L-4/T-2/CE

Date : 18/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 433** (Environmental Engineering IV : Environmental Pollution Control.)

Full Marks : ~~210~~ 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) A gas fired power plant emits 5.52 g/sec of NO_2 through a stack with an effective height of 45 m. The atmosphere is "slightly unstable', and the measured wind speed at 10 m height is 1.2 m/sec. Estimate: **(17)**

   (i) Ground level concentration of NO_2 at a location 0.75 km down-wind and 75 m off the centerline of the plume;

   (ii) Concentration of NO_2 and 1.0 km down-wind, 0.1 km off the centerline, and 60 m above ground level. [Given: p = 0.20; Table for calculation of dispersion coefficient provided].

   (b) Explain the "indirect radiative forcing" of (i) Methane, and (ii) Halocarbon. **(5)**

   (c) How does a 3-way catalytic converter reduce emission of pollutants from vehicles? How does air-fuel ratio affect the performance of a catalytic converter? Are catalytic converters suitable for reduction of emission from diesel engine vehicles? Explain. **(7⅓)**

2. (a) A gravitational settling chamber has been designed with a length of 7.0 m and height of 1.4 m. The chamber needs to be operated such that all particles ≥ 40 μm diameter are removed with 100% theoretical efficiency. Estimate the flow velocity that should be maintained in the chamber. Also, estimate the removal efficiency of 5 μm size particles in the chamber. $\mu = 2.0 \times 10^{-5}$ kg/m-sec particle Sp. Gr. = 2.0 **(8)**

   (b) For a gas fired power plant, the flow rate of exhaust gas through the stack is 563 kg/sec. If the estimated emission of NO_X through the stack is 4.623 g/sec, determine the concentration of NO_X in the exhaust gas in ppm (by volume). [assume all NO_X emitted as NO_2; MW of exhaust gas = 28 g/mol; R = 0.082 × 10^{-3} m^3.atm.mol^{-1} k^{-1}] **(4)**

   (c) Briefly describe the natural atmospheric cleansing processes. We know that air quality of Dhaka city deteriorates significantly during the dry season. What are the major reasons for this deterioration? **(5⅓)**

   (d) Define "adiabatic lapse rate". What do you understand by "stable", "unstable" and "neutral" atmosphere? Explain. Determine the nature of atmospheric stability for each of the following situation of "ambient atmosphere", and explain your answer:

   (i) $\frac{dT}{dz} = -\Gamma$; (ii) $\frac{dT}{dz} = -1.5\ \Gamma$; $\frac{dT}{dz} = 0$; (iv) $\frac{dT}{dz} = 1.2\,\Gamma$; **(6)**

Contd P/2

CE 433

3. (a) Provide 3 examples of emissions that could be considered as "line source". A highway has 5 vehicles per second passing a given spot. Each vehicle on an average emits 0.75 g/km of particulate matter (PM). If wind speed is 2.1 m/sec perpendicular to the road, estimate PM concentration 0.5 km downwind at a height of 10 m. Consider atmposphere to be "Stable". [Table for calculation of dispersion coefficient provided]. **(9)**

(b) How do hydrocarbons affect the $NO\text{-}NO_2\text{-}O_3$ photochemical reaction sequence and help produce O_3 and other secondary pollutants? Explain. Can carbon monoxide (CO) contribute to the formation of photochemical smog? Explain. **(10)**

(c) What are the major anthropogenic sources of SO_X in the atmosphere? Why is SO_x particularly harmful in dusty atmosphere? Explain. **(4⅓)**

4. (a) On a particular day, ambient atmospheric temperature profile is given by the following equations: **(7)**

$$\Lambda = 20 + 0.10\,z \quad ; \; z \leq 200 \text{ m}$$
$$= 44 - 0.02\,z \quad ; \; z \geq 200 \text{ m}$$

where, z = altitude in m.

(i) If a plume is emitted at 40°C from the top of a 50 m stack, how high it is expected is expected to rise under the existing conditions?

(ii) Draw (qualitatively) the shape of the plume emitted from the stack, along with the temperature profiles.

(b) What is a CAMS? Currently how many CAMS are operating in Dhaka? Which air quality parameters are measured at the CAMS.

On a particular day, air quality data recorded at a CAMS in Dhaka are as follows: $PM_{2.5}$ (24-h.) = 210 $\mu g/m^3$; PM_{10} (24-h.) = 340 $\mu g/m^3$; O_3 (8-hi) = 294 $\mu g/m^3$ SO_2 (24-h.) = 523 $\mu g/m^3$. Determine AQI for each parameter and report AQI for that particular day (assume. T = 25°C; p = 1 atm; Table for calculating AQI provided]. **(8)**

(c) Plot (qualitatively) the trend and seasonal cycle of CO_2 concentration in the atmosphere. How do atmospheric aerosols affect global warming? Explain. **(8⅓)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Describe the concept of natural succession in lakes. Briefly describe classifications of lake according to the degree of enrichment with nutrients and organic matter. **(6+3=9)**

(b) In a typical lake section, show different layers during summer stratification along with the temperature and DO profile. Explain the process of 'overturn' in stratified deep lakes. Show how 'overturn' affects the temperature and dissolved oxygen profile in a deep stratified lake. **(3+3+2=8)**

Contd P/3

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Contd ... Q. No. 5

(c) Explain the simple phosphorous model for lakes. A lake (surface area = 200×10^6 m^2) is fed by a stream with an average flow of 30 m^3/s and having an average phosphorous concentration of 0.005 mg/L. A wastewater treatment plant adds 10 mg/L of phosphorous with a flow of 0.4 m^3/sec. The settling rate of phosphorous is estimated to be 10 m/year. (i) Estimate average phosphorous concentration in the lake, (ii) Estimate phosphorous removal rate at treatment plant to keep phosphorous concentration below 0.01 mg/L. **(2+2⅓+2=6⅓)**

6. (a) List important sources and sinks of DO in rivers and streams. What are the key model assumptions used in derivation of the classic Streeter-Phelps dissolved oxygen sag curve equation? List the limitations of the dissolved oxygen sag curve equation. **(4+4⅓+2=10)**

(b) Derive expressions for rate of de-oxygenation and rate of re-aeration in the classic Streeter-Phelps dissolved oxygen sag curve equation for a river receiving organic waste. **(4+4+2=8)**

(c) Explain the effect of temperature and NBOD on the shape of the DO sag curve. **(2.5+2.5=5)**

7. (a) List the categories of water pollutants. Discuss the sources and effects of: (i) persistent organic pollutants (POPs), and (ii) Heavy metals. **(2+2+2=6)**

(b) Define BOD. What is the difference between CBOD and NBOD? Describe a typical problem in determining BOD_5 of wastewater samples in laboratory. What is usually done to overcome this problem? **(2+2+1+1=6)**

(c) For a BOD test (at 25°C) initial DO = 7.5 mg/L. After 5 days, DO = 2.3 mg/L. Given, dilution factor = 45, BOD rate constant, k = 0.20/day at 20°C (base e) and $\theta = 1.047$. **(3+3=6)**

(i) Calculate BOD5 at 20°C

(ii) Calculate BOD remaining after 5 days at 20°C

(d) A BOD test is run using 100 ml of treated wastewater mixed with 200 ml of pure water. The initial DO of the mix is 9.0 mg/L. After 5 days, the DO is 4.0 mg/L. After a long period of time, the DO is 2.0 mg/L and it no longer drops. Ignoring nitrification, what would be the remaining BOD after seven days have elapsed? **(5⅓)**

8. A public community discharges 2.5 m^3/sec of untreated domestic wastewater, through a storm-water outfall into a river. The untreated wastewater has an ultimate BOD of 200 mg/L with no dissolved oxygen in it. Upstream of the storm-water outfall, the river has a flow rate of 12 m^3/sec, a velocity of 0.35 m/sec, ultimate BOD of 5.0 mg/L, and a DO content of 7.8 mg/L. The saturation value of DO (at river temperature) is 9.0 mg/L.

Contd P/4

Contd ... Q. No. 7(a)

The deoxygenation co-efficient (k_d) is 0.50 day^{-1}, and the re-aeration co-efficient (k_r) is 0.70 day^{-1}. Assume complete mixing immediately downstream of the outfall and that the river has same cross section and flow rate both upstream and downstream of the outfall. Further assume the wastewater and the river has the same temperature.

(i) What are the initial oxygen deficit (D_0) and the ultimate BOD just downstream of the outfall (before any reaction takes place)? **(3)**

(ii) Calculate DO at distance, in kilometers, 5, 10, 15, 20, 25, 75, 100, 130, 160, and 210 downstream the outfall. Draw the DO profile using a plain graph paper. **(14⅓)**

(iii) From the DO profile, estimate the distance downstream of the outfall when the river becomes completely devoid of oxygen (i.e. DO = 0) **(2)**

(iv) Estimate the length of the river stretch, in kilometers, that remains under septic condition (i. e., DO = 0) **(2)**

(v) Estimate the distance downstream of the outfall where the river can restore back to DO level of 5.0 mg/L when different fish species and other aquatic life forms could survive. **(2)**

Table for Question Nos. 1(a), 3(a)

Table Values of the constants a, c, d, and f for use in ~~(7.44) and (7.45)~~ expressions for σ_y and σ_z

Stability	a	$x \le 1$ km			$x \ge 1$ 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	0.911	0	61.0	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

Note: The computed values of σ will be in meters when x is given in kilometers.
Source: Martin (1976).

$\sigma_y = a \cdot x^{0.894}$; $\sigma_z = cx^d + f$

Table for Question No. 4(b)

Table 1: AQI for different pollutants (for ques. no: ~~1 (a)~~)

Breakpoints							AQI
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	NO_2 (ppm) Annual	
0.000-0.064	--	0.0-15.4	0-54	0.0-4.4	0.000-0.034	(ii)	0-50
0.065-0.084	--	15.5-40.4	55-154	4.5-9.4	0.035-0.144	(ii)	51-100
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
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
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
(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
(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

(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 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 301 or higher are calculated with 1-hr O_3 concentrations

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L-4/T-2/CE

Date : 26/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 455** (Transportation Engineering V: Transport Projects and Operation)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Define Transportation Planning. Show, in a diagram, the basic elements of a transportation planning process. **(5)**

(b) Explain the basic requirements for transportation plans. **(5⅓)**

(c) Which committees are formed to carry out different activities in an urban transportation planning study? **(3)**

(d) A small study area represented by six traffic zones has following characteristics:

Zone	1	2	3	4	5	6
Trip Production	600	450	900	850	750	290
Car Ownership	250	200	710	615	280	130

(i) Which modeling technique would you use to develop relationship between "trip production" and "car ownership"? **(2)**

(ii) Develop the relationship and determine number of trips produced for a car ownership of 500. **(8)**

2. (a) Discuss the factors affecting travel demand. How can the mode choice models be classified in to different categories? **(9⅓)**

(b) Write down the typical form of the gravity model of trip distribution, and name the terms in it. **(4)**

(c) Given the utility equation

$$U_k = a_k - 0.003X_1 - 0.04X_2$$

where X_1 is the travel cost in cents and X_2 is the travel time in minutes.

(i) Calculate the market shares of the following travel modes: (6)

Mode k	a_k	X_1	X_2
Automobile	–0.20	120	30
Express bus	–0.40	60	45
Regular bus	–0.60	30	55

(ii) Estimate the effect that a 50% increase in automobile cost and a 20% decrease in regular bus cost will have on modal split. **(4)**

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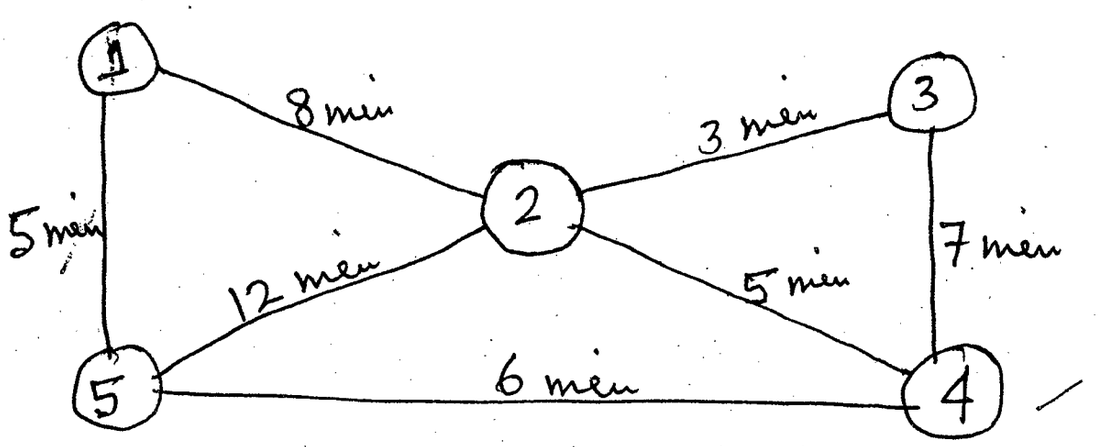
3. (a) What is the main difference between "all-or-nothing" and "capacity restrained" traffic assignment techniques? Which assignment technique would be more realistic for Dhaka City conditions and why? **(6⅓)**

(b) Explain with diagram, the difference between "origin-destination" and "production-attraction". **(3)**

(c) Assign vehicle trips onto the street network (shown below), using "all-or-nothing" assignment technique. Determine the traffic volume on each link (both way total): **(14)**

Trips among Zones

From/To	1	2	3	4	5
1	0	100	100	200	150
2	400	0	200	100	500
3	200	100	0	100	150
4	250	150	300	0	400
5	200	100	50	350	0



4. (a) What is the major product of a transportation planning study? Name the methods that are usually used to determine the economic worth of a transportation project. **(7⅓)**

(b) Define the terms: (i) First cost, (ii) Continuing cost, (iii) Sunk cost, and (iv) Salvage value. **(6)**

(c) A small city has four transportation alternatives for a bus terminal: The serviceable life of the terminal is 40 years. The costs of different alternatives are as follows: **(10)**

Alternative	Initial cost (millions of $)	Annual maintenance (thousands of $)
A	2.0	9.2
B	2.8	8.3
C	2.9	7.8
D	3.4	6.3

If the total cost is the criterion, which alternative would you suggest? Assume an interest rate of 10%.

Contd P/3

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SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

Assume missing value (if any)

5. (a) A public Bus system needs to be set up between an Origin A to a destination B. The operating time is 30 minutes and operating speed 18 mph. For this operation system 45 seaters buses are available, which can safely accommodate 20 standees. Design the bus system if the minimum terminal time is 7.5 mins. Minimum headway should be 10 minutes. Find the peak hour passenger demand and distance of 0-D. **(10⅓)**

(b) Briefly discuss the transit system characteristics. List the steps of maximum utility method. **(9)**

(c) "A transit mode is defined by three characteristics" — what are these characteristics? List them. **(4)**

6. (a) What are the components of ITS? What are ITS doing differently? **(6)**

(b) List the major areas where ITS is being used. List the advantages of Electronic Toll Collection (ETC) system. **(7⅓)**

(c) Discuss effects of private Cars on Public Transport. What are the ways of improving local bus services? **(10)**

7. (a) Discuss the responsibilities in Traffic engineering profession. List different organization for traffic Engineering in Bangladesh with their functions and responsibilities. **(11⅓)**

(b) What are the stages of highway development process? Explain the factors to be considered during planning stages. **(8)**

(c) What are the scopes of Traffic Engineering? **(4)**

8. (a) Discuss the Modal classification of transportation. Explain the relationship between Road density and development. **(7⅓)**

(b) Explain current and future application of Integrated traffic controls. List advantages and limitations of Maximum Utility System. **(7)**

(c) List the classification of various road patterns. Discuss characteristics of freight and vehicle in context of Urban Goods Movement. List the views of different parties involved in Urban Goods Movements. **(9)**

L-4/T-2/CE **Date : 18/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 433** (Environmental Engineering IV : Environmental Pollution Control.)

Full Marks : ~~210~~ 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

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   (i) Ground level concentration of NO_2 at a location 0.75 km down-wind and 75 m off the centerline of the plume;

   (ii) Concentration of NO_2 at 1.0 km down-wind, 0.1 km off the centerline, and 60 m above ground level. [Given: p = 0.20; Table for calculation of dispersion coefficient provided].

   (b) Explain the "indirect radiative forcing" of (i) Methane, and (ii) Halocarbon. **(5)**

   (c) How does a 3-way catalytic converter reduce emission of pollutants from vehicles? How does air-fuel ratio affect the performance of a catalytic converter? Are catalytic converters suitable for reduction of emission from diesel engine vehicles? Explain. **(7⅓)**

2. (a) A gravitational settling chamber has been designed with a length of 7.0 m and height of 1.4 m. The chamber needs to be operated such that all particles ≥ 40 μm diameter are removed with 100% theoretical efficiency. Estimate the flow velocity that should be maintained in the chamber. Also, estimate the removal efficiency of 5 μm size particles in the chamber. **(8)**

   (b) For a gas fired power plant, the flow rate of exhaust gas through the stack is 563 kg/sec. If the estimated emission of NO_X through the stack is 4.623 g/sec, determine the concentration of NO_X in the exhaust gas in ppm (by volume). [assume all NO_X emitted as NO_2; MW of exhaust gas = 28 g/mol; $\dot{R} = 0.082 \times 10^{-3}$ $m^3.atm.mol^{-1}$ k^{-1}] **(4)**

   (c) Briefly describe the natural atmospheric cleansing processes. We know that air quality of Dhaka city deteriorates significantly during the dry season. What are the major reasons for this deterioration? **(5⅓)**

   (d) Define "adiabatic lapse rate". What do you understand by "stable", "unstable" and "neutral" atmosphere? Explain. Determine the nature of atmospheric stability for each of the following situation of "ambient atmosphere", and explain your answer:

   (i) $\frac{dT}{dz} = -\Gamma$; (ii) $\frac{dT}{dz} = -1.5\ \Gamma$; $\frac{dT}{dz} = 0$; (iv) $\frac{dT}{dz} = 1.2\,\Gamma$; **(6)**

Contd P/2

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(a) Provide 3 examples of emissions that could be considered as "line source". A highway has 5 vehicles per second passing a given spot. Each vehicle on an average emits 0.75 g/km of particulate matter (PM). If wind speed is 2.1 m/sec perpendicular to the road, estimate PM concentration 0.5 km downwind at a height of 10 m. Consider atmposphere to be "Stable". [Table for calculation of dispersion coefficient provided]. **(9)**

(b) How do hydrocarbons affect the $NO\text{-}NO_2\text{-}O_3$ photochemical reaction sequence and help produce O_3 and other secondary pollutants? Explain. Can carbon monoxide (CO) contribute to the formation of photochemical smog? Explain. **(10)**

(c) What are the major anthropogenic sources of SO_X in the atmosphere? Why is SO_x particularly harmful in dusty atmosphere? Explain. **(4⅓)**

(a) On a particular day, ambient atmospheric temperature profile is given by the following equations: **(7)**

$$\Lambda = 20 + 0.10\,z \quad ; z \leq 200 \text{ m}$$
$$= 44 - 0.02\,z \quad ; z > 200 \text{ m}$$

where, z = altitude in m.

(i) If a plume is emitted at 40°C from the top of a 50 m stack, how high it is expected is expected to rise under the existing conditions?

(ii) Draw (qualitatively) the shape of the plume emitted from the stack, along with the temperature profiles.

(b) What is a CAMS? Currently how many CAMS are operating in Dhaka? Which air quality parameters are measured at the CAMS.

On a particular day, air quality data recorded at a CAMS in Dhaka are as follows: $PM_{2.5}$ (24-h.) = 210 $\mu g/m^3$; PM_{10} (24-h.) = 340 $\mu g/m^3$; O_3 (8-hi) = 294 $\mu g/m^3$ SO_2 (24-h.) = 523 $\mu g/m^3$. Determine AQI for each parameter and report AQI for that particular day (assume. T = 25°C; p = 1 atm; Table for calculating AQI provided]. **(8)**

(c) Plot (qualitatively) the trend and seasonal cycle of CO_2 concentration in the atmosphere. How do atmospheric aerosols affect global warming? Explain. **(8⅓)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

(a) Describe the concept of natural succession in lakes. Briefly describe classifications of lake according to the degree of enrichment with nutrients and organic matter. **(6+3=9)**

(b) In a typical lake section, show different layers during summer stratification along with the temperature and DO profile. Explain the process of 'overturn' in stratified deep lakes. Show how 'overturn' affects the temperature and dissolved oxygen profile in a deep stratified lake. **(3+3+2=8)**

Contd P/3

CE 433

Contd ... Q. No. 5

(c) Explain the simple phosphorous model for lakes. A lake (surface area = 200×10^6 m^2) is fed by a stream with an average flow of 30 m^3/s and having an average phosphorous concentration of 0.005 mg/L. A wastewater treatment plant adds 10 mg/L of phosphorous with a flow of 0.4 m^3/sec. The settling rate of phosphorous is estimated to be 10 m/year. (i) Estimate average phosphorous concentration in the lake, (ii) Estimate phosphorous removal rate at treatment plant to keep phosphorous concentration below 0.01 mg/L. **(2+2⅓+2=6)**

6. (a) List important sources and sinks of DO in rivers and streams. What are the key model assumptions used in derivation of the classic Streeter-Phelps dissolved oxygen sag curve equation? List the limitations of the dissolved oxygen sag curve equation. **(4+4⅓+⅔=10)**

(b) Derive expressions for rate of de-oxygenation and rate of re-aeration in the classic Streeter-Phelps dissolved oxygen sag curve equation for a river receiving organic waste. **(4+4+2=8)**

(c) Explain the effect of temperature and NBOD on the shape of the DO sag curve. **(2.5+2.5=5)**

7. (a) List the categories of water pollutants. Discuss the sources and effects of: (i) persistent organic pollutants (POPs), and (ii) Heavy metals. **(2+2+2=6)**

(b) Define BOD. What is the difference between CBOD and NBOD? Describe a typical problem in determining BOD_5 of wastewater samples in laboratory. What is usually done to overcome this problem? **(2+2+1+1=6)**

(c) For a BOD test (at 25°C) initial DO = 7.5 mg/L. After 5 days, DO = 2.3 mg/L. Given, dilution factor = 45, BOD rate constant, k = 0.20/day at 20°C (base e) and $\theta = 1.047$. **(3+3=6)**

(i) Calculate BOD5 at 20°C

(ii) Calculate BOD remaining after 5 days at 20°C

(d) A BOD test is run using 100 ml of treated wastewater mixed with 200 ml of pure water. The initial DO of the mix is 9.0 mg/L. After 5 days, the DO is 4.0 mg/L. After a long period of time, the DO is 2.0 mg/L and it no longer drops. Ignoring nitrification, what would be the remaining BOD after seven days have elapsed? **(5⅓)**

8. A public community discharges 2.5 m^3/sec of untreated domestic wastewater, through a storm-water outfall into a river. The untreated wastewater has an ultimate BOD of 200 mg/L with no dissolved oxygen in it. Upstream of the storm-water outfall, the river has a flow rate of 12 m^3/sec, a velocity of 0.35 m/sec, ultimate BOD of 5.0 mg/L, and a DO content of 7.8 mg/L. The saturation value of DO (at river temperature) is 9.0 mg/L.

Contd P/4

Contd ... Q. No. 7(a)

The deoxygenation co-efficient (k_d) is 0.50 day^{-1}, and the re-aeration co-efficient (k_r) is 0.70 day^{-1}. Assume complete mixing immediately downstream of the outfall and that the river has same cross section and flow rate both upstream and downstream of the outfall. Further assume the wastewater and the river has the same temperature.

(i) What are the initial oxygen deficit (D_0) and the ultimate BOD just downstream of the outfall (before any reaction takes place)? **(3)**

(ii) Calculate DO at distance, in kilometers, 5, 10, 15, 20, 25, 75, 100, 130, 160, and 210 downstream the outfall. Draw the DO profile using a plain graph paper. **(14 ⅓)**

(iii) From the DO profile, estimate the distance downstream of the outfall when the river becomes completely devoid of oxygen (i.e. DO = 0) **(2)**

(iv) Estimate the length of the river stretch, in kilometers, that remains under septic condition (i. e., DO = 0) **(2)**

(v) Estimate the distance downstream of the outfall where the river can restore back to DO level of 5.0 mg/L when different fish species and other aquatic life forms could survive. **(2)**

Table for Question Nos. 1(a), 3(a)

Table: Values of the constants a, c, d, and f for use in ~~(7.44) and (7.45)~~ expressions for σ_y and σ_z

		$x \le 1$ km			$x \ge 1$ km		
Stability	a	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	0.911	0	61.0	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

Note: The computed values of σ will be in meters when x is given in kilometers.
Source: Martin (1976).

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

Table for Question No. 4(b)

Table 1: AQI for different pollutants (for ques. no: ~~4 (b)~~)

Breakpoints							AQI
O_3 (ppm) 8-hr	O_3(ppm) 1-hr (i)	$PM_{2.5}$ (µg/m^3) 24-hr	PM_{10} (µg/m^3) 24-hr	CO (ppm) 8-hr	SO_2 (ppm) 24-hr	NO_2 (ppm) Annual	
0.000-0.064	--	0.0-15.4	0-54	0.0-4.4	0.000-0.034	(ii)	0-50
0.065-0.084	--	15.5-40.4	55-154	4.5-9.4	0.035-0.144	(ii)	51-100
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
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
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
(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
(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

(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 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 301 or higher are calculated with 1-hr O_3 concentrations

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L-4/T-2/CE

Date : 15/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 441** (Geotechnical Engineering-III)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable value of missing data, only if necessary symbols have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Derive an expression of amplitude for the steady-state free vibration without viscous damping for SDOF. **(5⅓)**

   (b) Using the derived expression of 1(a), draw a plot of displacements, velocities and accelerations for the SDOF system. **(8)**

   (c) The weight of a machine foundation is 50 kN and its spring constant = 10^4 kN/m, determine **(10)**

   (i) Natural frequency of vibration and

   (ii) Period of oscillation.

2. (a) Prove that logarithmic decrement δ can be defined as follows: **(5⅓)**

$$\delta = \frac{2\pi D}{\sqrt{I - D^2}}$$

   where D = damping ratio.

   (b) Prove that resonance occurs at w = $\omega n\sqrt{I - 2D^2}$ for a forced vibration with viscous damping. **(8)**

   (c) Explain the phenomena of resonance with a neat plot of normalized amplitude versus normalized frequency. **(10)**

3. (a) How do you estimate the dynamic property of soil with static laboratory tests. **(5⅓)**

   (b) Write down the steps of determining shear modulus 'G' from cyclic plate load tests. **(8)**

   (c) A square foundation with dimensions B×B has to be constructed on dense sand. Its depth D_f = 1 m. The unit weight is 18 kN/m^3 and static angle of friction is 39°. The foundation may have a maximum dynamic load of 1800 kN. Determine the size of the foundation using a safety factor of 3. **(10)**

4. (a) What is soil liquefaction. How does it relate to earthquake? **(5⅓)**

   (b) Describe the methods of dewatering in the construction sites. **(8)**

   (c) What is a slurry wall? Detail the method of slurry wall construction step by step. **(10)**

Contd P/2

CE 441

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Discuss the different modes of failure of a retaining wall from geotechnical point of view. **(6)**

   (b) Discuss the considerations behind selecting different types of retaining walls. **(5⅓)**

   (c) Check the stability of the retaining wall shown in Fig. 1. against sliding. **(12)**

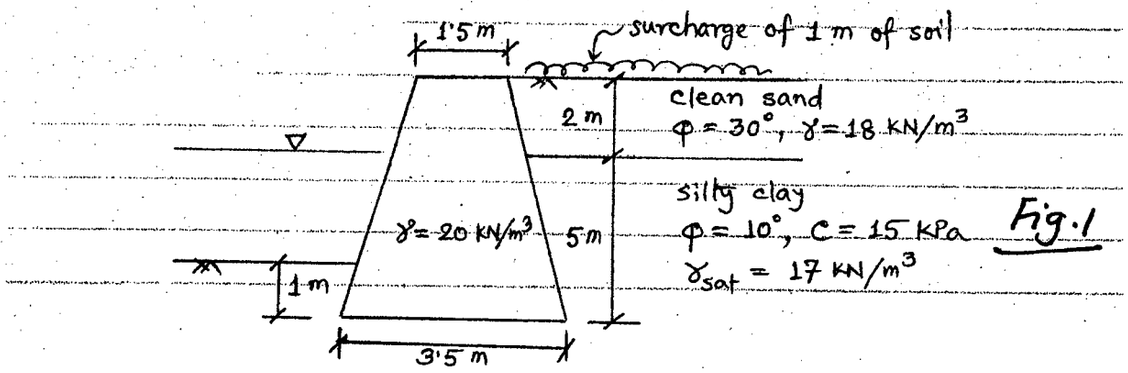

Fig.1

6. (a) Discuss the use of caisson foundations. Also discuss the factors that govern the size and shape of caissons. **(8⅓)**

   (b) Design the length of the cantilever sheetpile shown in Fig. 2. Use simplified method. **(15)**

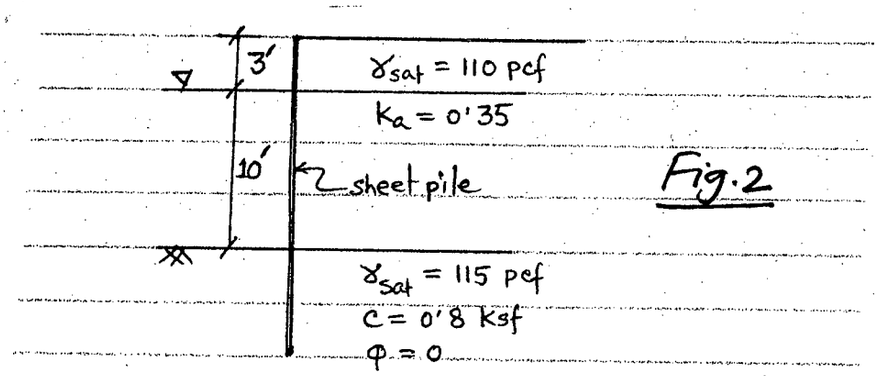

Fig.2

7. (a) "Lateral earth pressure on rigid ad flexible retaining structures are different". Explain. **(5⅓)**

   (b) Determine the required depth of embedement of the anchored sheet pile shown in Fig. 3 by free end method. **(18)**

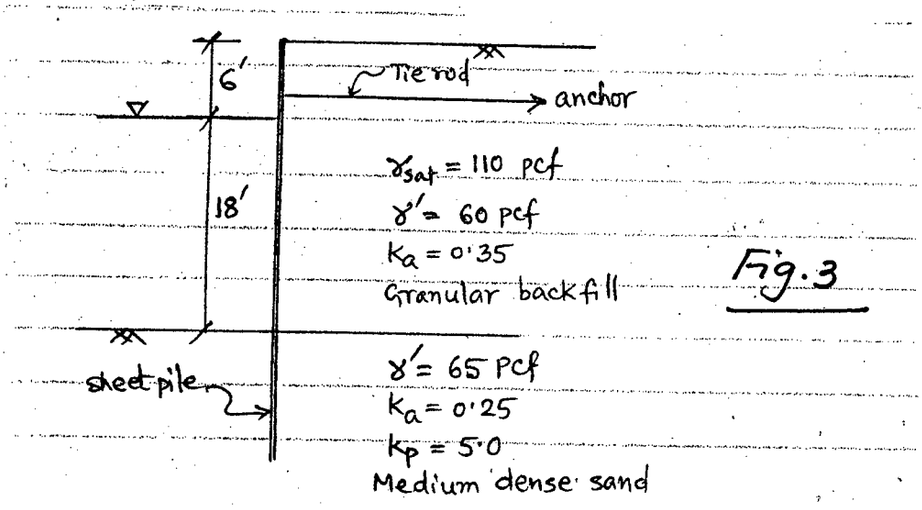

Fig.3

Contd P/3

CE 441

8. (a) A bracing system for an open cut is shown in Fig. 4. Determine the force in the struts A, B and C. The struts are spaced 10 ft center to center horizontally. **(15)**

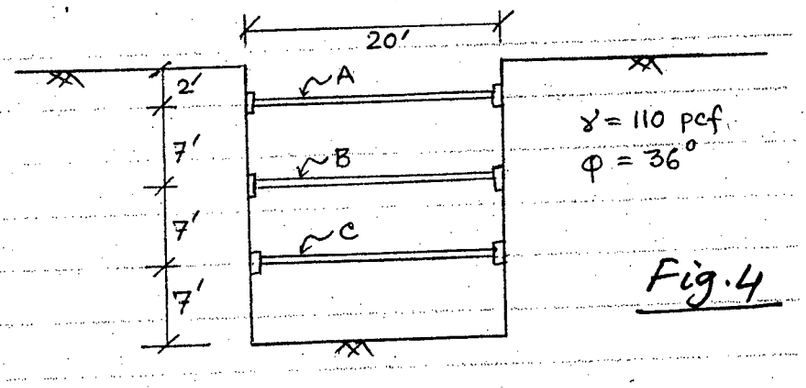

Fig. 4

(b) Referring to the excavation shown in Fig. 5 show that failure by bottom heaving will not occur if, **(8⅓)**

$$(\gamma H + q)B_1 - 2S - \frac{\pi}{2}B_1 q_u \le q_u B_1$$

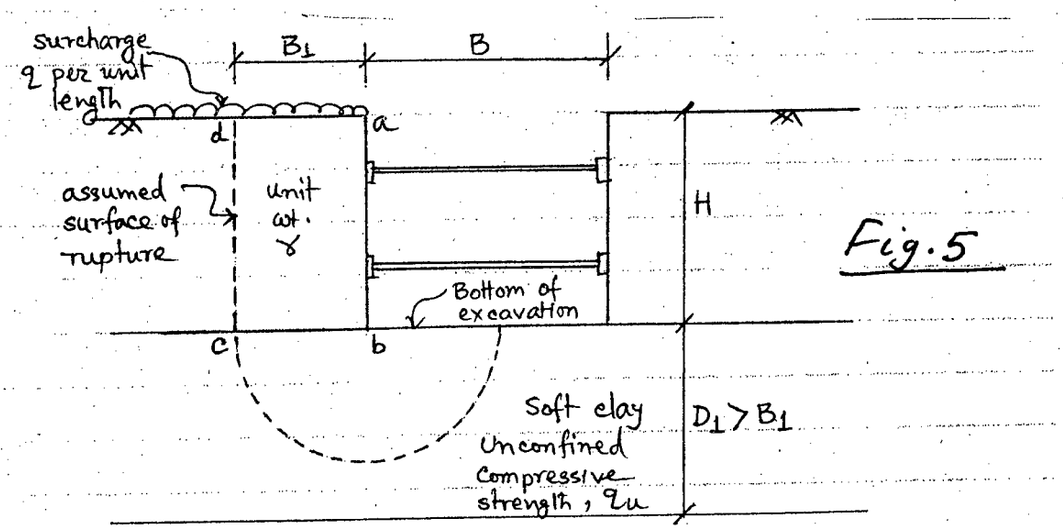

Fig. 5

S = shear resistance along surface of rupture cd.

L-4/T-2/CE Date : 01/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 415** (Prestressed Concrete)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Assume appropriate value(s) for any missing data.

1. (a) Draw and explain the load deflection curve of a prestressed concrete beam under different stages of loading. **(8)**

(b) A prestressed concrete beam (shown in Fig. 1) is posttensioned with 780 mm^2 of high tensile steel to an initial prestress of 1100 MPa immediately after transfer. Given: f'_{ci} = 30 MPa; f'_c = 40 MPa; f_r = 4.0 MPa. **(15⅓)**

(i) Compute the value of 'P' that will produce the first crack at the support section. Assume 20% loss of prestress and n = 7.

(ii) Compute the initial deflection at the free end of the beam due to prestress and load P = 100 kN. Estimate the deflection after three months, assuming a creep coefficient = 1.80 and an effective prestress of 880 MPa at that time.

2. (a) Explain the importance of transfer bond in a pretensioned prestressed concrete member. Also, write down the factors which control such transfer bond and hence the transfer length. **(6)**

(b) Why the transverse tension in the anchorage zone is so important in the design of a posttensined prestressed concrete beam? Explain briefly. **(6)**

(c) Determine the bearing plate area required for a tendon consisting of 19-12.7 mm dia. 7-wire strands anchored at the end of a beam as shown in Fig. 2. The tendon forces for design are 1800 kN due to maximum jocking force and 1400 kN at service load. Use f'_{ci} = 30 MPa and f'_c = 40 MPa. Follow the specification of the Post-Tensioning Institute (PTI) for allowable bearing stresses on the concrete. **(11⅓)**

3. (a) Explain the importance of using nonprestressed reinforcements in conjunction with prestressed steel in a partially prestressed concrete beam. **(8)**

(b) Determine the ultimate moment capacity of the section shown in Fig. 3. Use f'_c = 40 MPa; $E_p = 2 \times 10^5$ MPa; $E_c = 3 \times 10^4$ MPa; f_{pu} = 1860 MPa; f_y = 415 MPa; E_{cu} = 0.003 and effective prestress f_{se} = 1000 MPa. Follow any method for your calculation. **(15⅓)**

Contd P/2

CE 415

4. (a) Design a composite prestressed concrete structural system for a simply supported 20 m span. The beam will be Type III standard AASHTO-PCI section (Fig. 4) with a 160 mm thick deck slab. Design loads for the structure are: Dead load of the composite system (normal weight concrete), W_G, additional dead load, W_D = 900 pa; live load, W_L = 2500 pa. Consider f'_{ci} = 30 MPa, f'_c = 40 MPa for precast element and for the slab f'_c = 30 MPa. Design for unshored beams in construction following the ACI Code for the section at midspan. Assume that loss of prestress is 20% for this section and the initial force for 12.7 mm dia. 7-wire strand is 130 kN. **(23⅓)**

   (i) Determine the pretensioned strand-arrangement to fully utilize the precast beams.

   (ii) Find the maximum spacing of the beams for this structural system based on allowable stresses at service load.

   (iii) Check the strength following ACI Code.

   Section properties for precast beam (Type III) are given below:

   $A = 361 \times 10^3$ mm^2, $I = 522 \times 10^8$ mm^4, W_G = 8.51 kN/m,

   ρ_b = 515 mm, ρ_t = 628 mm, f_{pw} = 1860 MPa.

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

Assume reasonable value for any missing data.

5. (a) Briefly describe the losses of prestress in pretentioned and posttentioned members from each individual source. Hence explain which type of member will undergo greater loss of prestress. **(8⅓)**

   (b) A pretensined concrete beam, 12 metre long is eccentrically prestressed with 1400 mm^2 of steel wires which are anchored to the bulk heads (Fig. 5) with a stress of 1020 MPa. Compute the loss of prestress due to elastic shortening of concrete at the transfer of prestress. Use γ_{con} = 25 kN/m^3 and n = 6. **(15)**

6. The midspan section of a composite beam is shown in Fig. 6. The precast segment is an I-section 1000 mm in depth and 500 mm wide flanges. It is posttensined with an initial force of 3100 kN which reduces to 2550 kN after losses. Moment due to self weight of that precast section is 540 kN-m at midspan. After errection, the top slab of 160 mm by 1400 mm is to be cast in place producing a midspan moment of 375 kN-m. After hardening of the floor slab, the composite section is to carry a maximum live load moment of 1200 kN-m. Compute the stresses in the section at various stages of loading. f'_c = 45 MPa. **(23⅓)**

Contd P/3

CE 415

7. (a) Explain the importance of Kern points (K_t and K_b) in the design of prestressed concrete beams. **(3)**

(b) Show the qualitative stress distributions in a PC section for different location of compressive force in relation to the Kern points. **(5⅓)**

(c) Calculate the value of K_t and K_b for the beam sections of Fig. 7. All dimensions are in mm. **(15)**

8. (a) Make a preliminary design for section of prestressed concrete beam to resist a total moment of 560 kN-m of which M_G = 320 kN-m. Assume effective prestress for steel to be 840 MPa and allowable concrete stress of –12 MPa. Try with an overall depth of about 45 $\sqrt{M_T}$ in mm where M_T in kN-m. **(8⅓)**

(b) Make final design for the preliminary section obtained from the above problem allowing no tension in concrete. **(15)**

Given: f_b = –13 MPa, f_0 = 1025 MPa, f_t = –12 MPa, f_{se} = 840 MPa.

L-4/T-2/CE Date : 01/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : CE 419 (Introduction to Finite Element Method)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

The symbols carry their usual meaning. Assume reasonable values for missing data, if any.

1. (a) What are the basic components of a general purpose finite element software? **(5 1/3)**

   (b) Summarize the basic procedural steps that are followed in FEM for analyzing a structure. **(6)**

   (c) For the spring system with arbitrarily defined nodes and elements as shown in Figure 1, find the global stiffness matrix. **(12)**

2. (a) Introduce reasonable shape functions for a two noded beam element (Figure 2) and derive the element stiffness matrix (k). In this process also consider axial stiffness of a bar element and derive the stiffness matrix of a 2D general beam element. **(15)**

Contd P/2

CE 419

(b) A cantilever beam shown in Figure 3 is subjected to distribute lateral load. Write down the global FE equation for the beam and find out (i) deflection and rotation at right end (ii) reaction force and moment at left end. **(8⅓)**

3. (a) Introduce natural coordinate system and derive Jacobbean Matrix $\underline{J}$ for a constant strain triangle element. In this process derive the strain displacement matrix $\underline{B}$. **(15)**

(b) What is a constitutive relation? What is its purpose in a FEM program? **(8⅓)**

4. (a) Explain the following terms and write down constitutive laws for each of the cases: **(9)**
   (i) Plane stress problem
   (ii) Plane strain problem
   (iii) Axisymmetric problem.

(b) Explain the term 'Shape Functions'. Why polynomials are preferred for shape functions? **(10)**

(c) What are the basic assumptions in analyzing a structure based on linear static analysis? **(4⅓)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

Symbols carry their usual meaning.

5. (a) Using the Weighted Residual approach, find out an approximate solution to the following differential equation. **(13⅓)**

$$-\frac{d^2u}{dx^2} - u + x^2 = 0 \qquad 0 < x < 1$$

Given: u(0) = 0 and u(1) = 0.

(b) Using Three Point Gaussian Integration scheme, evaluate, $I = \int_{-1}^{1} e^{-3x/x^2}\, dx$ **(10)**

The Gaussian points and corresponding weights are:

Points	Weights
0	8/9
$\pm\sqrt{0.6}$	5/9

Contd P/3

CE 419

6. (a) How is a Finite Element Formulation classified based on the Gaussian Integration Scheme employed? **(6)**

(b) Express the Weak Formulation to the following differential equation for an element. **(17 ⅓)**

$$-\frac{d}{dx}\left(u\frac{du}{dx}\right)+f=0$$

Determine the integral expression of a member of the Coefficient Matrix or Stiffness Matrix of an element for the above equation.

7. (a) Member of a stiffness matrix for a problem is given by, **(13 ⅓)**

$$k_{ij}=\int_{x_A}^{x_B}(1+x)\frac{d\psi_i}{dx}\frac{d\psi_j}{dx}dx$$

Implement a linear element and derive the stiffness matrix.

(b) Suppose that the force-deformation relationship of a structural assemblage is given by, **(10)**

$$\begin{bmatrix} 4 & -3 & 6 & 2 \\ -3 & 2 & 5 & 3 \\ 6 & 5 & 1 & -4 \\ 2 & 3 & -4 & 3 \end{bmatrix}\begin{Bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{Bmatrix}=\begin{Bmatrix} 10 \\ R_2 \\ 20 \\ R_4 \end{Bmatrix}$$

The boundary condition is such that $u_2 = 2$ and $u_4 = 0$. Determine the unknown deformations u_1 and u_3 and the unknown reactions R_2 and R_4.

8. (a) Assemble the Finite Element Equations for the structure shown in Fig. 4. **(15 ⅓)**

(b) Suppose nodal deformations of a quadratic element are $u_1 = 0.5$, $u_2 = 2$ and $u_3 = 0.75$. Determine u at $\bar{x} = 0.75$. **(8)**

L-4/T-2/CE Date : 01/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 419** (Introduction to Finite Element Method)

Full Marks: 140 Time : 3 Hours

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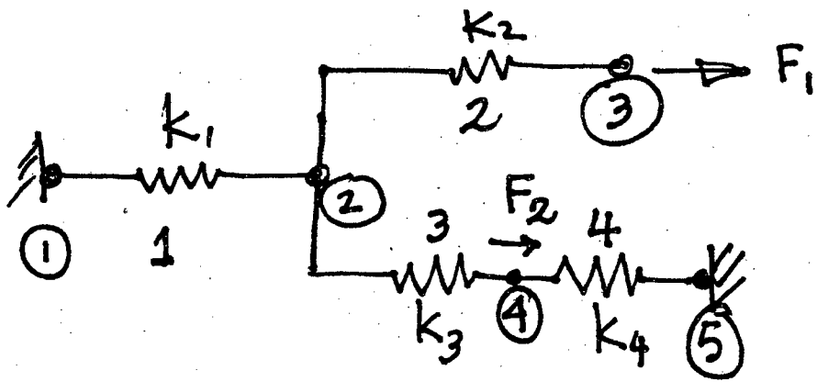

Figure 1

2. (a) Introduce reasonable shape functions for a two noded beam element (Figure 2) and derive the element stiffness matrix (K). In this process also consider axial stiffness of a bar element and derive the stiffness matrix of a 2D general beam element. **(15)**

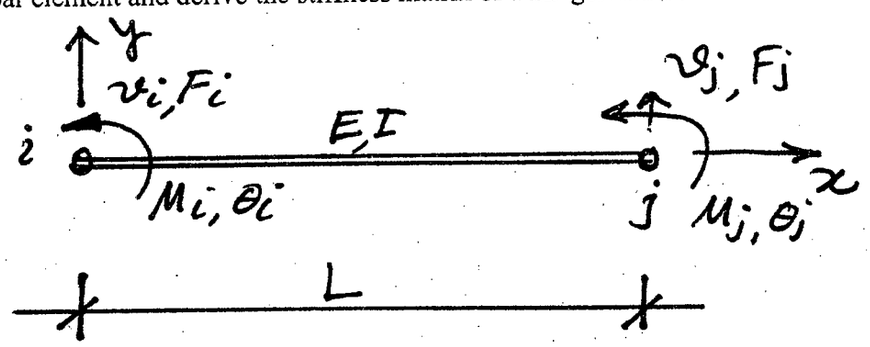

Figure 2

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CE 419

(b) A cantilever beam shown in Figure 3 is subjected to distribute lateral load. Write down the global FE equation for the beam and find out (i) deflection and rotation at right end (ii) reaction force and moment at left end. **(8⅓)**

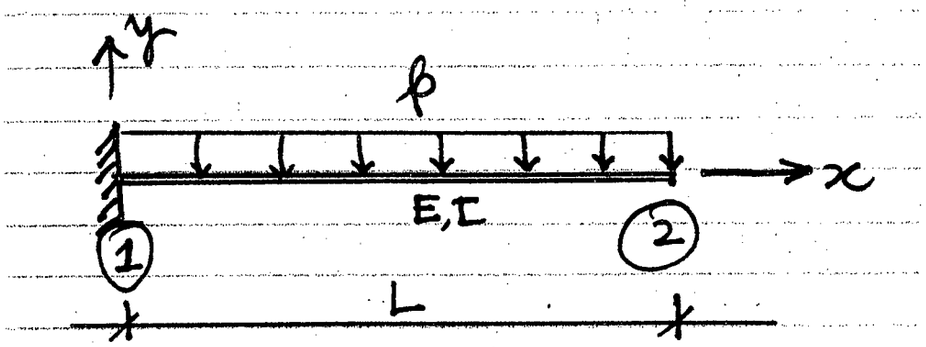

Figure 3.

3. (a) Introduce natural coordinate system and derive Jacobbean Matrix J for a constant strain triangle element. In this process derive the strain displacement matrix B. **(15)**

(b) What is a constitutive relation? What is its purpose in a FEM program? **(8⅓)**

4. (a) Explain the following terms and write down constitutive laws for each of the cases: **(9)**
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Contd P/3

CE 419

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(b) Express the Weak Formulation of the following differential equation for an element. **(17⅓)**

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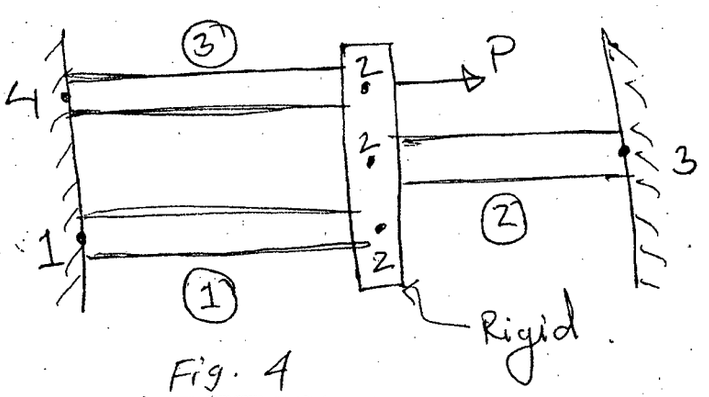


Fig. 4

(b) Suppose nodal deformations of a quadratic element are $u_1 = 0.5$, $u_2 = 2$ and $u_3 = 0.75$. Determine u at $\bar{x} = 0.75$. **(8)**

Tanjeeb Ahmed
1.1.13

L-4/T-2/CE. **Date : 01/01/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 415** (Prestressed Concrete)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Assume appropriate value(s) for any missing data.

1. (a) Draw and explain the load deflection curve of a prestressed concrete beam under different stages of loading. **(8)**

(b) A prestressed concrete beam (shown in Fig. 1) is posttensioned with 780 mm^2 of high tensile steel to an initial prestress of 1100 MPa immediately after transfer. Given: f'_{ci} = 30 MPa; f'_c = 40 MPa; f_r = 4.0 MPa. **(15⅓)**

(i) Compute the value of 'P' that will produce the first crack at the support section. Assume 20% loss of prestress and n = 7.

(ii) Compute the initial deflection at the free end of the beam due to prestress and load P = 100 kN. Estimate the deflection after three months, assuming a creep coefficient = 1.80 and an effective prestress of 880 MPa at that time.

2. (a) Explain the importance of transfer bond in a pretensioned prestressed concrete member. Also, write down the factors which control such transfer bond and hence the transfer length. **(6)**

(b) Why the transverse tension in the anchorage zone is so important in the design of a posttensined prestressed concrete beam? Explain briefly. **(6)**

(c) Determine the bearing plate area required for a tendon consisting of 19-12.7 mm dia. 7-wire strands anchored at the end of a beam as shown in Fig. 2. The tendon forces for design are 1800 kN due to maximum ~~jocking~~ jacking force and 1400 kN at service load. Use f'_{ci} = 30 MPa and f'_c = 40 MPa. Follow the specification of the Post-Tensioning Institute (PTI) for allowable bearing stresses on the concrete. **(11⅓)**

3. (a) Explain the importance of using nonprestressed reinforcements in conjunction with prestressed steel in a partially prestressed concrete beam. **(8)**

(b) Determine the ultimate moment capacity of the section shown in Fig. 3. Use f'_c = 40 MPa; $E_p = 2 \times 10^5$ MPa; $E_c = 3 \times 10^4$ MPa; f_{pu} = 1860 MPa; f_y = 415 MPa; E_{cu} = 0.003 and effective prestress f_{se} = 1000 MPa. Follow any method for your calculation. **(15⅓)**

Contd P/2

CE 415

4. (a) Design a composite prestressed concrete structural system for a simply supported 20 m span. The beam will be Type III standard AASHTO-PCI section (Fig. 4) with a 160 mm thick deck slab. Design loads for the structure are: Dead load of the composite system (normal weight concrete), W_G, additional dead load, W_D = 900 pa; live load, W_L = 2500 pa. Consider f'_{ci} = 30 MPa, f'_c = 40 MPa for precast element and for the slab f'_c = 30 MPa. Design for unshored beams in construction following the ACI Code for the section at midspan. Assume that loss of prestress is 20% for this section and the initial force for 12.7 mm dia. 7-wire strand is 130 kN. **(23⅓)**

(i) Determine the pretensioned strand-arrangement to fully utilize the precast beams.

(ii) Find the maximum spacing of the beams for this structural system based on allowable stresses at service load.

(iii) Check the strength following ACI Code.

Section properties for precast beam (Type III) are given below:

$A = 361 \times 10^3$ mm^2, $I = 522 \times 10^8$ mm^4, W_G = 8.51 kN/m,

C_b = 515 mm, C_t = 628 mm, ~~f_{pw}~~ f_{pu} = 1860 MPa.

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

Assume reasonable value for any missing data.

5. (a) Briefly describe the losses of prestress in pretentioned and posttentioned members from each individual source. Hence explain which type of member will undergo greater loss of prestress. **(8⅓)**

(b) A pretensined concrete beam, 12 metre long is eccentrically prestressed with 1400 mm^2 of steel wires which are anchored to the bulk heads (Fig. 5) with a stress of 1020 MPa. Compute the loss of prestress due to elastic shortening of concrete at the transfer of prestress. Use γ_{con} = 25 kN/m^3 and n = 6. **(15)**

6. The midspan section of a composite beam is shown in Fig. 6. The precast segment is an I-section 1000 mm in depth and 500 mm wide flanges. It is posttensined with an initial force of 3100 kN which reduces to 2550 kN after losses. Moment due to self weight of that precast section is 540 kN-m at midspan. After errection, the top slab of 160 mm by 1400 mm is to be cast in place producing a midspan moment of 375 kN-m. After hardening of the floor slab, the composite section is to carry a maximum live load moment of 1200 kN-m. Compute the stresses in the section at various stages of loading. f'_c = 45 MPa. **(23⅓)**

Contd P/3

CE 415

7. (a) Explain the importance of Kern points (K_t and K_b) in the design of prestressed concrete beams. **(3)**

(b) Show the qualitative stress distributions in a PC section for different location of compressive force in relation to the Kern points. **(5⅓)**

(c) Calculate the value of K_t and K_b for the beam sections of Fig. 7. All dimensions are in mm. **(15)**

8. (a) Make a preliminary design for section of prestressed concrete beam to resist a total moment of 560 kN-m of which M_G = 320 kN-m. Assume effective prestress for steel to be 840 MPa and allowable concrete stress of –12 MPa. Try with an overall depth of about 45 $\sqrt{M_T}$ in mm where M_T in kN-m. **(8⅓)**

(b) Make final design for the preliminary section obtained from the above problem allowing no tension in concrete. **(15)**

Given: f_b = –13 MPa, f_0 = 1025 MPa, f_t = –12 MPa, f_{se} = 840 MPa.

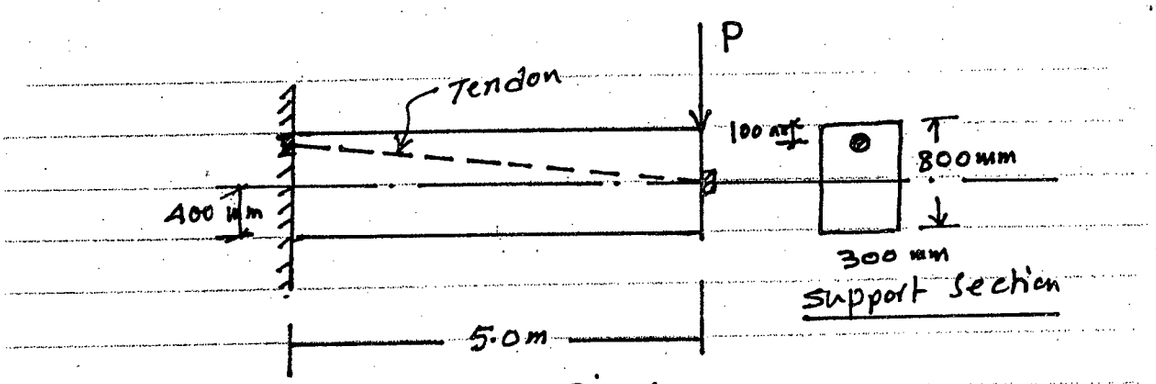


Fig.1

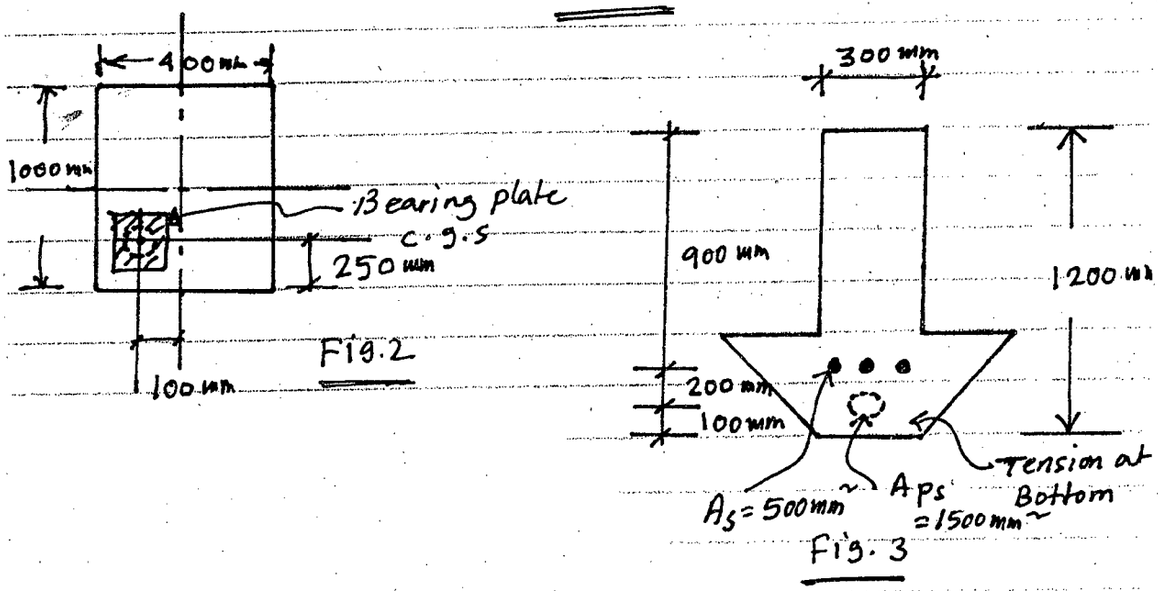


Fig.2

Fig.3

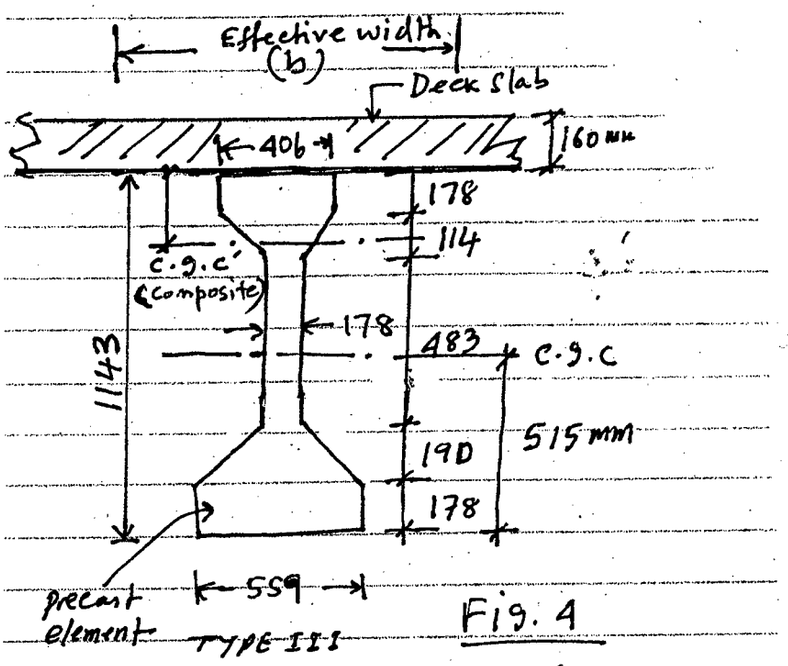


Fig. 4

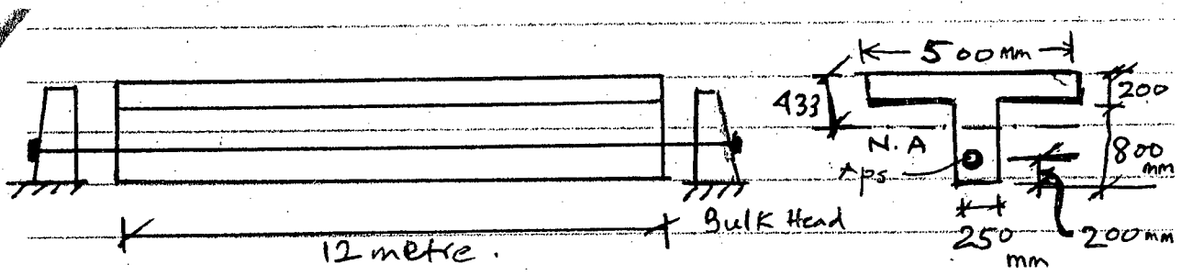


fig. 5

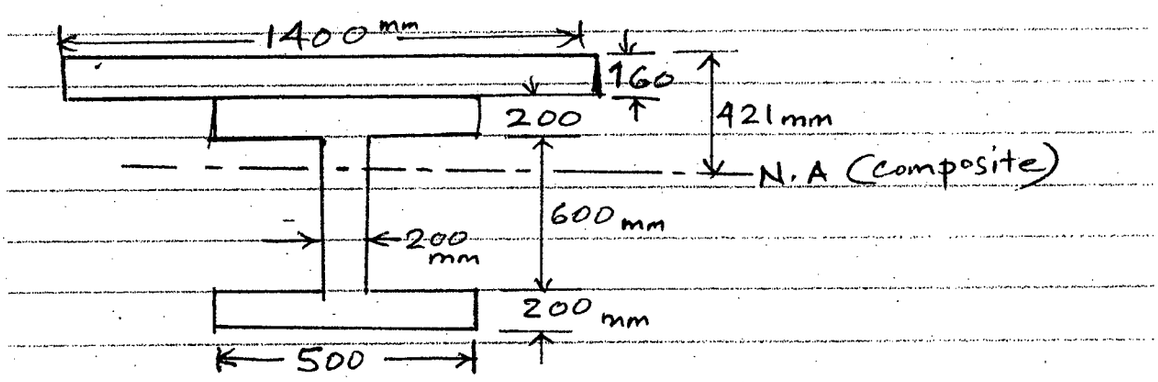


fig. 6

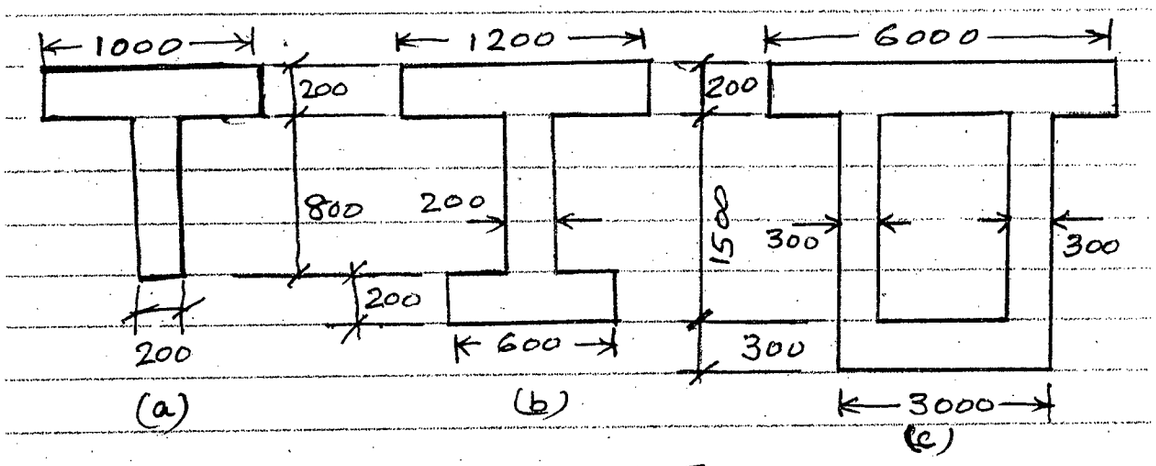


fig. 7

L-4/T-2/CE

Date : 08/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 443** (Geotech Engg. IV)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Write short notes on **(10⅓)**

   (i) Liquefactional Potential Index

   (ii) Blasting

   (b) For a proposed construction, a 8 m thick normally consolidated clay layer will be subjected to a pressure of 55 kPa as shown in Figure 1. It is decided to improve the soil by applying a surcharge load of 75 kPa for 5 months. What would be the reduction in the consolidation settlement due to this surcharge? **(13)**

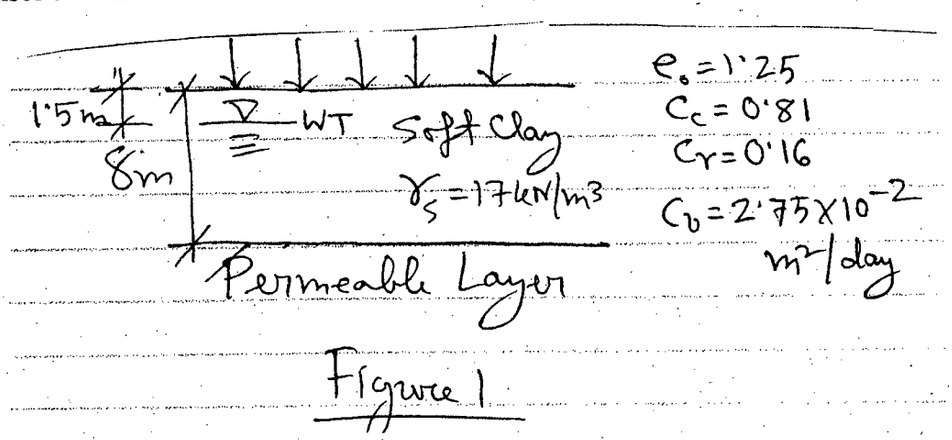


Figure 1

2. (a) Write the names of different types of vertical drains. Discuss a case study with necessary sketches of the application of PVD in Bangladesh. **(10⅓)**

   (b) Estimate liquefaction potential index at a proposed construction site for a 7.0 magnitude earthquake producing a peak ground acceleration of 0.37g. Consider the water table to be at a depth of 1.5 m. The saturated unit weight of soil is 17 kN/m^3. The required data is provided below: **(13)**

Depth(m)	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12	13.5	15	16.5
N-Value	2	1	1	2	3	4	6	5	7	9	11
d_{50}(mm)	0.10	0.15	0.18	0.2	0.21	0.21	0.22	0.24	0.23	0.24	0.25

Contd P/2

CE 443

3. (a) Discuss countermeasures for building foundations against liquefaction with neat sketches. **(10⅓)**

(b) An embankment is to be constructed over a layer of clay 7 m thick, with a permeable lower boundary. Construction of the embankment will increase the total vertical stress in the clay layer by 45 kPa. For the clay layer: C_v = 4.3 m^2/yr; C_h = 7.9 m^2/yr and m_v = 0.23 m^2/MN. The design requirement is that all but 0.27 mm of the settlement due to consolidation of the clay layer will have taken place after 7 months. Determine the spacing in a square pattern of 275 mm diameter sand drains to achieve the above requirements. **(13)**

4. Write short notes on: **(23⅓)**

(a) Dynamic Consolidation

(b) Vibroflatation

(c) Surcharge with Vertical Drains

(d) Compaction Pile.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

Normal graph paper should be supplied.

5. (a) Discuss the significance of stress paths in geotechnical problems. Define 'total' and 'effective' stress paths. **(8⅓)**

(b) Draw typical stress paths (TSP and ESP) for **(8)**

(i) drained triaxial compression test

(ii) undrained triaxial compression test

(iii) drained extension test with constant axial stress

(iv) drained extension test with constant radial stress.

(c) The following results were obtained from direct shear tests on specimens of a sand compacted to the in-situ density. Determine the values of the shear strength parameters. **(7)**

Normal stress (kN/m^2)	50	100	200
Shear stress at failure (kN/m^2)	36	80	154

Would failure occur on a plane in a mass of this sand at a point where the shear stress is 122 kN/m^2 and the effective normal stress is 246 kN/m^2. (Use graph paper).

Contd P/3

CE 443

6. (a) How the failure at a point in a soil mass is defined in relation to its shear strength? **(3)**

(b) Define pore-pressure coefficients A & B at failure and state their significance. **(7)**

(c) A specimen of saturated sand was consolidated under all round pressure of 60 psi. The axial stress was then increased and drainage was prevented. The specimen failed when the axial deviator stress reached 50 psi. The pore-pressure at failure was 41.35 psi. Determine– **(8)**

(i) consolidated undrained angle of shearing resistance

(ii) drained friction angle

(d) Draw common stress-paths to failure in the ground. **(5⅓)**

7. (a) Discuss the applicability of drained (c, φ) and undrained (s_u) shear strength parameters for foundation design. **(8)**

(b) In a triaxial test a specimen was consolidated under an all-round pressure of 800 kN/m^2 and a back pressure of 400 kN/m^2. Thereafter, under undrained conditions, the all-round pressure was raised to 900 kN/m^2, resulting in a pore water pressure reading of 495 kN/m^2; then (with the all-round pressure remaining at 900 kN/m^2) axial load was applied to give a principal stress difference of 585 kN/m^2 and a pore water pressure reading of 660 kN/m^2. Calculate the values of pore pressure coefficients A & B at failure. **(10)**

(c) "When an embankment is built on a saturated clay layer, the factor of safety changes with time" — explain. **(5⅓)**

8. (a) Define 'critical state' in a soil mass. Also state the parameters of the critical state soil model. **(5⅓)**

(b) Do critical state soil model represent the results of consolidated undrained triaxial tests on normally consolidated clay? Explain with appropriate figures. **(12)**

(c) Define 'state boundary surface', 'Hvorslev surface' and 'Roscoe surface' as used in the critical state soil model. **(6)**

CE 443

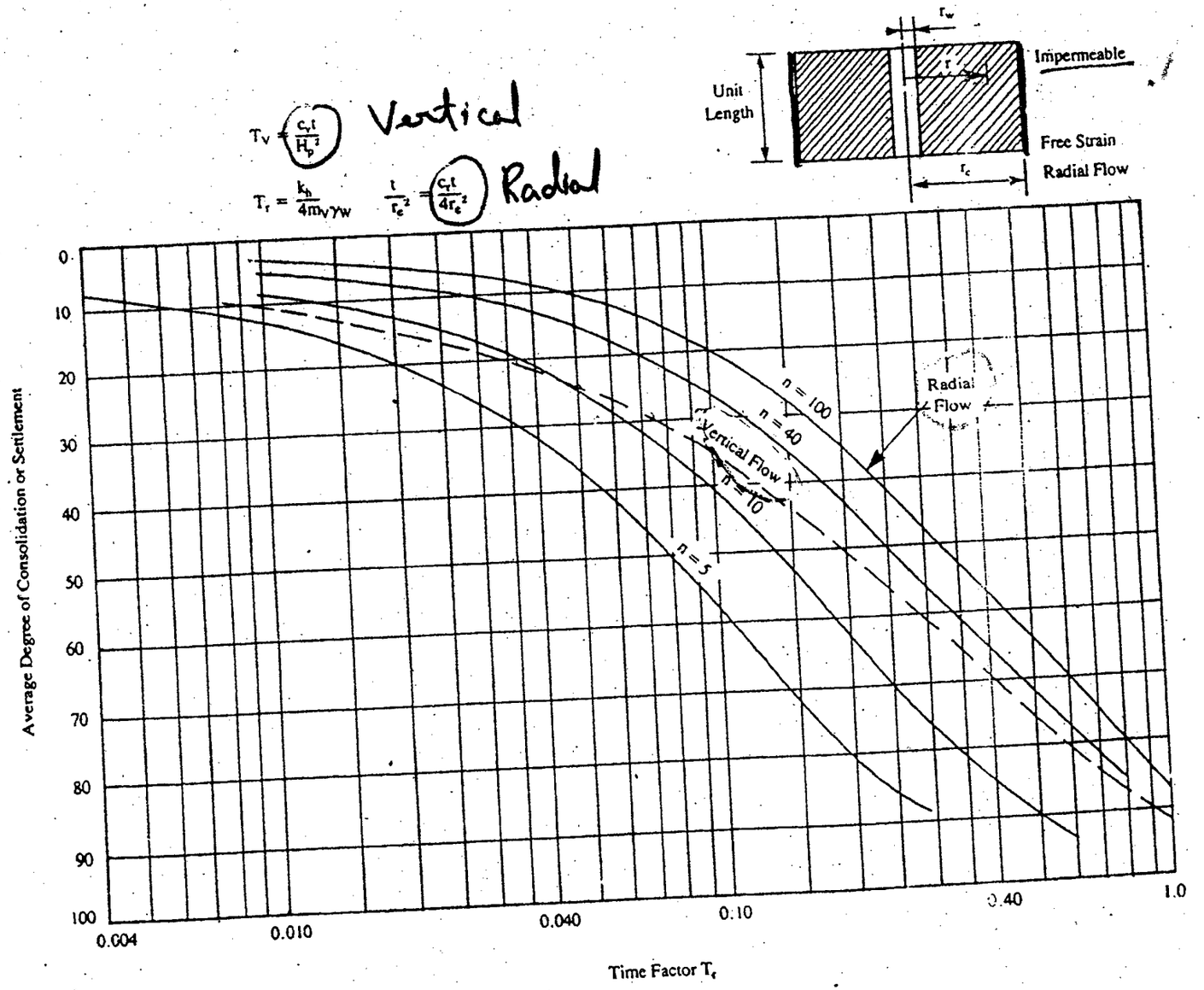


Chart 1

Rate of Consolidation with Sand Drains, Free Strain and Vertical Flow (SOURCE: Barron, 1948. Courtesy American Society of Civil Engineers)

L-4/T-2/CE

Date : 08/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 445** (Geotechnical Engineering V)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Give three examples related to soil-water interaction problems. Explain with neat sketches wherever applicable. **(10 ⅓)**

   (b) Define the terms apparent opening size (AOS) and permittivity related to geotextiles. Describe briefly with necessary sketches how these can be obtained in laboratory. **(4+9)**

2. (a) Explain with sketches the primary functions of a filter behind the weep holes of a retaining wall. **(5)**

   (b) Show with neat sketches a typical river bank protection scheme usually employed in Bangladesh. Describe the functions of each of the components. **(10)**

   (c) Do you think bio-degradable jute geotextile (JGT) can be used as filter material on river bank slopes instead of non-biodegradable synthetic geotextiles? Give reasons in support of your answer. **(8 ⅓)**

3. (a) Explain the mechanisms involved with topsoil erosion of hill slopes. Give neat sketches. **(6)**

   (b) Describe the procedure explaining how such top soil erosion can be controlled using geojute (soil saver) and vegetation establishment. **(7)**

   (c) Explain the functions of geojute and vegetation cover in such topsoil erosion control schemes. **(10 ⅓)**

4. (a) For the grain-size distribution of a back-fill material given below, determine the range of grain-size distribution for the filter material. **(15)**

Sieve no.	Diameter (mm)	% Finer
4	4.750	100.0
10	2.000	95.2
20	0.850	84.2
40	0.425	61.4
60	0.250	41.6
100	0.150	20.4
200	0.075	7.0
Pan	---	---

Use semi-log paper for solving the problem.

(b) What general criteria should be considered during design of revetment structure? Explain with sketches, wherever applicable. **(8 ⅓)**

Contd P/2

CE 445

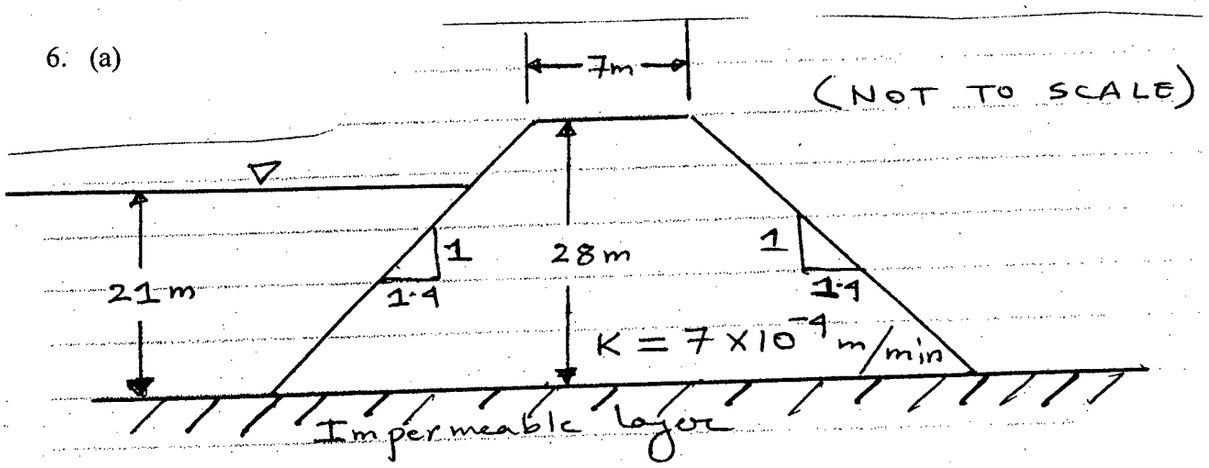
SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Starting from basic principles show mathematically that flow lines and equipotential lines are perpendicular to each other. Also show that the stream function $\psi(x, y)$ satisfies the Laplace's equation in two dimensions. **(13 ⅓)**

(b) Define briefly the two types of flow net with two examples of each. Describe briefly the four possible types of boundary conditions during flow through a porous media. **(10)**

6. (a)



Calculate the rate of seepage q in $m^3/(min.m)$ through the above earth dam using the Leo Casagrande method. **(13 ⅓)**

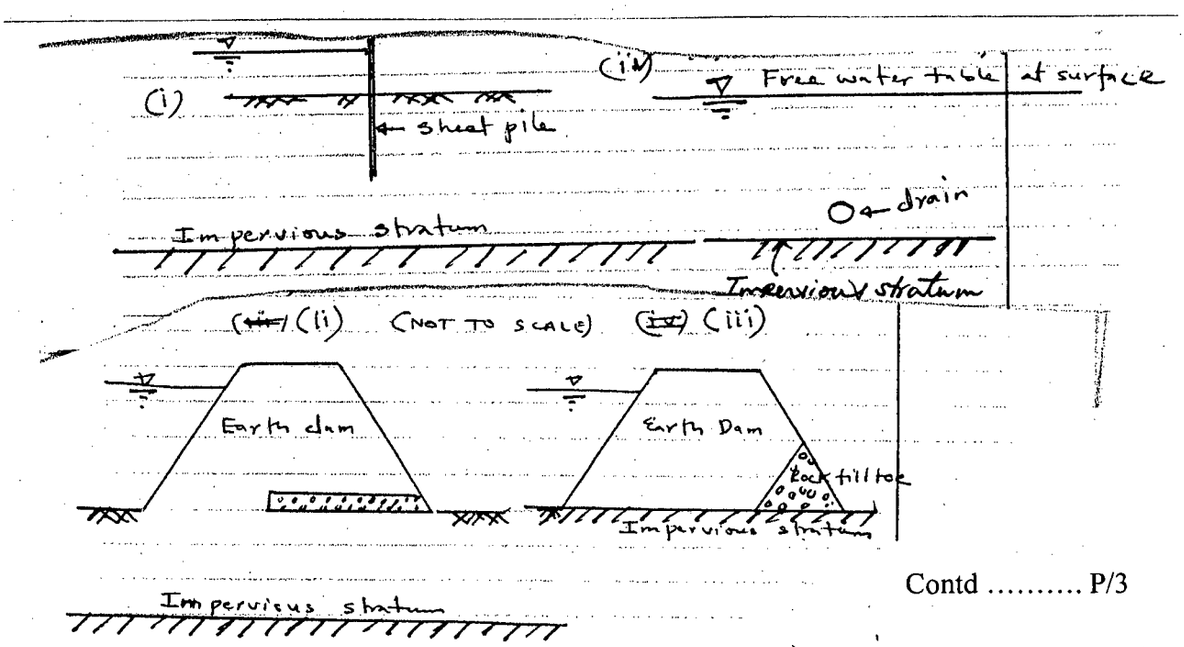
(b) Draw qualitative flow nets for the following: **(10)**

(i) sheet pile coffer dam

(ii) earth dam with downstream drain

(iii) earth dam with rock fill toe

(iv) drain.

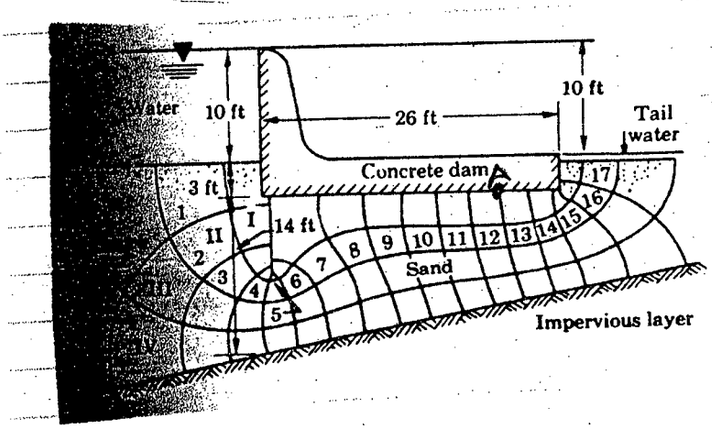


Contd P/3

CE 445

7. (a) Determine the radius of influence of the depression cone after an ordinary perfect well has been pumped for 24 hrs using Weber's equation. The water bearing stratum is of medium sand with thickness H = 7.0 m, and coefficient of permeability K = 0.005 m/s and porosity n = 0.3. Assume the value of the coefficient c = 3.0 in Weber's equation. If the radius of the well r_0 = 0.1 m and maximum drawdown S_{max} = 3.5 m, compute the radius of influence R under steady state condition of using Sichordt's equation and hence compute the rate of flow Q into the well is m^3/s. **(13 ⅓)**

(b) For the given flow net for the low concrete dam in a cohesion less soil with



Coefficient of permeability k = 8×10^{-4} cm/s **(10)**

(i) determine the quantity of water flowing under the dam per foot of width per day in ft^3/day.

(ii) determine the uplift pressure in the bottom of the dam at point A.

8. (a) Show using Schaffernak and Van Iterson's method that for an earth dam with downstream slope angle β < 30°, the seepage line is given by the following equation: **(13 ⅓)**

$$y = \sqrt{h^2 + 2a \sin\beta \tan\beta (x - d)}$$

where $a = \frac{d}{\cos\beta} - \sqrt{\frac{d^2}{\cos^2\beta} - \frac{h^2}{\sin^2\beta}}$

(b) Determine the required rate of pumping from wells surrounding an excavation pit 40 ft by 50 ft to lower the groundwater surface by 10 ft from its current position in 7 days of pumping. Assume the height H of the current groundwater surface from a reference plane H = 40 ft, K = 0.02 ft/min, n = 0.25, α = 2.0 and $R = c\sqrt{\frac{HKt}{n}}$ where c = 3.0. **(10)**

L-4/T-2/CE **Date : 17/11/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 417** (Design of Steel Structures)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Draw a column strength curve and indicate regions of short, intermediate and long column. How does failure of short column differ from that of long column? **(6)**

   (b) Differentiate between overall buckling and local buckling. **(4)**

   (c) Calculate the ultimate strength of the column having cross section and support conditions as shown in Figure 1. Use A572 Grade 50 steel. **(13 ⅓)**

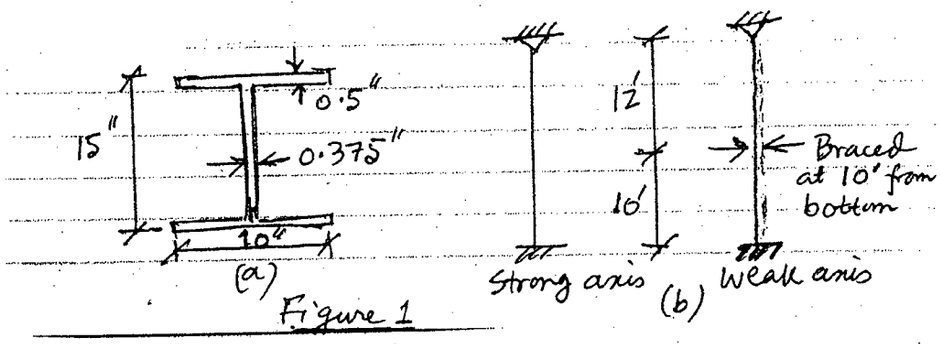


Figure 1

2. (a) Determine effective length factors for the columns of the frame shown in Figure 2. **(9)**

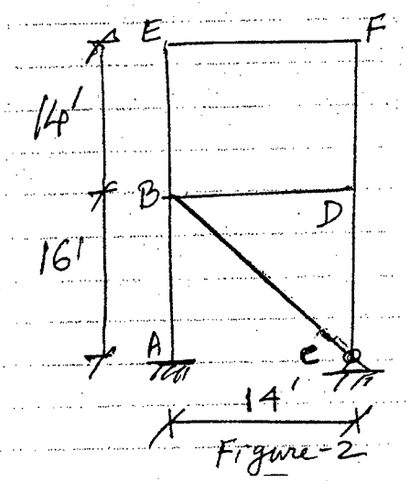


Figure-2

Given:

Beam size: W 12 × 96

$I_x = 833$ in^4

Column size: W 10 × 112

$I_x = 716$ in^4

k-factors are given in Annexure-1

(b) Select lightest section of A36 steel for a column of 20 feet long to carry an axial load of 180 kip. Use ASD method. Assume Fixed-Pinned ends for both axes (Figure 3). Probable column sizes with sectional properties are given below. **(14 ⅓)**

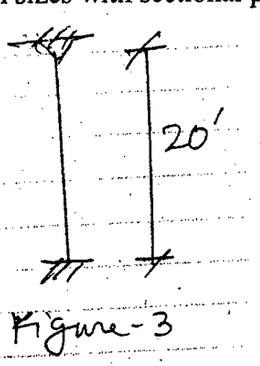


Figure-3

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	11.8	5.13	1.93

Contd P/2

CE 417

3. (a) Write short notes on compact and non-compact sections. **(4)**

   (b) Determine whether the beam with cross-section shown in Figure 1(a) is compact (i) in $F_y = 50$ ksi (ii) in $F_y = 65$ ksi. **(4)**

   (c) What are C_b and L_c.? **(3)**

   (d) Compute (i) yield moment, M_y (ii) Plastic moment, M_p and (iii) shape factor, S for the beam with cross section shown in Figure 1(a). Assume, $F_y = 50$ ksi. **(12 ⅓)**

4. (a) Write down allowable bending stresses when strength of a beam is controlled by lateral torsional buckling. **(6)**

   (b) Compute value of C_b for the continuous beam shown in Figure 4. Lateral supports are placed at the supports only. **(3)**

   (c) Investigate the adequacy of the beam section under the load shown in Figure 5. Steel is A572 Grade 60. Consider all modes of failure and maximum allowable deflection for non-plastered floor. **(14 ⅓)**

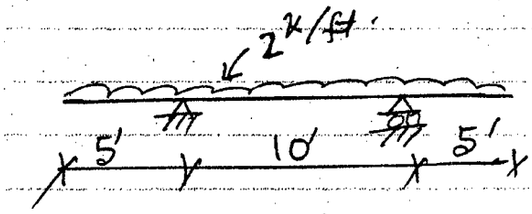
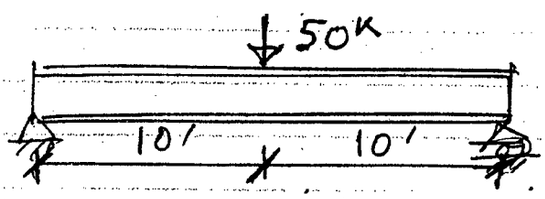


Figure 4



Lateral supports are provided at the supports and mid-span. Beam section : W 16 × 50, $b_f = 7.07''$, $t_f = 0.63''$, $\frac{d}{A_f} = 3.65$, $I_x = 659$ in^4, $r_T = 1.84''$, $d = 16.26''$.

Figure 5

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

Assume reasonable values for any missing data.

Notations convey usual meaning unless otherwise described.

5. (a) Classify the types of bolted connections and explain with neat sketches the mechanism of their load transmission. **(6 ⅓)**

   (b) Using AISC/LRFD method, determine the dead load capacity in tension for failure by tearing through the free edges of the joint shown in Fig. 6, if the simultaneous live load is 240 kip. The load is to be transmitted through two C 12 × 25 to a 0.75-in. gusset plate. All material is A529 with $F_y = 42$ ksi and $F_u = 60$ ksi. Bolts are $\frac{7}{8}$-in. A625 in standard holes in a bearing-type connection. Annexure-II is provided to facilitate design. **(17)**

Contd P/3

CE 417

6. (a) What is shear lag? Explain with neat sketches. **(6 ⅓)**

   (b) Two plates, one 8″ wide and ½″ thick and the other 10″ wide and 7/16″ thick, are lap welded with 12″ lap as shown in Fig. 7. The transverse weld size is 5/16″ and the longitudinal weld size is ⅜″. Welds are deposited manually using E80XX electrodes. Determine the design strength of the tension joint. Given: Nominal strength of fillet weld for stress on effective area is 0.6 times the nominal tensile strength of weld metal and $\phi = 0.75$; plates are of A36 steel and U = 1. **(17)**

7. (a) Explain with neat sketches the phenomenon of strain aging. **(6 ⅓)**

   (b) A 10″ × ¾″ plate that is 5-ft long and has standard holes for ¾″ dia bolts at one end (see Fig. 8) for attachment to other structural members, is to be used as a tension member. Check slenderness limit and using AISC/ASD method, determine the axial tension capacity of the A36 steel member. Given: U = 0.85. **(17)**

8. The residual stress for a 20 × 2 in. plate to be used as a tension member is shown in Fig. 9. Find the equation for the stress-strain behaviour of the plate in tension at an imposed tensile strain of 0.0015 in./in.. What is the value of tangent modulus at a strain of 0.0016 in./in.? Given: $F_y = 42$ ksi and $E = 30000$ ksi. **(23 ⅓)**

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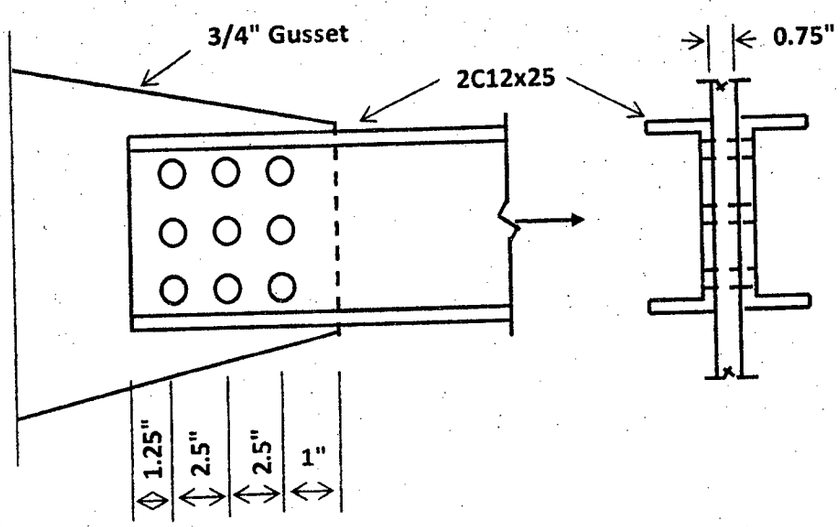

Fig. 6

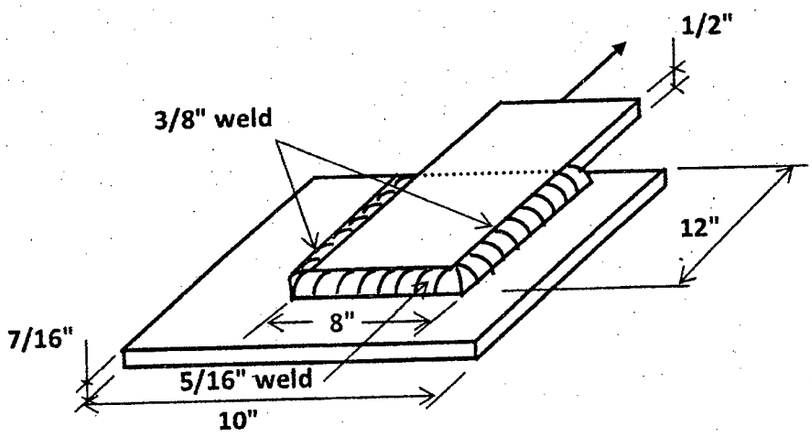

Fig. 7

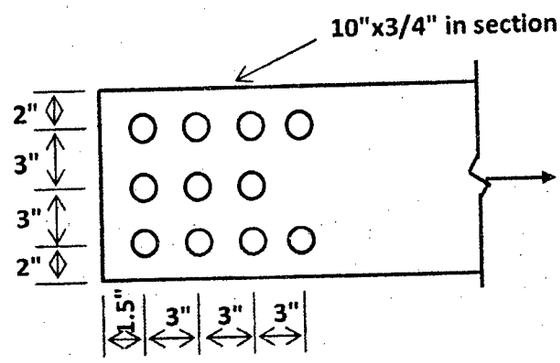

Fig. 8

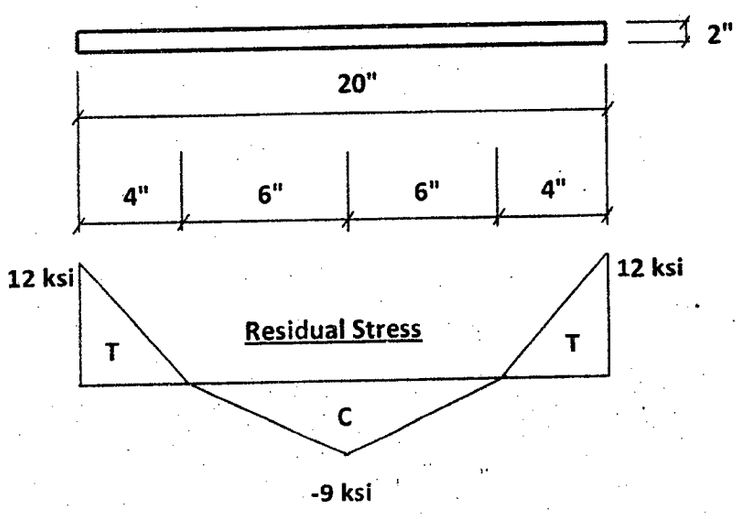

Fig. 9

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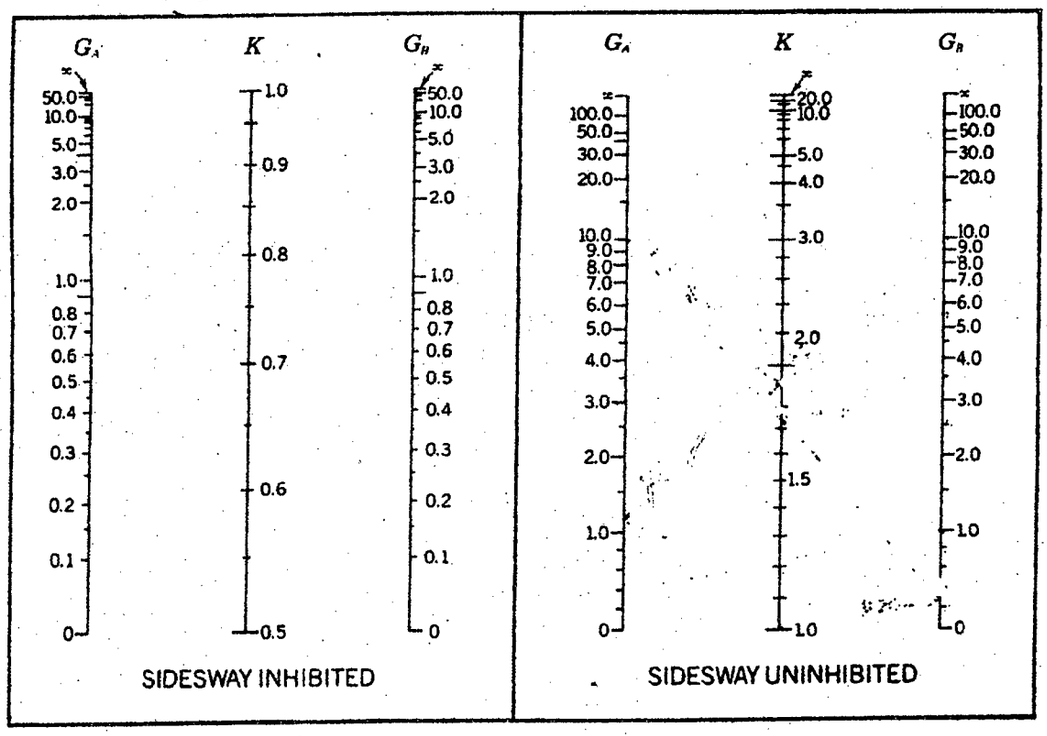
Annexure – 1

(1) K-factors for column in Frame



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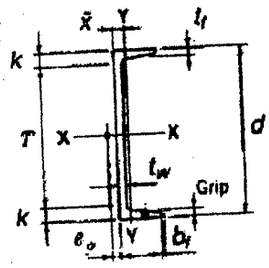
Annexure-II



CHANNELS
AMERICAN STANDARD
Dimensions

Designation	Area A	Depth d	Web		$\frac{t_w}{2}$	Flange				Distance		Grip	Max. Fige. Fas-ten-er
			Thickness t_w			Width b_f		Average thickness t_f		T	k		
	In.^{2}	In.	In.		In.	In.		In.		In.	In.	In.	In.
C 15×50	14.7	15.00	0.716	11/16	5/8	3.716	3 3/4	0.650	5/8	12 1/8	1 7/16	5/8	1
×40	11.8	15.00	0.520	1/2	1/4	3.520	3 1/2	0.650	5/8	12 1/8	1 7/16	5/8	1
×33.9	9.96	15.00	0.400	3/8	3/16	3.400	3 3/8	0.650	5/8	12 1/8	1 7/16	5/8	1
C 12×30	8.82	12.00	0.510	1/2	1/4	3.170	3 1/8	0.501	1/2	9 3/4	1 1/8	1/2	7/8
×25	7.35	12.00	0.387	3/8	3/16	3.047	3	0.501	1/2	9 3/4	1 1/8	1/2	7/8
×20.7	6.09	12.00	0.282	9/16	1/8	2.942	3	0.501	1/2	9 3/4	1 1/8	1/2	7/8
C 10×30	8.82	10.00	0.673	11/16	5/16	3.033	3	0.436	7/16	8	1	7/16	3/4
×25	7.35	10.00	0.526	1/2	1/4	2.886	2 7/8	0.436	7/16	8	1	7/16	3/4
×20	5.88	10.00	0.379	3/8	3/16	2.739	2 3/4	0.436	7/16	8	1	7/16	3/4
×15.3	4.49	10.00	0.240	1/4	1/8	2.600	2 5/8	0.436	7/16	8	1	7/16	3/4
C 9×20	5.88	9.00	0.448	7/16	1/4	2.648	2 5/8	0.413	7/16	7 1/8	15/16	7/16	3/4
×15	4.41	9.00	0.285	9/16	1/8	2.485	2 1/2	0.413	7/16	7 1/8	15/16	7/16	3/4
×13.4	3.94	9.00	0.233	1/4	1/8	2.433	2 3/8	0.413	7/16	7 1/8	15/16	7/16	3/4
C 8×18.75	5.51	8.00	0.487	1/2	1/4	2.527	2 1/2	0.390	3/8	6 1/8	15/16	3/8	3/4
×13.75	4.04	8.00	0.303	5/16	1/8	2.343	2 3/8	0.390	3/8	6 1/8	15/16	3/8	3/4
×11.5	3.38	8.00	0.220	1/4	1/8	2.260	2 1/4	0.390	3/8	6 1/8	15/16	3/8	3/4
C 7×14.75	4.33	7.00	0.419	7/16	3/16	2.299	2 1/4	0.366	3/8	5 1/4	7/8	3/8	5/8
×12.25	3.60	7.00	0.314	5/16	3/16	2.194	2 1/4	0.366	3/8	5 1/4	7/8	3/8	5/8
× 9.8	2.87	7.00	0.210	3/16	1/8	2.090	2 1/8	0.366	3/8	5 1/4	7/8	3/8	5/8
C 6×13	3.83	6.00	0.437	7/16	3/16	2.157	2 1/8	0.343	5/16	4 3/8	13/16	5/16	5/8
×10.5	3.09	6.00	0.314	5/16	3/16	2.034	2	0.343	5/16	4 3/8	13/16	5/16	5/8
× 8.2	2.40	6.00	0.200	3/16	1/8	1.920	1 7/8	0.343	5/16	4 3/8	13/16	5/16	5/8
C 5× 9	2.64	5.00	0.325	5/16	3/16	1.885	1 7/8	0.320	5/16	3 1/2	3/4	5/16	5/8
× 6.7	1.97	5.00	0.190	3/16	1/8	1.750	1 3/4	0.320	5/16	3 1/2	3/4	—	—
C 4× 7.25	2.13	4.00	0.321	5/16	3/16	1.721	1 3/4	0.296	5/16	2 5/8	11/16	5/16	5/8
× 5.4	1.59	4.00	0.184	3/16	1/16	1.584	1 5/8	0.296	5/16	2 5/8	11/16	—	—
C 3× 6	1.76	3.00	0.356	3/8	3/16	1.596	1 5/8	0.273	1/4	1 5/8	11/16	—	—
× 5	1.47	3.00	0.258	1/4	1/8	1.498	1 1/2	0.273	1/4	1 5/8	11/16	—	—
× 4.1	1.21	3.00	0.170	3/16	1/16	1.410	1 7/16	0.273	1/4	1 5/8	11/16	—	—

L-4/T-2/CE

Date : 20/11/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 403** (Professional Practices and Communication)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Describe the process of human communication. **(13 ⅓)**

   (b) Explain the following: **(10)**

   (i) How should one communicate favorable or unfavorable information?

   (ii) How do Sender's attitude affect communication?

   (iii) What is miscommunicated instructions?

2. (a) Describe briefly the steps for preparing effective oral presentations. **(13 ⅓)**

   (b) List in detail what a body of proposal should contain. **(10)**

3. (a) What are the seven principles or "C" s of effective communication? Describe and explain consideration and concreteness. **(13 ⅓)**

   (b) Describe the deductive and inductive approach in organizing a message. **(10)**

4. Answer the following questions based on the code of Ethics for Engineers document:

   (a) According to section 4, the Engineer shall not issue statements, criticism or arguments on matters connected with public policy in which circumstances? **(4)**

   (b) According to section 6, when should an Engineer undertake engineering assignments for which he will be responsible? **(4)**

   (c) According to section 7, what kind of information an Engineer will not disclose? **(4)**

   (d) According to section 15, how should as Engineer cooperate in extending the effectiveness of the profession? **(4)**

   (e) Describe the preamble of the Code of Ethics for Engineers. **(7 ⅓)**

Contd P/2

CE 403

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) What is meant by IRR. Discuss its significance in relation to project investment. **(7)**

(b) For the project data given below calculate the Net Present Value of the investment and comment on the prospect of the investment. **(13)**

Year	Investment Tk.	Return Tk.	Given :
1	3,00,000	-	Discount rate = 15%
2	1,50,000	50,000	Salvage value
3	-	100,000	= 2,00,000 taka in
4		2,50,000	the 6th year.
5		3,00,000	

(c) Discuss the limitation of 'Pay Back Period' of project evaluation. **(3 ⅓)**

6. (a) Define the term BoQ - explain its significance in relation to a civil work contract. **(5)**

(b) With appropriate format prepare BoQ with item description of a concreting work of 50 cu.m. Item description should include necessary details of the materials, construction method, workmanship etc. **(8)**

(c) In tabular format show the relationship of GCC and PCC clauses of standard tender in relation to the following: **(6)**

(i) Definition of "The Engineer".

(ii) Defect liability Period

(iii) Intended Completion Date

(d) Define compensation events in the GCC. Give two examples of compensation events applicable for a civil work contract. **(4 ⅓)**

7. (a) Describe the legal frame work of public procurement in Bangladesh. **(5)**

(b) Write the steps of Tender Evaluation. **(7)**

(c) Describe the role of Tender Evaluation Committee. **(5)**

(d) Name different types of tendering methods. Explain the suitability of each method. **(6 ⅓)**

8. (a) Why specifications are an important element in construction contract? **(5)**

(b) What are the desirable attributes of specification? **(5)**

(c) In writing specifications, particular brand and specific country of origin should not be mentioned - why? **(5)**

(d) If an electric pump is to be procured for lifting water from an underground reservoir to the roof top tank of a six storied building, mention the relevant technical parameters that should be included in the specification. **(8 ⅓)**

L-4/T-2/CE **Date : 20/11/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 405** (Socio Economic Aspects of Development Projects)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Briefly describe the different levels of community participation with the examples of Arsenic mitigation program for the Rural areas of Bangladesh. **(13)**

   (b) Discuss the strategic issues to be considered for the success of WSS projects in Bangladesh. Explain how this can be achieved. **(10⅓)**

2. (a) What are the difficulties in conducting socio economic assessments in developing countries? Explain with examples. **(11)**

   (b) Briefly discuss methodologies in practice to ensure community participation in development projects. **(12⅓)**

3. (a) What are the advantages and features of Social Impact Assessment (SIA) process? **(9)**

   (b) List four replicable Urban development projects and three rural development projects in Bangladesh. **(6)**

   (c) List the major socio economic issues in water quality management planning projects. **(8⅓)**

4. (a) Define "People's Participation". What is the significance of people's participation in WSS projects? **(13)**

   (b) What are the direct and indirect impacts associated with a wastewater treatment plant project? **(10⅓)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) While the HDI measures average achievement, the HPI-1, for developing countries, measures deprivations in the three basic dimensions of human development. What are these deprivations and how are they measured? What is the fourth deprivation in case of HPI-2 for selected OECD countries and how is this deprivation measured? **(13⅓)**

   (b) How does GDI differ from HDI? Briefly describe the three steps involved in calculating GDI. Why $\epsilon = 2$ in calculating GDI? **(10)**

Contd P/2

CE 405

6. (a) Development projects that displace people involuntarily give rise to severe economic, social and environmental problems. How? **(8 ⅓)**

   (b) What are the legal frameworks for land acquisition required for development projects in Bangladesh? Briefly discuss the resettlement approaches and issues in the legal context of Bangladesh. **(15)**

7. (a) What commitments were made by the world leaders in the historical UN Millennium Declaration at the Millennium Summit in September 2000? **(6)**

   (b) Make a list of the MDGs. What are the targets set out for achieving goal 7? Mention at least one indicator for each target under Goal 7. **(10)**

   (c) What strategies must be followed in order to reaching the MDGs in 2015? **(7 ⅓)**

8. (a) In spite of individuals' differences in development priorities, there are some fundamental goals for which there is a general consensus. What are these fundamental goals? **(6)**

   (b) Sustainable development is about equity - "intergenerational" and "intragenerational". Explain. **(7 ⅓)**

   (c) Make a list of objectives of sustainable development in the three major interrelated areas - economic, social and environmental. **(10)**

L-4/T-2/CE **Date : 29/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 435** (Environmental Engineering-V)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Define EIA. What are the major objectives of EIA in infrastructural development? **(5⅓)**
   (b) Discuss briefly different EIA methodologies. **(18)**

2. (a) Derive a conceptual model for sustainable development. How should population growth be ideally regulated by population carrying capacity. **(12)**
   (b) What are the guiding strategy to achieve the goal of sustainable development? How does EIA contribute towards sustainable development at project level? **(11⅓)**

3. Discuss briefly the potential impacts of 'Thana Irrigation Scheme', 'Thana Road project' and 'Upazila Embankment project' on the following: **(23⅓)**
   (i) Loss of Agricultural land (ii) Fisheries
   (iii) Employment. (iv) Surface water pollution.

4. (a) What are the objectives of Environmental monitoring? Mention the components of a monitoring program. **(10)**
   (b) State the Environmental Management strategies of development projects. What are the potential impacts and possible mitigation measures of **(13⅓)**
   (i) Loss of agricultural lands due to project.
   (ii) Obstruction to migration of fish.
   (iii) Use of irrigation water with high and imbalanced salt content.

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) List the environmental issues related to an Oil and Gas exploration project. **(9⅓)**
   (b) Draw the flow chart depicting the seven phases of an Impact assessment process. Explain, with example, the need for Public Participation in the assessment Process. **(8)**
   (c) Define, with example, Environmental Guidelines and Environmental Standards. **(6)**

6. (a) Draw the typical project cycle for environmental and natural resources management and planning. Identify the activities which run simultaneously with the principal steps of the project cycle. Give explanation for such simultaneous operation. **(9⅓)**
   (b) Write down the names of the Ecologically Critical Areas as designated by the Government of Bangladesh. **(8)**
   (c) Draw and label the Conceptual Framework for Environmental Impact studies. **(6)**

Contd P/2

CE 435

7. (a) The Directional Graph (Di-Graph) in figure-1 shows the possible impacts of a proposed housing project near Gazipur. Explain the Di-graph in details. Also, mention the implication of Loop "A" in the diagram. **(9⅓)**

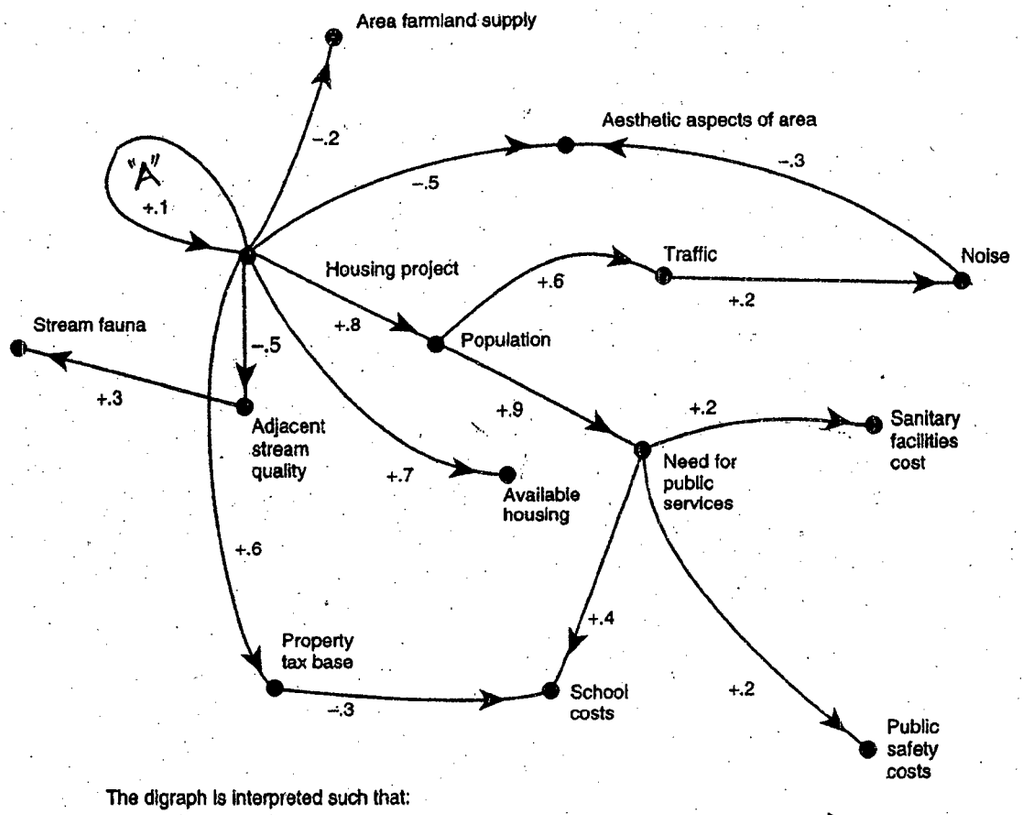


Fig. 1 for Ques No. 7(a)

(b) "Exposure standards are set to mitigate the negatively valued impacts" - Justify the statement with example. **(8)**

(c) List the limitations of the Environmental Conservation Rules '97. **(6)**

8. (a) The Hollywood movie "Erin Brockovich" is based on a true story of a catastrophic environmental pollution caused by a major industry in USA. **(9⅓)**

(i) Briefly describe the story of the disaster as depicted in the movie.

(ii) There are cases of environmental pollution in Bangladesh caused by the same pollutant as shown in the movie. What type of industries caused this pollution and where? What are the possible impacts of these industries?

(iii) What remedial measures do you suggest to mitigate the impacts of this pollution? How do you think one can prevent future pollution caused by these industries?

(b) Draw the schematic diagram showing the Environmental Chain Approach, with corresponding standards. **(8)**

(c) Briefly explain, with example, how behavioral standards influence human needs. **(6)**

L-4/T-2/CE Date : 19/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **WRE 411** (Hydraulic Structures)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Write short notes on (i) Weir and barrage, (ii) Pond level and Afflux. **(5)**

   (b) With neat figures, explain difference between aqueduct and canal-syphon. **(6)**

   (c) Design a suitable cross-drainage work by using the following data. See Figure 1. **(12⅓)**

Full supply discharge	= 32 cumec
Full supply level	= RL 213.5 m
Canal bed level	= RL 212.0 m
Canal bed width	= 20 m

   Trapezoidal canal section with 1.5 H : 1 V slopes. Canal water depth = 1.5 m

   Drainage:

High flood discharge	= 300 cumec
High flood level	= 210.0 m
High flood depth	= 2.5 m
General ground level	= 212.5 m

   Determine (i) Drainage waterway and (ii) Canal waterway.

2. (a) A barrage is to be constructed on a river having a high flood discharge of about 8200 cumec, with the given data as follows. **(13⅓)**

Average bed level of river	= 250 m
High flood level (before)	= 255.2 m
Permissible Afflux	= 1.0 m
Pond level	= 253 m

   Assume safe exit gradient $\frac{1}{6}$, Lacey silt factor = 0.8, 0.5 m retrogression and 20% discharge concentration. Determine (i) waterway, (ii) crest levels of under-sluices and barrage bays and (iii) Design of under-sluice portion at high flood condition discharge concentration and retrogression.

   (b) Explain Kholsa's theory and concept of flow nets. **(5)**

   (c) Define 'concentration factor' and 'retrogression'. **(5)**

3. (a) Use Khosla's theory and relevant equations to calculate the percentage uplift pressures at the three cut-offs for a barrage foundation profile shown in Figure 2. Use slope correction for 1 in 4 is 3.3%. **(10⅓)**

   (b) What are the main causes of failures of weirs on permeable foundations? **(8)**

   (c) What factors govern the selection of a suitable type of cross-drainage work? **(5)**

Contd P/2

WRE 411

4. (a) Draw a typical layout of Diversion head works and indicate the various components of the system. Briefly indicate the function of each component. **(10)**

(b) Write short notes on (i) Stream lines and equipotential lines, (ii) Inverted filter and launching apron, (iii) Critical exit gradient. **(6)**

(c) What are the corrections applied for determining the percentage of pressure at various keypoints of a hydraulic structure? Why it is needed? **(7⅓)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Define hydraulic structure. Mention its major characteristics. **(5)**

(b) The section of a non-overflow portion of a gravity dam built of concrete is shown in Figure 3. Neglecting earthquake forces, calculate- **(18⅓)**

(i) the maximum vertical stresses at the toe and heel of the dam, and

(ii) the intensity of shear stress on a horizontal plane near toe. Assume unit weight of concrete as 24 kN/m^3.

6. (a) Write short notes on (i) radial gate, and (ii) bear-trap gate. **(4+4)**

(b) Briefly describe the salient features of shaft spillway. **(6)**

(c) Discuss the methods of energy dissipation to solve the problem for Class 3 condition. **(9⅓)**

7. (a) Briefly describe the classifications of dam. **(6)**

(b) Discuss the load combinations in the case of 'reservoir full' during the design of a gravity dam. **(5)**

(c) Given the ogee spillway of Figure 4 with coefficient of discharge of 3.8, find the total force of the water on the curved section AB. **(12⅓)**

8. (a) Explain the effect of tail water depth on the character and location of a hydraulic jump. **(6)**

(b) Write short note on tension failure of gravity dam. **(5)**

(c) Determine the crest elevation and the shape of an overflow spillway section having a vertical upstream face and a crest length of 250 ft. The design discharge is 75000 cfs. The upstream water surface at design discharge is at an elevation of 1000 ft and the average channel floor is at an elevation of 880 ft. Relevant chart is provided in Figure 5. **(12⅓)**

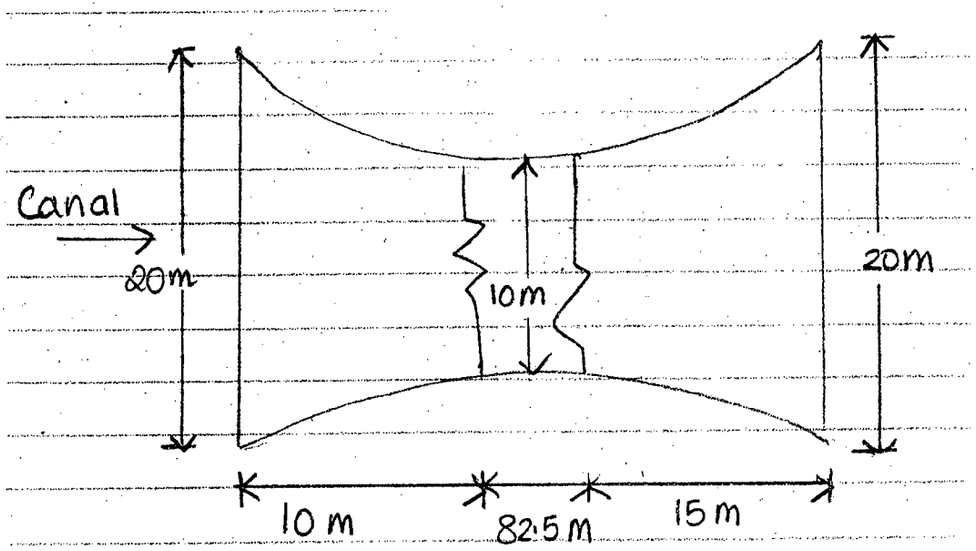


Figure 1 for Q: 1(c)

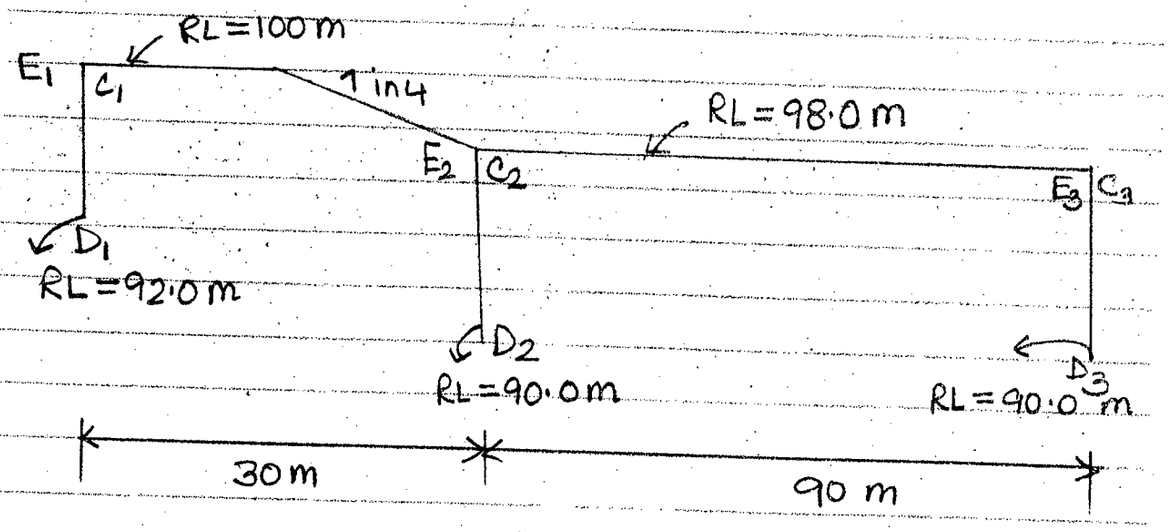


Figure 2 for Q: 3(a)

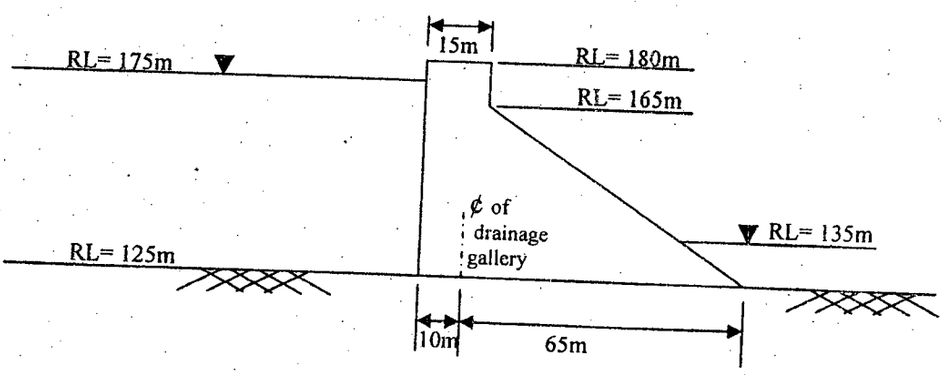


Figure 3 for Q.5(b)

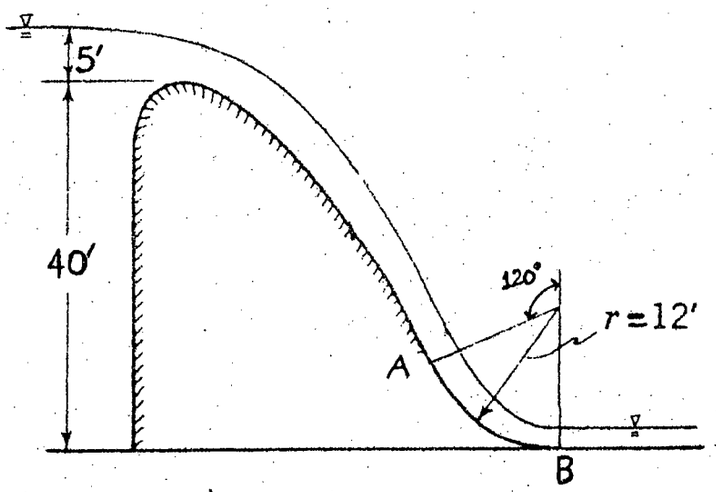


Figure 4 for Q.7(c)

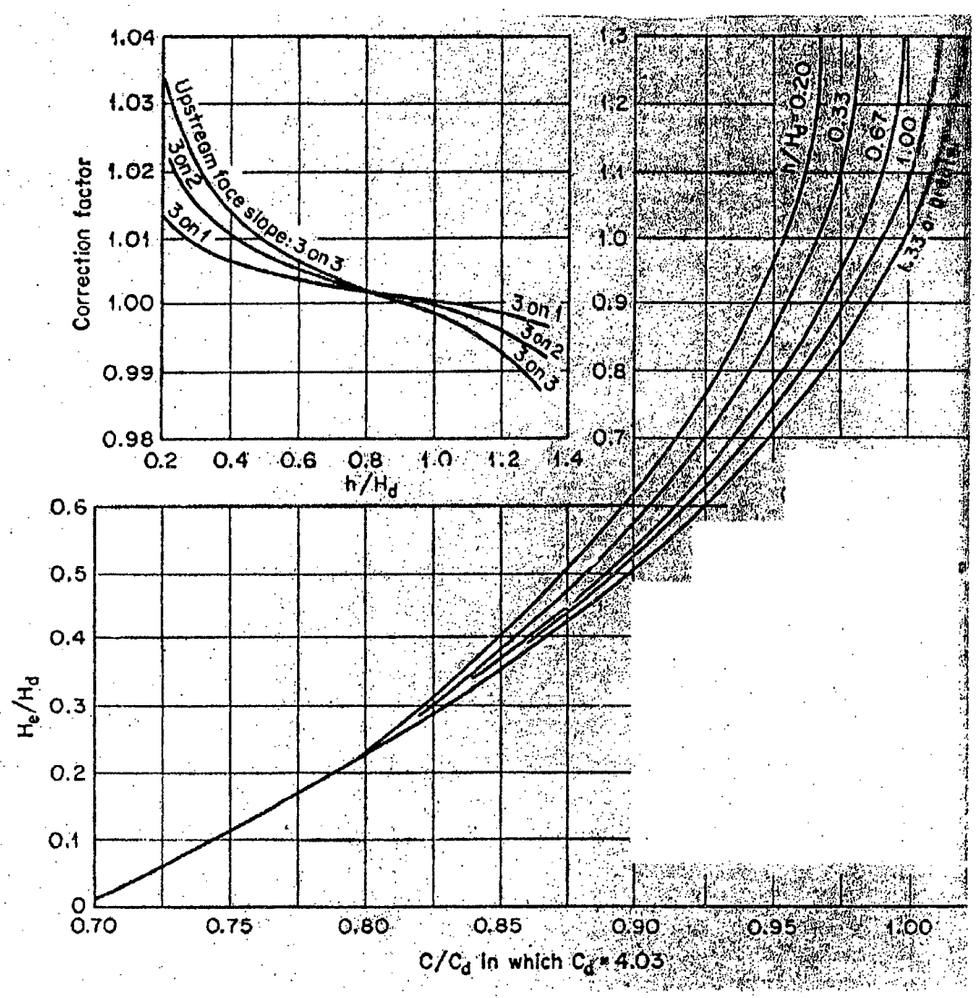


Figure 5 for Q.8(c)

L-4/T-2/CE **Date : 29/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 431** (Environmental Engineering-III)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What are the factors controlling the selection of site for a Transfer Station? **(6)**

(b) Draw the flow chart showing the inter-relationship among the functional elements of the solid waste management system. Also, briefly explain the inter-relationship among the functional elements. **(7)**

(c) A small township has plans to set up a Waste to Energy facility to generate their own power from the daily waste collected by the city corporation. Waste generation rate was found to be 3.5 kg/capita/day. The percentage distribution of the different components and the corresponding energy value for each component are provided in the following Table. Dry Ash and Metal free wastes may only be used in the proposed Energy Recovery Plant. If this plant is designed to generate at least 10000 Giga-Joules per day, how many households (with average family size of 8 persons) must participate in the Waste to Energy program to make it successful. **(10 ⅓)**

Component	% Dry Mass	Typical Energy Value (kJ/Kg)
Food Waste	70	4700
Paper	10	16700
Cardboard	2	16000
Plastics	10	32600
Rubber	5	23300
Tin Cans	1	700
Ash	2	7000

2. (a) What are the most important properties one should know if one wants to use solid waste as fuel? **(6)**

(b) List the names of the different types of Transfer Stations. Write descriptions on these types with appropriate diagrams. **(7)**

(c) A newly constructed shopping complex in Dhaka Cantonment area is planning to set up a solid waste collection system using large containers (drop boxes), some of which will be used in conjunction with stationary compactors. Based on traffic studies it is estimated that the average time to drive from the depot to the first container location and from the last container location to the depot each day will be 20 and 15 minutes, respectively. It takes 24 minutes per trip to pickup and drop off the containers and 8 minutes to unload the containers at the disposal site. If the average time required to drive between the containers is 6 minutes and the one-way distance to the disposal site at Amin Bazar is 15.5 miles for speed limit of 55 mph, determine the number of containers that can be emptied per day, based on an 8-hr workday. Assume, the workers spend 1 hour 15 minutes for lunch and other necessary stoppage. Also, assume the haul speed constants a and b to be 0.016 hr/trip and 0.018 hr/mile, respectively. **(10 ⅓)**

Contd P/2

CE 431

3. (a) List the factors governing the solid waste generation rate. Provide examples for each. **(6)**

(b) "Use of volatile matters in expressing the Biodegradability of solid waste is not an appropriate approach" - Explain, citing of the mathematical expression for biodegradability **(7)**

(c) Draw the definition sketch for allocation of solid waste from five transfer stations to three disposal sites. Write the mathematical expressions for minimization of haul cost for the above. Also, enumerate the appropriate assumptions and constraints with the corresponding mathematical expressions. **(10 ⅓)**

4. (a) Define the two methods used to estimate Waste Quantities. **(6)**

(b) Draw the schematic diagram showing the operational sequences of conventional HCS and SCS. Write the definitions with mathematical expressions of the Terms for each of these systems. **(7)**

(c) The following average speeds (y) were obtained for various round-trip distances (x) to a disposal site. Using the graphical method, find the haul speed constants a and b for the haul speed equation represented by a rectangular hyperbola;

$$y = \frac{x}{a + bx}$$

Also, find the round-trip haul time for a site that is located 21 km away. **(10 ⅓)**

Round-trip Distance x (km)	Average Haul Speed y (kph)
3.2	27.4
8.0	45.1
12.9	51.5
19.3	57.9
25.7	64.4
32.2	67.6
40.2	72.4

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Discuss briefly the ultimate disposal methods of solid wastes. **(7 ⅓)**

(b) What are the main features of the different landfill development levels in developing countries? **(6)**

(c) How will you manage storm water in a landfill site? Explain. **(6)**

(d) Mention the typical composition of landfill gasses. **(4)**

Contd P/3

CE 431

6. (a) List the area exclusion criteria for selecting a landfill site. **(6)**

(b) What are the important factors in the design of a leachate treatment system? Summarise the leachate treatment options. **(9⅓)**

(c) The following three soil layers are lying between the base of a landfill and the underlying aquifer. How long will it take for leachate to migrate to the aquifer? Also, calculate the amount of leachate flowing down if the landfill area is 60 hactare. **(8)**

Soil layer	Depth (m)	Porosity (%)	Permeability (m/s)
A	2.5	45	3.5×10^{-8}
B	3.5	39	2.8×10^{-9}
C	2.0	42	6.3×10^{-7}

7. (a) List the potential environmental impacts of landfill gases. **(8)**

(b) Why and how will you recover gas from a landfill? **(5)**

(c) Describe briefly the recycling process of solid wastes in Bangladesh. **(5⅓)**

(d) Calculate the required landfill capacity for a community for the year 2030 from the following data:

Projected population (for 2030) = 15,00,000

Per capita generation rate = 5.4 lb/cap/d

Diversion factor = 0.20

Compacted waste density = 42.6 lb/cft

Assume a soil daily cover is used that accounts for 15% of the landfill volume. **(5)**

8. (a) What is a hazardous waste? Sketch the human exposure pathways for hazardous wastes. **(5)**

(b) Draw a flow sheet for hazardous waste treatment and disposal facilities. **(7)**

(c) List the standard for deep burial of hospital wastes. **(6⅓)**

(d) What are the problems of hazardous waste management in developing countries? **(5)**
