2200 ksi, t_{Wall} = 10″].
   (ii) Increase wall thickness and insert cross-walls where necessary to satisfy seismic detailing requirements for out-of-pane conditions.

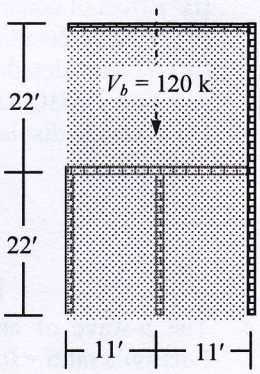


Fig. 4

10. For the floor plan of a 33-storied RC frame (with 10′-high columns) shown in Fig. 5, with beam load w_u = 3.3 k/ft, check adequacy of web reinforcements of a (33″ × 33″) RC column C_R (with steel ratio = 0.033, clear cover = 1.5″ and #3 ties @S_t = 15″) for the following major seismic detailing provisions; i.e.
   (i) To provide adequate area of rectangular hoops
   (ii) To ensure the column yields in flexure before it fails in shear.

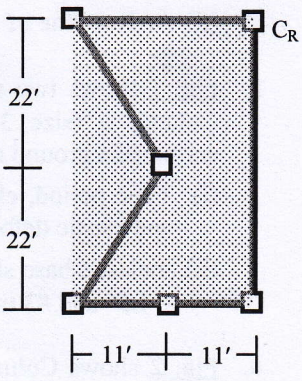


Fig. 5

List of Useful Formulae for CE 423

* $Z = 279 \times 10^{-6}\, e^{(1.8\,M)}/R_e^{1.64}$ [Davenport (1972)]

  $Z = 5.6\, e^{(0.8M)}/(R_h + 40)^2$ [Esteva and Villaverde (1974)]

PGAs during shaking of different Intensities [Bolt (1993)]

MMI	V	VI	VII	VIII	IX	X
Shaking	Moderate	Strong	Very Strong	Severe	Violent	Extreme
PGA (g)	0.03~0.04	0.06~0.07	0.10~0.15	0.25~0.30	0.50~0.55	> 0.60

* Governing equation of motion of SDOF system for ground motion $\Rightarrow m\, d^2u_r/dt^2 + c\, du_r/dt + k\, u_r = -m\, d^2u_g/dt^2$

* For lumped 2-DOF system

$$\begin{bmatrix} m_1 & 0 \\ 0 & m_2 \end{bmatrix} \begin{Bmatrix} d^2u_1/dt^2 \\ d^2u_2/dt^2 \end{Bmatrix} + \begin{bmatrix} c_1 + c_2 & -c_2 \\ -c_2 & c_2 \end{bmatrix} \begin{Bmatrix} du_1/dt \\ du_2/dt \end{Bmatrix} + \begin{bmatrix} k_1+k_2 & -k_2 \\ -k_2 & k_2 \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \end{Bmatrix} = \begin{Bmatrix} f_1(t) \\ f_2(t) \end{Bmatrix}$$

* Eigenvalue problem (to calculate natural frequencies and modal vector)

  $|\mathbf{K} - \omega_{nr}^2\, \mathbf{M}| = 0$ and $[\mathbf{K} - \omega_{nr}^2\, \mathbf{M}]\, \boldsymbol{\phi}_r = \mathbf{0}$

* BNBC 93

  $V_b = ZICW/R$, where $C = 1.25S/T_n^{2/3} \le 2.75$

* $T_n = C_t\, (h_n)^{3/4}$

  $C_t = 0.083$ for steel, 0.073 for RC frame, 0.049 for others

* Proposed new BNBC

  $V_b = (2/3)\, ZICW/R$, where

  $C = S\,[1 + (T_n/T_B)\,(2.5\eta - 1)]$ for $0 \le T_n \le T_B$

  $= S\,(2.5\eta)$ for $T_B \le T_n \le T_C$

  $= S\,[(2.5\eta)\,(T_C/T_n)]$ for $T_C \le T_n \le T_D$

  $= S\,[(2.5\eta)\,(T_C T_D/T^2)]$ for $T_D \le T_n$

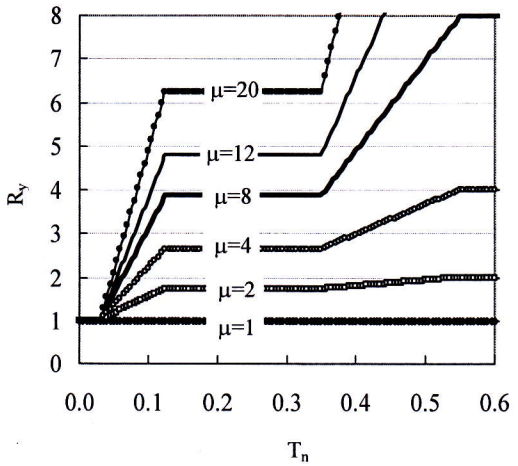
Soil Type	S	T_B	T_C	T_D
S_B	1.20	0.15	0.50	2.00

* $T_n = 0.0466(h_n)^{0.90}$ for RC frames

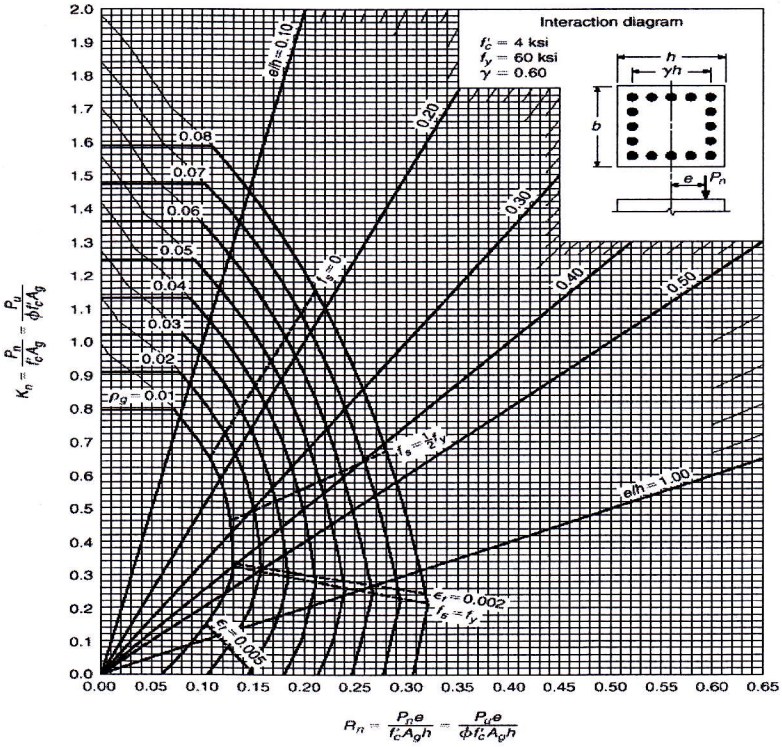
  $= 0.0724(h_n)^{0.80}$ for Steel frames

  $\eta = \sqrt{\{10/(5+\xi)\}} \ge 0.55$

* $R_y = f_0/f_y$ $\mu = u_m/u_y$



Variation of R_y with T_n



* Reinforced Concrete

* $V_{Des} \ge 1.4\,(M_{ul} + M_{u2})/L_n + V_{Ext}$

* For Beam, $a = A_s f_y/0.85 f_c' b$

  $M_{ult} = A_s f_y\,(d - a/2)$

* $V_c = 2\sqrt{f_c'}\, bd$, $S_{max} = A_s f_y d/(V_n - V_c)$

* $\sum M_{c,ult} \ge 1.2 \sum M_{b,ult}$

Seismic Detailing of Web Reinforcement for Axial Members (Major Risk Zone)

Specification	Possible Explanation
Design shear force is the maximum of (a) shear force from analysis, (b) shear force required for flexural yielding of joints	It is desirable that the columns should yield in flexure before failure in shear
For special confinement, area of circular spirals $\geq 0.11\ S_t d\ (f_c'/f_y)(A_g/A_c-1)$, rectangular hoops $\geq 0.3\ S_t d\ (f_c'/f_y)(A_g/A_c-1)$	To ensure load carrying capacity upto concrete spalling, taking into consideration the greater effectiveness of circular spirals compared to rectangular hoops. It also ensures toughness and ductility of columns

* Kent & Park (1971) model

$\varepsilon_0 = 0.002$ $\quad \varepsilon_u = \varepsilon_{50u} + \varepsilon_{50h}$ with $\varepsilon_{50u} = (3 + 2f_c')/(f_c' - 1) \times 10^{-3}$

$\varepsilon_{50h} = 0.75\rho_{st}\sqrt{(b_c/S_t)}$ where ρ_{st} = Volumetric ratio of confining hoops to concrete core = Vol_{st}/Vol_{con}

* Flat slab

$M_{ub} = [1/\{1+ 2/3\sqrt{(c_1 + d)/(c_2 + d)}\}]\ M_u$ and $M_{uv} = M_u - M_{ub}$

$v_l = V_u/A_c - M_{uv}\ c_l/J_c$ and $v_r = V_u/A_c + M_{uv}\ c_r/J_c$

where A_c = Area of the critical section

c_l, c_r = Distances from centroid of critical section to the left and right face of section respectively

J_c = Property of critical section analogous to polar moment of inertia

For an interior column, $A_c = d\ [2(c_1 + d) + 2(c_2 + d)]$

$J_c = 2d(c_1+d)^3/12 + 2(c_1+d)d^3/12 + d(c_2+d)(c_1+d)^2/2$

For an exterior column, $A_c = d\ [2(c_1 + d/2) + (c_2 + d)]$

$J_c = 2d(c_1+d/2)^3/12 + 2(c_1+d/2)d^3/12 + d(c_2+d)(c_1+d/2)^2/4$

Lateral Drift and Punching Shear

DR = 3.5 – 5.0 VR, if VR ≤ 0.6 and DR = 0.5, if VR > 0.6

where VR is the shear ratio, given by the relation, $VR = V_u/(\phi V_c)$

where V_u is the factored axial force of the column and V_c is the nominal capacity in the absence of unbalanced moment, calculated from

$V_c = (2 + 4/\beta_c)\ \sqrt{f'_c}\ b_o\ d \leq 4\sqrt{f'_c}\ b_o\ d$

Bent Bar Reinforcement

Limit value of nominal shear strength V_n, calculated at the critical section d/2 from the support face = $6\sqrt{f_c'}\ b_0 d$.

The shear resistance of concrete, $V_c = 2\sqrt{f_c'}\ b_0 d$, and reinforcement must be provided for excess shear above ϕV_c.

The total bar area $A_v = (V_n - V_c)/(f_y\ \text{Sin}\ \alpha)$

* Brick Masonry

Stiffness of Cantilever and Fixed Wall or Pier (Wall height h, width d, thickness t, E_m = Modulus of elasticity)

$k_c = E_m t/[4(h/d)^3 + 3(h/d)]$ $\quad k_f = E_m t/[(h/d)^3 + 3(h/d)]$

$X_m = \Sigma(W_i\ X_i)/\Sigma W_i$ and $Y_m = \Sigma(W_i\ Y_i)/\Sigma W_i$

$X_r = \Sigma R_{yi}\ x_i$ and $\bar{Y}_r = \Sigma R_{xi}\ y_i$

Torsional eccentricities are given by $e_x = \bar{X}_m - \bar{X}_r$ and $e_y = \bar{Y}_m - \bar{Y}_r$

$P_{xi} = P_x\ (R_{xi}) \pm P_x\ e_y\ (R_{xi}\ \bar{y}_i/J_r)$ $\quad P_{yi} = P_y\ (R_{yi}) \pm P_y\ e_x\ (R_{yi}\ \bar{x}_i/J_r)$

where $\bar{x}$ or $\bar{y}$ are perpendicular distances from center of rigidity to the wall axis and $J_r = \Sigma(R_y\ \bar{x}^2 + R_x\ \bar{y}^2)$ is the polar moment of inertia.

- Height of walls (h) should not be taller than 7.5 m and not more than 2-stories high
Total length (L) of the wall should extend as far as possible in both horizontal directions
Buttresses or cross-walls shall be provided if wall length is more than 3.5 m
- Thickness (t) of wall ≥ h/14 for single-storied buildings, h/9 for top story of multistoried buildings, h/20 for other stories of multistoried buildings

* Column-Beam Moment Ratio

The following relationship must be satisfied for beam-column joint $\Sigma M_{pc}^* > \Sigma M_{pb}^*$

Also $M_{pb}^* = M_{pr} + V_{beam}\ (s_h + d_{col}/2)$, and $M_{pc}^* = M_{pc} + V_{col}\ (d_{beam}/2)$

with $M_{pr} = 1.1\ R_y\ M_p$

* Wave Velocity

$v_p = \sqrt{(M/\rho)}$ and $v_s = \sqrt{(G/\rho)}$,

where M = p-wave Modulus = $E(1-\nu)/[(1+\nu)\ (1-2\nu)]$, and G = Shear Modulus = $E/[2(1+\nu)]$

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course Title: Professional Practices and Communication — Course Code: CE 403
Time: 2 hours — Full marks: 80

There are 5 (five) questions. Answer any 4 (four) of them

1. a. What is your understanding on personal ethics? (4)
   b. How can you manage if conflicts arise among your professional ethics, organizational ethics and personal ethics? Explain with examples. (7)
   c. Describe malpractice model and reasonable care model of responsibility. (9)

2. a. Describe the six dispute resolution methods with examples. How do these six methods differ in terms of legal action? (12+4)
   b. How does barrier in communication differ from the aspects of communicator than receiver? (4)

3. a. What are the four ways to manage risk? Explain them. (6)
   b. How you can establish a risk management program in your organization? (6)
   c. Describe the aspects investigated by a surety company before issuing a bond? (8)

4. a. What do you understand by 'model contract', 'negotiated contract', 'client developed contract', and 'purchase order'. (8)
   b. Differentiate between the two leadership styles followed in meetings. (6)
   c. What are the don'ts in presentation? (6)

5. Write short notes on any 4 (four) of the following: (5x4)
   a. Managing fiduciary risk
   b. Workplace conflict
   c. Effective communication skill
   d. Concreteness in communication
   e. Meeting minutes

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University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2017
Program: B.Sc. Engineering (Civil)

Course title: Environmental Engineering VI — Course code: CE 437
Time: 2 hours — Full marks: 100

There are FIVE (5) questions. Answer all questions (28 + 4*18=100).

1. A) Define the following: (6)
   - Environment management system
   - Built environment
   - Biotic resources
   - Utilitarian justification of environmental value
   - Human induced environmental change
   - Biomass

   B) Explain tropical forest biome, tundra biome and savanna biome. (6)

   C) Assess the relationship between ecosystem, environment and biodiversity. (8)

   D) Explain the differences between environmental organization and environmental institution. (8)

2. A) Summarize four key principles of United Nations Framework Convention on Climate Change (included in Article 3 of the Convention). Explain how these principles could help reducing climate change related impacts in Bangladesh. (5+5)

   B) Summarize the process of ozone layer depletion in the stratosphere. (8)
   OR
   C) Demonstrate how environmental management in national level differs from environmental management in international level. (8)

3. A) List eight laws in Bangladesh that are related to pollution and conservation, agriculture, land use, water resources, and forestry. (6)

   B) Select 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. (2+10)
   OR
   C) According to the Kigali Amendment (2016) to the Montreal Protocol on Substances that deplete the Ozone Layer, outline the phase down schedule of HFCs for developing countries (Group 1 and Group 2). Explain how major industries of Bangladesh could be benefited from Kigali Amendment. (6+6)

4. A) Summarize different requirements of ISO 14001 certification and implementation (plan-do-check-act cycle). (6)

B) Detect three environmental aspects in UAP Civil Engineering Department and quantify their significance along with your recommendations to improve the situation (2+10)

OR

C) Set up six important environmental objectives and targets that are important to achieve the commitments specified in the draft environmental policy of UAP. (12)

5. A) Describe the requirements of obtaining environmental clearance certification for a red category industry in Bangladesh according to Environmental Conservation Rules, 1997. (6)

B) Assess four steps of pollution prevention hierarchy of waste management as stipulated by Environmental Protection Agency (EPA), USA. (12)

OR

C) Illustrate the current pollution prevention hierarchy of waste management that is currently being practiced in Bangladesh. Which step in pollution prevention hierarchy is most important but ignored in Bangladesh? (12)