L-4/T-2/CE **Date : 01/04/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **CE 455** (Transportation Engineering IV: Pavement Management, Drainage and Airport)

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**.

Assume any reasonable value of missing data.

1. (a) Explain the basic concepts of "Effective Thickness Method of overlay design." Analyze the steps in overlay design. **(7⅓)**

   (b) Determine the overlay requirements of the existing pavements from the flowing data. **(8)**

Thickness of existing pavement	Thickness of new pavement
Granular sub-base: 300 mm	Granular sub-base: 400
Water-bound Macadam: 250 mm	Water-bound Macadam: 250 mm
Bituminous Binder: 100 mm	Bituminous Binder: 100 mm
Asphalt Concrete : 40 mm	Asphalt Concrete : 60 mm

   Assume Asphalt Institute Conversion factors for different layers of new and old pavements. Sub-base (0.1–0.2), Asphalt Concrete (0.5 – 1.0)

   (c) What does HDM-4 do? Analyze Project analysis and Strategic analysis by using HDM-4. **(8)**

2. (a) State the functions of an Airport sub-surface drainage system. Examine the Layout of Airport Sub-Surface drainage. **(8)**

   (b) The design of surface drainage system may be divided into two phase. What are these phases? Explain briefly. **(9⅓)**

   (c) Write short note on "Culvert types and Materials". **(6)**

3. (a) The distance between the furthest point in the turf covered drainage (with an average slope of 1.0% towards the drain) and the point of entry to side drain is 250 meter. The weighted average value of the runoff co-efficient is 0.265. The length of the longitudinal open drain in a sandy clay soil from the inlet point to the cross drainage is 500 meter. The velocity of flow in the side drain may be assumed 0.50 m/s so that silting and erosion are prevented. Find the design quantity of flow on the side drain for a 50 years period of frequency of occurrence of the storm. (Chart attached). **(9⅓)**

   (b) Diagnose the effects of maintenance and rehabilitation on pavement conditions. Break down the sources of surface water in highway drainage design. **(8)**

   (c) Evaluate the importance of highway drainage. **(6)**

4. (a) The maximum quantity of water expected in an open longitudinal drains on clayey soil is 1.2 m^3/sec. Design the X-section and longitudinal slope of Trapezoidal drain assuming the bottom width to be 1.0 meter and cross slope to be 1V : 1.5 H. Allowable velocity of flow in

Contd P/2

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Contd ... Q. No. 4

the drain is 1.25 m/sec and Mannig's roughness co-efficient is 0.02. Assume a free board = 0.15 m. **(10)**

(b) Explain "Pavement life cycle". **(6⅓)**

(c) Where should be the general locations of culvert? Differentiate between bridges and culverts. **(7)**

SECTION – B

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

5. (a) Discuss the concepts – 'Next Generation Air Transportation System' and 'Free Flight Air Traffic Control'. **(3+3)**

(b) State the factors to be considered for the site selection of an airport. Depict the components of an airport system for a large airport. **(3+6⅓)**

(c) Classify parking based on aircraft maneuver with respect to the terminal building. Discuss the salient features for designing 'Holding Fix'. **(4+4)**

6. (a) Compare the function of airport traffic control centre and airway traffic control centre. **(4)**

(b) Write the considerations for environmental study in airport planning. State the factors that affect runway orientation. Explain with diagrams different runway configurations. **(2+2+8)**

(c) State the factors that affect size of the apron. Discuss the frontal and satellite apron-gate system with neat sketches. **(2+5⅓)**

7. (a) Explain with diagrams the different concepts for designing an airport terminal building. **(7⅓)**

(b) Write short note on: (i) ILS; (ii) Jet Routes; and (iii) Threshold Marking. **(3×3)**

(c) Write the functions of bypass taxiway. Also, compare the right-angled and high-speed exit taxiways. **(3+4)**

8. (a) Explain with diagram the narrow-gauge pattern for runway lighting. **(5⅓)**

(b) Differentiate between VFR and IFR conditions. Explain culvert and ICAO system of runway approach lighting. **(2+8)**

(c) State the criteria for parallel runway numbering. Define TACAN. Write the differences in designing threshold lighting for small and large airport. **(2+2+4)**

Contd.... P/3

Distance, (m)

DISTANCE, METRES

Q 3(a)

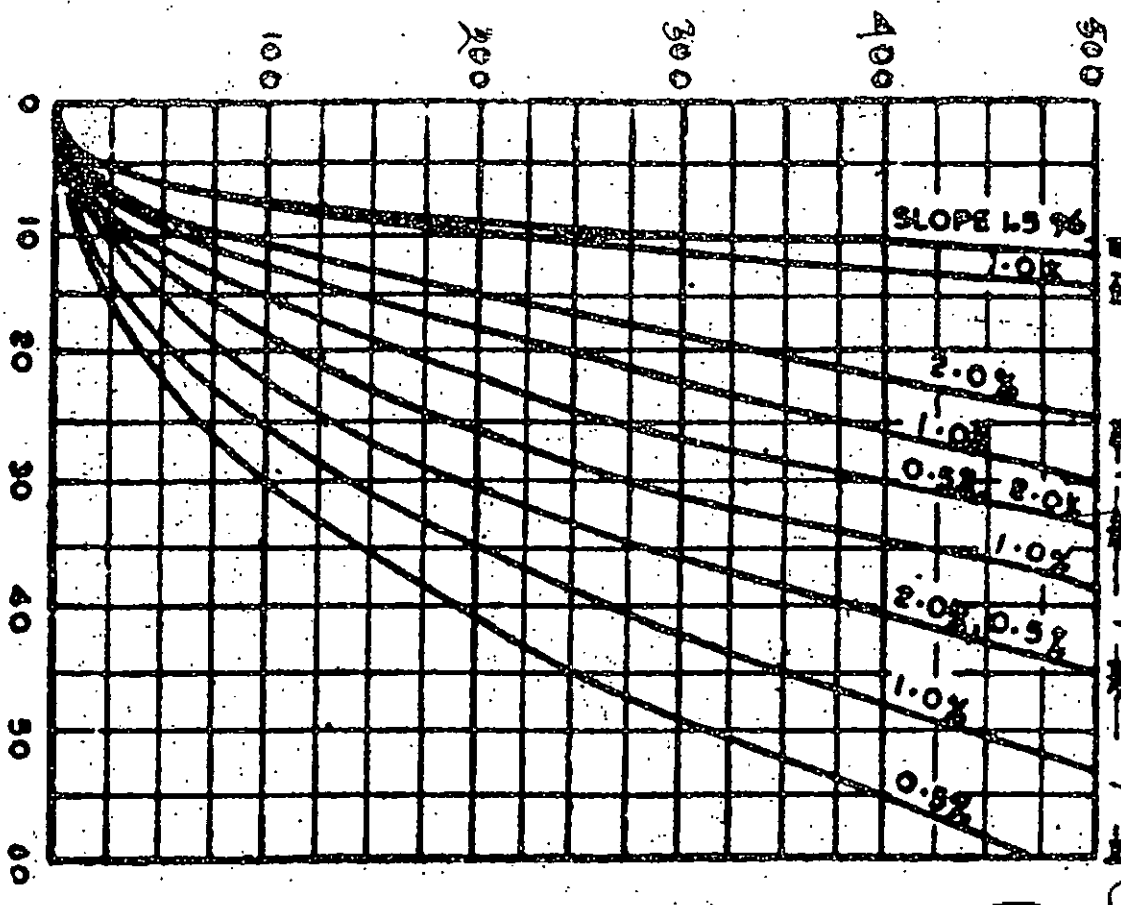
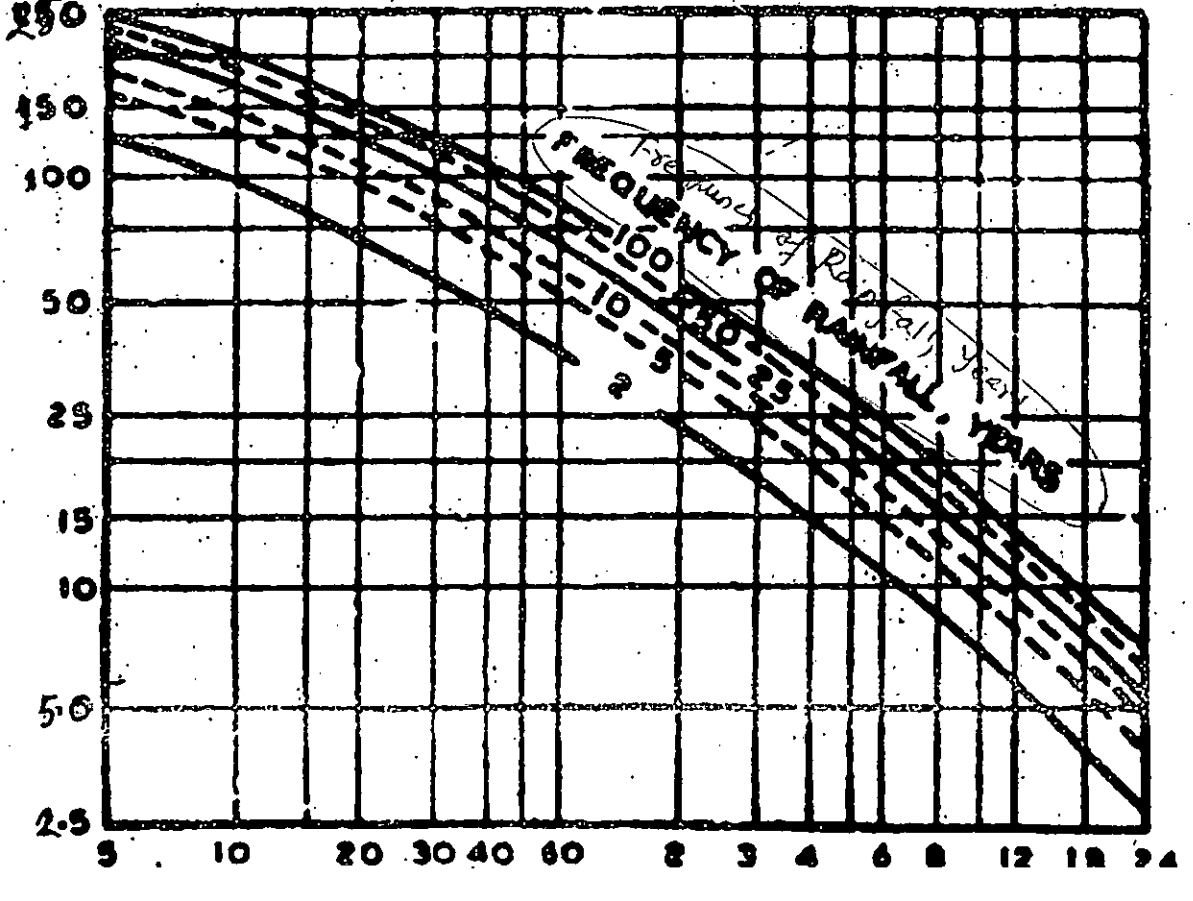


Fig. 1 Time of Flow to Inlet



L-4/T-2/CE **Date : 07/04/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **WRE 409** (River Engineering)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

Assume any reasonable value if necessary.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What are the uses of rivers? River water has to be utilized as major source of water supply for urban areas-Justify your answer. **(5⅓)**

   (b) Classify the rivers based on variation of discharge. **(10)**

   (c) Define: (i) Meander Width (ii) Crossover (iii) Sinuosity (iv) Tortuosity **(8)**

2. (a) Define fluvial process. Briefly describe the processes of river bank erosion. **(10)**

   (b) A meandering river is flowing with a discharge 40000 m^3/s. **(6)**

   Calculate:

   (i) Meander width (ii) Meander length (iii) Meander ratio

   (c) Explain the conditions favorable for cutoff development. **(7⅓)**

3. (a) Explain with help of sketch "Helicoidal Flow" in a river bend. **(8)**

   (b) A meandering river channel of radius of curvature 3 km has a bankfull flow area of 1000 m^2 and longitudinal slope is 1 m in 3 km. Calculate bankfull discharge. **(5⅓)**

   (c) What do you mean by hydraulic geometry? Bankfull discharge of the river Ganges is 43,000 m^3/s. Calculate the water surface width, mean depth and average velocity using the concept of at a station hydraulic geometry. **(2+8=10)**

4. (a) Write down the salient characteristics of aggrading and degrading rivers. **(6⅓)**

   (b) Distinguish between "Clear water scour" and "Live bed scour" **(5)**

   (c) Draw a figure showing different types of bridge scour. A bridge is going to built over Mahananda River where the section is 300 m wide. Calculate total scour (Construction and Local) for the following data: **(2+10=12)**

   Maximum discharge = 10000 m^3/s

   No of pier = 6 of each 2 m wide (cylindrical)

   Angle of attack = 30°

   Bed material size = 0.15 mm

   Reduced level of river bed = −1.5 m

   High water level = 4.5 m

   [Assume reasonable data if necessary]

Contd P/2

WRE 409(CE)

Cont. Q. no. 4(c)

Table for Question no 4.(c)

K_1 FOR PIER TYPE, AND CORRECTION FACTOR K_2 FOR ANGLE OF ATTACK OF THE FLOW

K_1 for pier type			Correction factor, K_2			
	Type of pier	K_1	Angle	$L/a = 4$	$L/a = 8$	$L/a = 12$
(a)	Square nose	1.1	0	1.0	1.0	1.0
(b)	Round nose	1.0	15	1.5	2.0	2.5
(c)	Circular Cylinder	1.0	30	2.0	2.5	3.5
(d)	Sharp nose	0.9	45	2.3	3.3	4.3
(e)	Group of cylinders	1.0	90	2.5	3.9	5.0

where Angle is the skew angle of flow, and
L is the length of pier.

SECTION – B

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

5. (a) Define: **(3×1=3)**

(i) Critical shear stress (ii) Suspended sediment load (iii) Hard point

(b) What are the different types of river training and bank protection techniques commonly used in Bangladesh? **(5⅓)**

(c) Write down the general consideration of designing an earthen dam or levee? Describe the main causes of failure of an earthen or levee with neat sketches. **(15)**

6. (a) Describe different types of groynes with neat sketches **(8⅓)**

(b) For the river Gangs, following data are given. **(15)**

Design discharge = 48,000 m^3/s

Highest Flood level = 10.5 m PWD

Bank full Water Level = 6.5 m PWD

Low water level = 2.5 m PWD

Bed material size = 0.18 mm

Design a guide bank for a barrage construction. Sketch your design.

7. (a) Write a short note on the peripheral rivers of Dhaka city. **(5⅓)**

(b) Describe different types of temporary measures to control river bed for navigation purposes with neat sketches. **(8)**

(c) Classify the waterway routes according to BIWTA and give example of each route. Discuss briefly the causes of deterioration of waterways in Bangladesh. **(5+5=10)**

Contd P/3

WRE 409(CE)

8. (a) What do you mean by hydraulic dredging? Briefly discuss on Payra Port Dredging Project. **(2+4 ⅓ =6 ⅓)**

   (b) Derive the relationship between Shield's entrainment function and particle Reynold number. **(7)**

   (c) Determine the critical size of which erosion of the non-cohesive bed materials of a river can just be prevented. The existing water depth is found as 1.2 m. and the flow velocity is determined as 1.22 m/s. The bed material has a specific gravity of 2.65 and its Manning's roughness value is 0.018. Assume any other data if needed. **(10)**

L-4/T-2/CE **Date : 07/04/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

B. Arch. Engineering Examinations

Sub : **CE 435** (Environmental Pollution Management)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable values for parameters not given.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) How do hydrocarbons affect the $NO\text{-}NO_2\text{-}O_3$ photochemical reaction sequence, and help to produce O_3 and other secondary pollutants? Explain. Can SO_2 promote formation of photochemical smog? Explain. **(8⅓)**

   (b) Derive an expression for determining the diameter of particle (dp) that would be removed with 100 % theoretical efficiency in gravitational settling chamber of length L and height H. A gravitational settling chamber has been designed such that all particles with diameter ≥ 40 μm are removed with 100% theoretical efficiency. Calculate the fractional removal efficiency of 25 μm particles in this settling chamber. Assume reasonable values for parameters, as needed. **(7)**

   (c) Draw a graph (qualitative) showing variation of carbon-di-oxide concentration in the atmosphere over time (last decades). Why do we observe a seasonal oscillation of carbon-di-oxide concentration in the atmosphere? **(8)**

2. (a) What is AQI? What are its purposes?

   On a particular day, air quality data recorded at a CAMS in Dhaka are as follows: **(8)**

   $PM_{2.5}$ (24-hr) = 185 μg/m^3

   PM_{10} (24-hr) = 280 μg/m^3

   O_3 (8-hr) = 155 μg/m^3

   CO (8-hr) = 8.0 ppm

   Determine AQI for each parameter, and report AQI for that particular day [Give: T = 23°C; P = 1 atm; Table for calculating AQI provided]

   (b) What do you understand by SLCP? How do "black carbon" and other atmospheric particulates affect global warming? Explain. **(7)**

   (c) What do you understand by stoichiometric ratio, lean mixture, and rich mixture? Explain the working principles of "Exhaust Gas Recirculation (EGR)" and "Thermal Reactor" devices in reducing automotive emission. **(8⅓)**

Contd P/2

CE 435

3. (a) A power plant burns 5.5 metric tons of coal per hour and discharge the combustion product through a stack with an effective height of 50 m. The coal has sulfur content of 4.5% and 25% of this sulfur is emitted as SO_2. Wind speed at instrument height (10 m) is 3.0 m/sec, and the atmosphere is characterized as "slightly stable".

Compute (i) ground level SO_2 concentration 2 km downwind along the center-line of the plume; (ii) ground level concentration 2 km downwind and 150 m off the center-line of the plume. **(10)**

[Given: p = 0.40; Table for calculation of dispersion coefficient provided]

(b) What are the important processes leading the emission of pollutants into the atmosphere? What are "primary" and "secondary" pollutants? What do you understand by aerodynamic diameter of particulate matter (PM)? **(6⅓)**

(c) What do you understand by "ambient" and "adiabatic" lapse rates? Explain how these lapse rates are used to define atmospheric stably (stable, unstable and neutral atmosphere). How does atmospheric stability affect air quality? Explain.

Determine the nature of atmospheric stability for each of the following situation of ambient atmosphere: **(7)**

(i) $dT/dz = 0$; (ii) $dT/dz = -\Gamma$; (iii) $dT/dz = -1.5\ \Gamma$.

4. (a) A highway has 525 vehicles passing a given spot per hour. Each vehicle, on an average, emits 9.5 g/km of Carbon Monoxide (CO). If wind speed is 2.5 m/sec perpendicular to the highway, estimate CO concentrations at 0.90 km downwind at a height of 25 m. Consider atmosphere to be "neutral". [Table for calculation of dispersion coefficient provided]. **(9)**

(b) What do you understand by "thermal NO_x" and "fuel NO_x"? Explain the adverse health effects of Carbon Monoxide (CO). **(6⅓)**

(c) What are the major anthropogenic sources of SO_x in the atmosphere? Identify the fuels with higher sulfur content. Explain the adverse impacts of SO_x on materials. **(5)**

(d) How do tropospheric ozone and stratospheric ozone affect global warming? Explain. **(3)**

SECTION – B

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

5. (a) Briefly discuss the measures that can be taken to control eutrophication. **(7⅓)**

(b) Define bioaccumulation. How does if differ from bioconcentration? Briefly describe the significance of bioaccumulation in toxicity impact of DDT on Human. **(6)**

(c) Two-thirds of the energy content of fuel entering a 1000 MW nuclear power plant is removed by condenser cooling water that is withdrawn from a local river (there are no stack losses). The river has an upstream flow of 100 m^3/s and a temperature of 20°C. **(10)**

Contd P/3

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Contd. Q. No. 5(c)

(i) If the cooling water is only allowed to rise in temperature by 10°C, calculate the flow rate required to be withdrawn from the river.

(i) Determine the river temperature after it receives the heated cooling water.

6. (a) With neat sketches explain the effect of temperature, NBOD, and multiple point sources on DO sag curve. **(8⅓)**

(b) A municipality is installing a treatment plant to treat the domestic wastewater. The proposed plan is to discharge treated effluent into a nearby river. Characteristics of the effluent and river (just upstream of the discharge point) are given below. **(15)**

Effluent:	**River Water**:	River depth = 3 m
Flow rate= 0.2 m^3/s	Flow rate = 0.8 m^3/s	River velocity = 0.3 m/s
Ultimate BOD = 40 mg/L	Ultimate BOD = 5 mg/L	BOD rate constant = 0.22 d^{-1}
DO = 1 mg/L	DO = 6 mg/L	(at 20°C)
Temperature = 28°C	Temperature 23°C	

There is an existing floating fish farm in the river, 10.4 km downstream of the discharge point, that would require a minimum DO level of 5 mg/L. As an engineer of DPHE, you have been asked to check whether the DO level at that point would satisfy the requirement for fish farming. Assume complete and instantaneous mixing of effluent and river water. [Note: Relevant table and equations are provided]

(i) Comment on the condition of the river for fish farming after the installation of the new treatment plant, on the basis of DO requirement only.

(ii) Calculate the time and distance to reach the minimum DO.

(iii) Estimate the minimum DO.

7. (a) Define NAPLs. With help of appropriate sketches, briefly describe the flow of light NAPLs and dense NAPLs through an aquifer. **(7⅓)**

(b) Define cultural eutrophication of a lake. List the characteristics of oligotrophic lakes and eutrophic lakes. **(6)**

(c) A lake with surface area of 100×10^6 m^2 is fed by a stream having a flow rate of 20 m^3/s with no phosphorus concentration. Agricultural runoff adds on average 0.2 g/s phosphorus into the lake. In addition, effluent from a wastewater treatment plant, with flow rate of 0.25 m^3/s and phosphorus concentration of 8 mg/L is discharged into the lake. **(10)**

(i) If the phosphorus settling rate is 10 m/yr, calculate the average phosphorus concentration in the lake.

(ii) Estimate the level of additional phosphorus removal required at the treatment plant to keep the concentration of phosphorus in the lake below 0.010 mg/L.

Contd P/4

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8. (a) Briefly discuss the effects that arsenic-contaminated groundwater may have on food chain and irrigated soil. **(7⅓)**

(b) Briefly discuss the principle of following Arsenic removal technologies: (i) Oxidation, (ii) Coagulation-Adsorption-Coprecipitation, and (iii) Adsorption. **(6)**

(c) List three groundwater remediation technologies. Leachate from a landfill infiltrate through a clay layer to the aquifer beneath it. Estimate the depth of clay layer required to keep the maximum concentration of a specific pollutant in the aquifer 10% of that in the landfill for 100 years. Coefficient of molecular diffusion for the clay layer is 8.5×10^{-6} m^2/d. [Note: Relevant table and equations are provided] **(10)**

Contd.... P/5

Table for calculation of AQI [for Question No. 2(a)]

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

Table for estimation of dispersion coefficients [for Questions 3(a) and 4(a)]

		$x \le 1$ 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

[a] The computed values of σ will be in meters when x is given in kilometers.

$\sigma_y = a.x^{0.894}$

$\sigma_z = c.x^d + f$

Contd.... P/6

Table for Saturation values of dissolved oxygen in freshwater **(for Ques. 6(b))**

Temperature (°C)	Oxygen Solubility (mg/L)
0	14.62
5	12.80
10	11.33
15	10.15
20	9.17
25	8.38
30	7.63

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

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

$k_r = \frac{3.9\sqrt{u}}{H^{3/2}}$; at 20°C

Temperature correction,

$$k_{r,T} = k_{r,20}(1.024)^{T-20}$$

Equations for Ques. 6(b)

The complementary error function table **(for Ques. 8(c))**

x	erfc(x)	x	erfc(x)
0	1.0		
0.05	0.943628	1.1	0.119795
0.1	0.887537	1.2	0.089686
0.15	0.832004	1.3	0.065992
0.2	0.777297	1.4	0.047715
0.25	0.723674	1.5	0.033895
0.3	0.671373	1.6	0.023652
0.35	0.620618	1.7	0.016210
0.4	0.571608	1.8	0.010909
0.45	0.524518	1.9	0.007210
0.5	0.479500	2.0	0.004678
0.55	0.436677	2.1	0.002979
0.6	0.396144	2.2	0.001863
0.65	0.357971	2.3	0.001143
0.7	0.322199	2.4	0.000689
0.75	0.288844	2.5	0.000407
0.8	0.257899	2.6	0.000236
0.85	0.229332	2.7	0.000134
0.9	0.203092	2.8	0.000075
0.95	0.179109	2.9	0.000041
1.0	0.157299	3.0	0.000022

$\text{erfc}(x) = 1 - (2/\sqrt{\pi})\int_0^x e^{-\epsilon^2} d\epsilon$

$\text{erfc}(-x) = 2 - \text{erfc}(x)$

[a] Adapted from Freeze and Cherry (1979).

For low velocities,

$$C(x,t) = C_0\left[erfc\left(\frac{x}{2\sqrt{D^* t}}\right)\right]$$

For large t or large velocity,

$$C(x,t) = \frac{C_0}{2}\left[erfc\left(\frac{x - \bar{v}_x t}{2\sqrt{D_x t}}\right)\right]$$

Equations for Ques. 8(c)

L-4/T-2/CE **Date: 03/04/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

B. Sc. Engineering Examinations 2017-2018

Sub: **CE 443** (Earth Retaining 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) List five main causes that may induce lateral load to foundations. List the common methods for analyzing foundations subject to lateral loads. **(5)**

   (b) Write down the step-by-step procedure for designing reinforced-earth retaining wall using metallic strip reinforcement. **(5)**

   (c) Determine the factor of safety against sliding for the rectangular footing (2.0 m × 2.5 m) shown in the **Fig. 1**. Is the footing safe against sliding? Describe the effect of water table on the stability against sliding? **(13 1/3)**

2. (a) List the common uses of retaining walls. Briefly describe the main components of a retaining wall with metallic strip. **(5)**

   (b) List the common types of retaining wall drainage. Draw schematic diagrams of the drainage systems. **(5)**

   (c) Determine the factor of safety against sliding and overturning failure for the retaining wall shown in the **Fig. 2**. Ignore the passive resistance in front of the wall. Comment on the safety against overturning and sliding. What will be the effect on the factor of safety, if you consider the passive resistance in front of the wall? Unit weight of concrete, γ_{conc} =24 kN/m^3. **(13 1/3)**

3. (a) Show the main components of a cofferdam in neat sketch. What do you mean by "Failure by Bottom Heaving? How such failure can be prevented? **(5)**

   (b) Discuss briefly the phenomenon of 'earth pressure on braced cofferdam in soft clay'. Why does the earth pressure on braced cofferdam in stiff clay change over time? **(5)**

   (c) A braced excavation system for an open cut is shown in the **Fig. 3**. Determine the force in the struts **A, B** and **C**. The struts are spaced 3 m center-to-centre in plan. **(13 1/3)**

4. (a) Draw schematic diagrams of different caissons. List the advantages of pneumatic caissons. **(5)**

   (b) Briefly describe the general construction procedure of caissons. **(5)**

   (c) Will the caissons shown in the **Fig. 4** be self sinking? If not determine: (i) the required amount of ballast and (ii) the thickness for self sinking. Calculate the allowable load capacity (Factor of Safety, FS = 3.0) on the caissons. **(13 1/3)**

   Given, for $\phi = 34°$, $N_q = 36.5$, $N\gamma = 36.0$ and $S\gamma = 0.6$.

Contd P/2

CE 443

SECTION - B

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

5. (a) What do you mean by slurry trench wall? Comment on the desirable properties of slurry. Discuss advantages and applications of slurry trench wall construction. **(11 1/3)**

   (b) Describe with neat sketches, the following methods of dewatering: **(3×4=12)**

   (i) Cut-off wall
   (ii) Electro-Osmosis
   (iii) Well points

6. (a) Present neat sketches of various sections of steel sheet piles. Briefly discuss their applications. **(6)**

   (b) Write short notes on (Present neat sketches) **(4×2=8)**

   (i) Tromie concreting
   (ii) Deadman (anchorage)

   (c) Discuss methods to determine or estimate modulus of horizontal subgrade reaction. **(3 1/3)**

   (d) Using Broms method, determine the allowable lateral load on a 20 inch dia 30 ft long fixed-head pile in cohesionless soil. Assume worst case scenario regarding ground water able (GWT). Soil properties are: Unit weight (above GWT) = 110 pcf. Unit weight (below GWT) = 118 pcf, Angle of internal friction = 30°. Assume yield moment of pile = 80 kip-ft. **(6)**

7. (a) What do you mean by p-y curves? Briefly describe the use of computational p-y curves method. **(5)**

   (b) How do you consider the effect of unbalanced water pressure in sheet pile design? Discuss. **(4 1/3)**

   (c) Determine the length of a cantilever sheet pile retaining 3 m of sandy backfill material overlying silty sand deposit as shown in Fig. 5. A sur charge of 12 kN/m^2 acts on top of backfill. Ground water table is at a depth of 1.5 m from top of backfill. Soil properties are given in the figure. **(14)**

8. (a) Determine the required length of anchored sheet pile, shown in Fig. 6, retaining 7 m of sandy backfill material but embedded in silly clay deposit. Determine the size and spacing of mild steel tie-rod. Comment on the drainage condition considered. **(18)**

   (b) With neat sketches, show different types of anchorage systems for anchored sheet piles. **(5 1/3)**

Contd.... P/3

CE 443: Earth Retaining Structures (Sec. A)

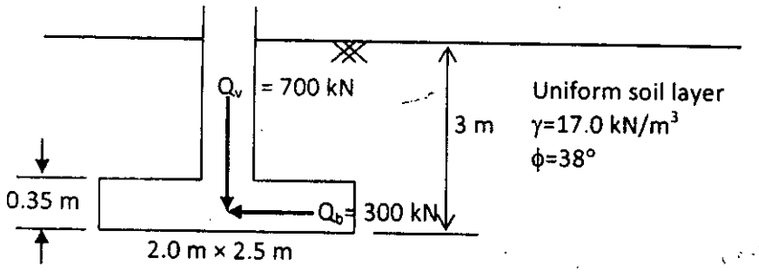


Fig. 1. for Q. 1(c)

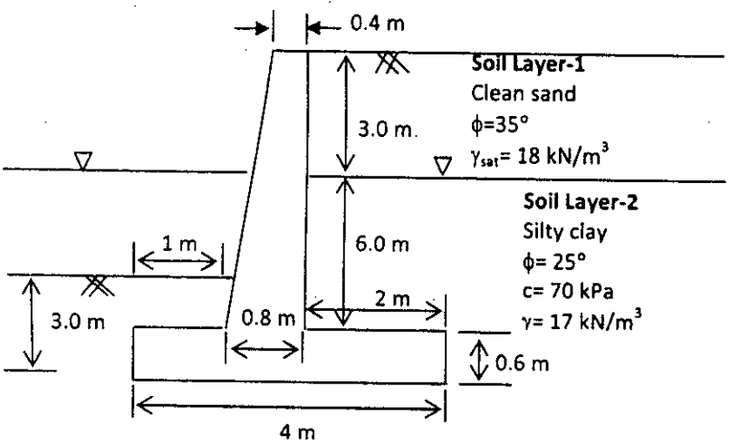
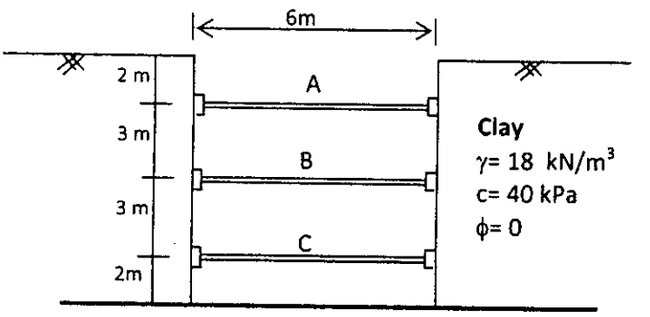


Fig. 2. for Q. 2(c)



Bottom of excavation, Water table is at greater depth

Fig. 3. for Q. 3(c)

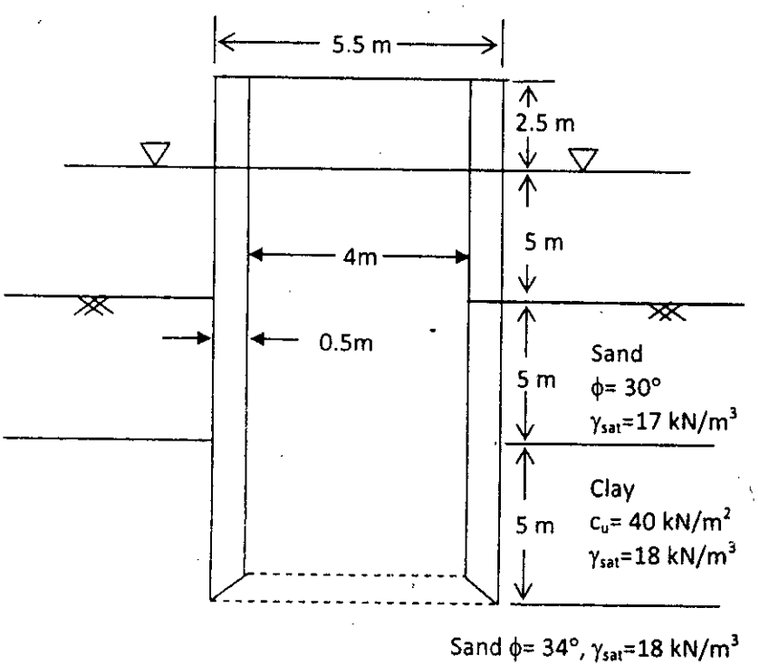


Fig. 4. for Q. 4(c)

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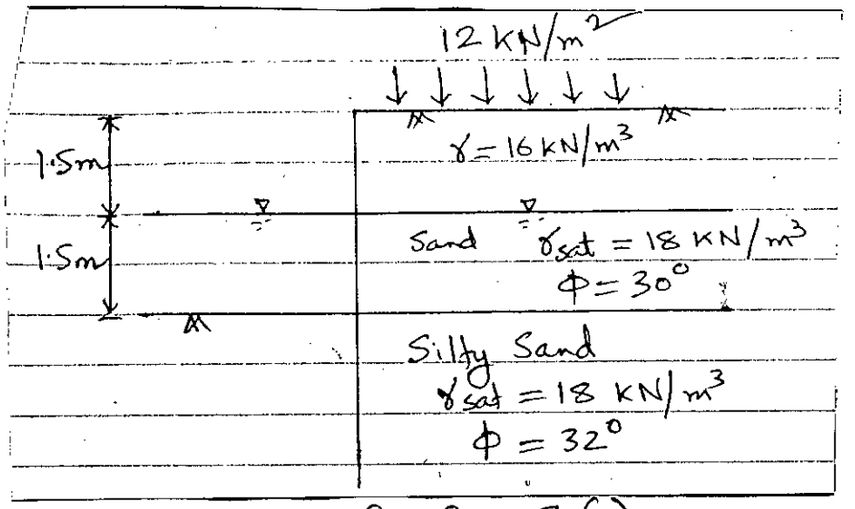


Fig. 5 for Ques 7(c)

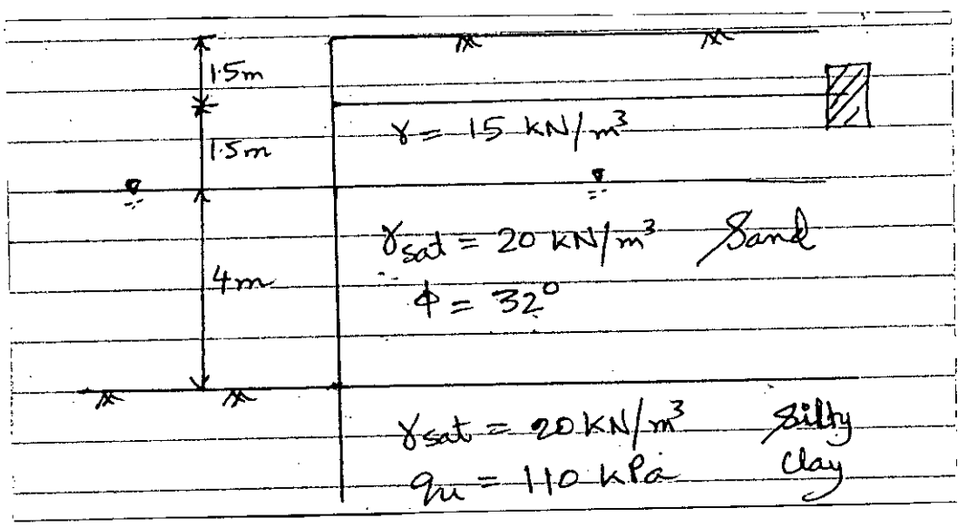


Fig. 6 for Ques 8(a)

contd.... P/5

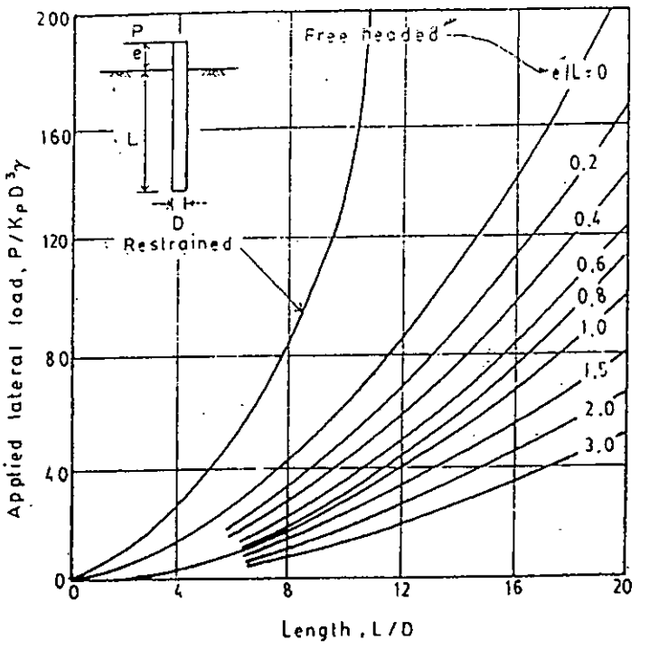


Chart 1

Ultimate lateral registance for cohesionless soils related to embedment length. After Bengt B. Broms

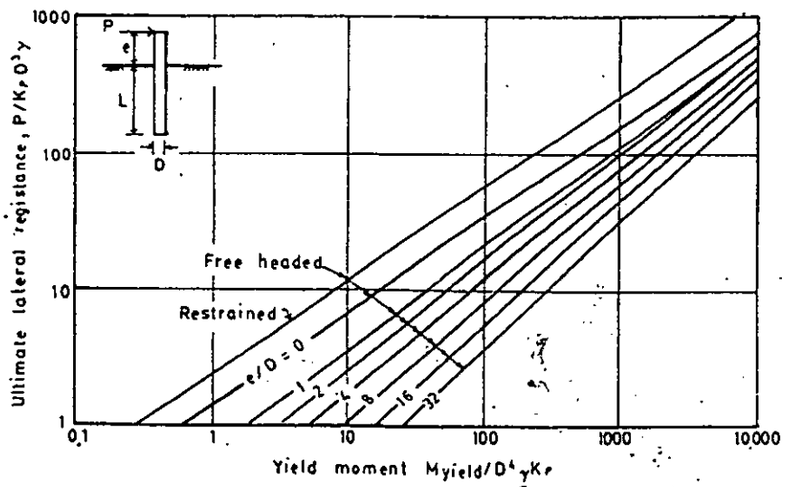


Chart 2

Ultimate lateral registance for cohesionless soils related to yield moment. After Bengt B. Broms

L-4/T-2/CE Date : 09/04/2019

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

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

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 short note on (i) modern concrete weir with vertical glacis (ii) Design consideration of a divide wall. **(3+2=5)**

   (b) Discuss the methods for barrage regulation and silt control at diversion head works. What are the functions of a head regulator? **(4+3=7)**

   (c) Describe the design considerations of the components of a silt excluder and state the limitations of the silt excluder. **(11⅓)**

2. (a) Differentiate between the weir and barrage with sketch. Discuss the correction of seepage pressure for floor thickness and slope. **(3+5=8)**

   (b) Discuss the "Lane's weighted creep theory" with sketch and formulation. Differentiate between the streamlines and equipotential lines according to the Khosla's theory and concept of flow nets. **(5+5=10)**

   (c) Show that for sandy rivers, magnitude of the critical exit gradient is unity. **(5⅓)**

3. (a) Design a suitable cross drainage works, Given the following data: **(16)**

   (i) Irrigation Cannal:

   Full Supply Discharge: 354 cumecs
   Bed Width: 24 m
   Full Supply level: 207. 6 m
   Canal Bed Level: 201.4 m
   Side Slopes: 1 H:2V

   (ii) Natural Discharge:

   High Flood Discharge: 600 cumecs
   Drainage bed level: 203.6 m
   High Flood Level: 206.3 m

   (b) Discuss the types of the aqueduct and syphon aqueduct with sketch. **(7⅓)**

4. (a) Write short note on the followings: (i) design considerations for pucca canal through of cross drainage works (ii) Fluming of the canal of aqueduct and syphon-aqueduct. **(4+4=8)**

Contd P/2

WRE 411(CE)

Contd...Q. No. 4

(b)The concrete floor of a head regulator as shown in Figure 1 is level with the canal bed and is 13 m long. The floor is provided with cutoff walls at its upstream and downstream ends. The depth of upstream cutoff is 1.5 m and that of the downstream wall is 2 m. Using Khosla's theory determine the thickness of the floor at its mid length and also at its junction with the upstream and downstream walls. The floor thickness may not be less than 30 cm anywhere. The upstream FSL is 1.5 m above the floor level. Assume reasonable value for any missing information. **(15⅓)**

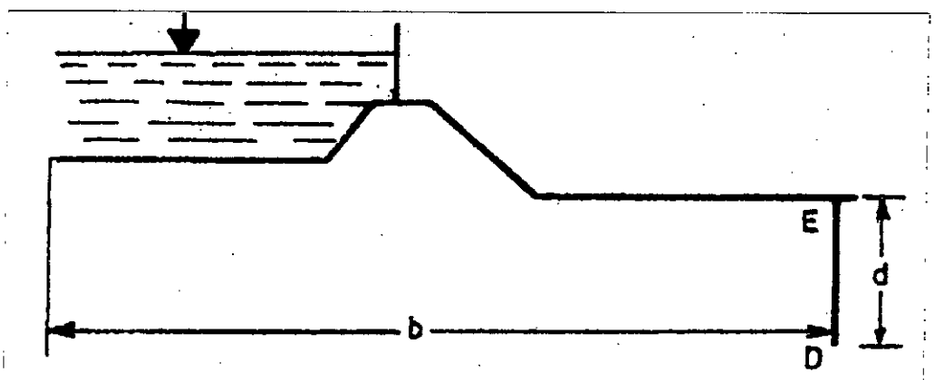


Figure 1

SECTION – B

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

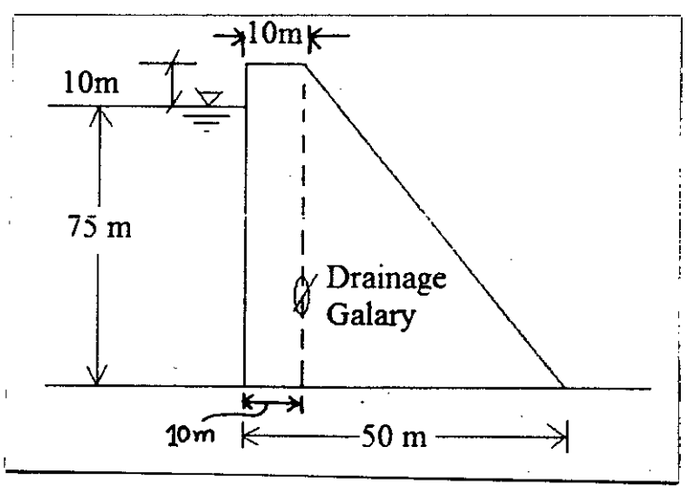
5. (a) Discuss the problem of dam construction. **(5)**

   (b) Draw a typical cross section of a reservoir and show various storage zones. **(8⅓)**

   (c) Discuss following governing factors for the selection of particular types of dam: (i) Geology and foundation condition, (ii) Spillway size and location. **(10)**

6. (a) What is a gravity dam? Write down different forces acting on a gravity dam. **(5)**

   (b) Following figure shows the cross-section of a gravity dam. Neglecting earthquake forces, calculate- (i) Maximum vertical stress at heel and toe. (ii) Major principal stresses at heel and toe. Assume any reasonable values if not given. Assume there is no tail water and the unit weight of concrete is 24 kN/cubic m. **(18⅓)**



WRE 411(CE)

7. (a) Monthly inflow rate during a low-water period at the site of a proposed dam are tabulated in col-2 of the following table. Monthly pan evaporation and precipitation are given in the col.-3 and col-4. Prior water rights make it obligatory to release full natural water flow or 12 ha-m., whichever is minimum. Estimated monthly demands are shown in col-5. The net increased pool area is 400 hectres. Assume pan evaporation coefficient to be 0.75. **(18⅓)**

Month	Inflow at Dam site (ha-m.)	Pan evaporation (cm)	Precipitation (cm)	Demand (ha-m.)
1	1.3	1.8	1.3	15.8
2	0	1.8	1.7	14.3
3	0	2.6	0.6	9.6
4	0	10.2	0	4.8
5	0	15.4	0	3.5
6	0	1.6	1.1	3.4
7	240	10.8	16.1	5
8	430	11.7	16.4	5
9	1	10.8	2.2	10
10	0.6	9.6	0.8	15.6
11	0.5	7.8	0	16.8
12	0.2	2	0	16.8

(b) Draw a typical cross section of Syphon type and Shaft type Spillway. **(5)**

8. (a) Differentiate between storage basin and retarding basin. **(5)**

(b) Design the downstream portion of an Ogee spillway for a dam having following characteristics. The u/s is vertical and the downstream portion is having a slope of 0.7H:1V. The design discharge is 7500 cumecs. The height of spillway crest is kept at RL 300 m. And the bed elevation is 180 m. Spillway length consists of 6 spans having clear width of 10 m each. Pier thickness is 2.5 m. Assume $K_p = 0.01$, $K_a = 0.1$. **(18⅓)**

L-4/T-2/CE Date : 09/04/2019

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **CE 433** (Solid and Hazardous Waste Management)

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) Explain with diagram the hierarchy of solid waste management options. Provide appropriate example for each option. **(6)**

(b) The second solid waste dumpsite of the DCC is located near the Boliapur near Amin Bazar of Savar. Based on the factors governing the selection of the location for Transfer station, briefly discuss why it would have been wise to use the site for Transfer station rather than a dumpsite. **(6)**

(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; **(11 ⅓)**

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

Also, find the round-trip haul time for a site that is located 10 miles away.

y (mi/hr)	10	21	30	34	37.5	38.0	39.5	39.8	40
x (mi/trip	9.8	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0

2. (a) Draw the typical weekly and daily MSW generation rate curves for BUET Area. Explain the nature of the curves according to the salient features. **(6)**

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

(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. **(11 ⅓)**

3. (a) What are the primary properties to be known to use the MSW as fuel? List the tests required to asses these primary properties. **(6)**

(b) Draw the schematic diagram showing the operational sequences of conventional HCS and Exchange Mode HCS. Write the definitions with mathematical expressions of the Terms for each of these systems. Identify the major differences. **(6)**

Contd P/2

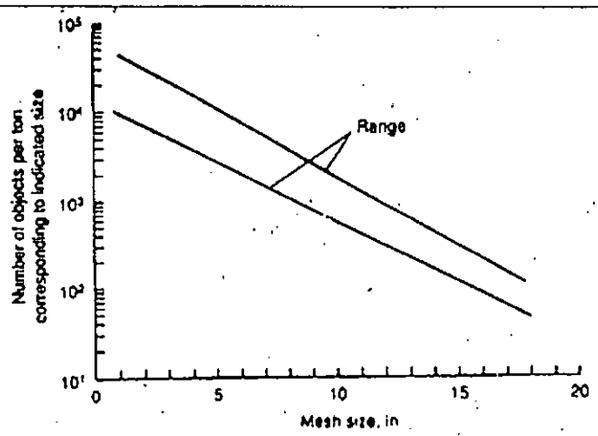
CE 433

Contd...Q. No. 3

(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 compactions. 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 pick-up 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. **(11 ⅓)**

4. (a) Write the mathematical expression for assessing the compressibility of Municipal Solid Waste and briefly explain with appropriate example on use of the information. **(6)**

(b) Briefly describe the information that can be extracted from the two sets of graphs shown. Also, explain the use of the extracted information in the solid waste management system. **(6)**



Typical sizes of individual components comprising residential and commercial MSW [4, 12].

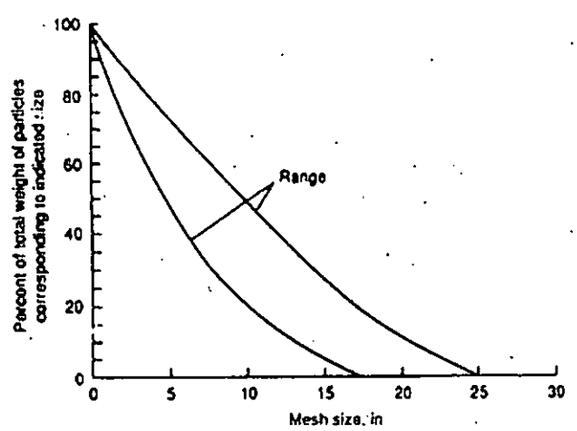


Figure for Question No. 4(b).

Percentage of total mass of residential and commercial MSW as a function of mesh size [4, 12

Contd P/3

CE 433

Contd...Q. No. 4

(c) An enterprise gave you the responsibility to assess the feasibility of setting up a waste to energy facility. In this context you collected solid waste sample from a residential area and analyzed each component individually to determine the energy content (see table). If the community plans to recycle parts of its wastes afterwards by separating 30% of paper, 80% of cardboard and 50% of plastics, estimate the energy content in BTU/lb of the source separated waste. How is this source separation going to affect the feasibility of the waste to energy facility? **(11⅓)**

Component	Solid Wastes, lb	Energy (BTU/lb)
Food wastes	8	2000
Paper	35.8	7200
Cardboard	6.4	7000
Plastics	6.9	14000
Textiles	1.8	7500
Rubber	0.4	10000
Leather	0.4	7500
Garden trimmings	17.3	2800
Wood	1.8	8000
Glass	9.1	60
Tin cans	5.8	300
Aluminum	0.6	---
Other metals	3	300
Dirt, Ash, etc.	2.7	3000

SECTION – B

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

5. (a) What is a sanitary landfill? Describe the area method of landfilling. **(6)**

(b) Draw a layout plan of a sanitary landfill and lebel it. **(6⅓)**

(c) List the problems of indiscriminate dumping of solid wastes in cities in low-income countries. **(5)**

(d) Estimate the percolation of leachate through a landfill of 15 m deep with a 0.75 m final cover of silty clay for the following data: **(6)**

Precipitation = 2300 mm/year

Runoff coefficient = 0.32

Evapotranspiration = 770 mm/year

Silty clay field capacity = 390 mm/m

Municipal solid waste field capacity = 290 mm/m

Contd P/4

CE 433

Contd...Q. No. 5(d)

Assume further that the moisture content of the soil cover is 300 mm/m when applied, and the incoming waste has a moisture content of 170 mm/m.

6. (a) What is leachate? Draw typical concentration profiles of leachate constituents. What are the requirements that are to be satisfied by the linear system of a landfill? (7)

(b) What are the important features in the design of a leachate treatment system? Summarize the leachate treatment options. (9⅓)

(c) Design the spacing of laterals for an uncapped landfill for a required maximum leachate head of 32 cm, if the top surface of the laterals is 12 cm above the bottom liner. Assume that the hydraulic conductivity of the drainage layer is 110 m/d and the overall vertical hydraulic conductivity through the waste is 1.1×10^{-3} cm/s. Also, determine the flow through each lateral. (7)

7. (a) State the potential environmental impacts of landfill gases. (7)

(b) Draw a figure showing idealistic generation of landfill gases. (5)

(c) What are the objectives of landfill gas recovery? Draw a typical gas recovery system. (5⅓)

(d) Estimate the theoretical volume of methane and carbon dioxide gases that would be expected from the anaerobic decomposition of 25 ton of a waste having the composition $C_{48}H_{96}O_{38}N_2$.

Given: Density of methane gas at STP $= 0.7167$ kg/m^3

Density of carbon dioxide gas at STP $= 1.9783$ kg/m^3

Comment on the results obtained. (6)

8. (a) What the problems of hazardous waste management in developing countries? (5)

(b) Draw a flow sheet for hazardous waste treatment and disposal facilities. (8⅓)

(c) List the design considerations of a hazardous waste landfill. (6)

(d) What are the main sources of infectious wastes in the hospitals? (4)

L-4/T-2/CE **Date : 09/04/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **CE 437** (Environmental and Sustainable Management)

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 power and functions of the Director General of DoE related to environmental protection? What do you mean by 'Action taken in good faith'? What is the difference between 'Act' and 'Rules'? **(9)**

   (b) What are the objectives of Bangladesh Environmental Policy 2013? What legal framework and institutional arrangements have been proposed in the Bangladesh Environmental Policy 2013? **(14⅓)**

2. (a) What are the major provisions of Bangladesh Water Act 2013 and Labour Act 2006? What major issues were addressed in the 2013 amendment of the Labour Act? **(7⅓)**

   (b) What are the salient features of the Environment Court Act? What are the guiding legislations of environmental court in Bangladesh? State the criticisms of environmental court. **(12)**

   (c) What are the difference between guidelines and standards? Give examples. **(4)**

3. (a) Briefly explain (with diagrams) how environmental assessment nowadays has been integrated in the project cycle? What are the differences between EIA and IEE? How would you decide whether to perform EIA or IEE? **(8⅓)**

   (b) What is opportunity cost? Explain with examples. How can opportunity cost be measured? Explain equimarginal principle with diagrams. **(8)**

   (c) Four homeowners are willing to pay money for the cleanup of a water body which is shared by them. However, the marginal willingness to pay (MWTP) of the homeowners varies depending on the concentration of the pollution that can be achieved after a certain level of cleanup (see table below). Based on this information, what will be the acceptable level of water quality in the water body? Explain your results graphically. **(7)**

Level of Contaminant (ppm)	MWTP Homeowner A (Thousand BDT per year)	MWTP of Homeowner B (Thousand BDT per year)	MWTP of Homeowner C (Thousand BDT per year)	MWTP of Homeowner D (Thousand BDT per year)	Marginal cost for cleanup (Thousand BDT per year)
4	110	60	30	100	50
3	85	30	20	80	65
2	70	10	15	60	95
1	55	45	10	40	150
0	45	0	5	10	240

Contd P/2

CE 437

4. (a) What are the merits and demerits of public consultation? How is public participation related to the EIA process? How would you conduct an effective public consultation? **(14⅓)**

   (b) Write short notes on the following: **(9)**

   (i) Role of civil society in environmental management. (ii) Environmental Management Plan (iii) Limitations of Standards in ECR 1997

SECTION – B

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

5. (a) How does development projects influence the different components of environment? Explain with examples. **(8⅓)**

   (b) "Increase of GDP does not always mean Sustainable Development' – Explain this with examples. **(8)**

   (c) Why is Ecological Footprint used as a sustainability Indicator instead of Farth's Human Carrying Capacity? **(7)**

6. (a) List at least four goals that should be achieved in the following sectors to make development sustainable. (i) Economic (ii) Environmental and (ii) Social **(9)**

   (b) Read the following two cases and answer this:

   Case 1) A Bangladeshi Company is going to produce Smart Phone, keeping in view minimizing environmental impacts over its life cycle. As an environmental management specialist, what factors do you think they should consider to achieve sustainability? **(8⅓)**

   Case 2) A Textile Industry likes to get 'LEED' Certificate. Which areas should be taken care of to achieve it?

   (c) Write short notes on (i) Cleaner Production (ii) Bangladesh Delta Plan (BDP) 2100. **(6)**

7. (a) Why is Bangladesh one of the most vulnerable countries with regard to Climate Change? State the effects of Climate Change in Agriculture sector in Bangladesh. What steps have been taken by Bangladesh Government to mitigate the impacts of Climate Change? Describe. **(8⅓)**

   (b) In your opinion, what is the most priority area, where Bangladesh should focus on, to reduce environmental degradation? Justify your answer. **(5)**

   (c) Describe the activities involved in Transport Sector Development and their impacts on Environment. **(10)**

8. (a) What are the major constraints in using Wind and Solar energy in energy sector development? **(6)**

   (b) Differentiate between 'Check List' and 'Matrix' method in evaluating impact. **(5)**

Contd P/3

CE 437

Contd...Q. No. 8

(c) An embankment project has been under-taken in a coastal town of Southern part of Bangladesh to protect the land from annual flooding. Evaluate the impacts on physico-chemical, biological and social environment of that area due to this project by checklist method. **(12⅓)**

L-4T-2/CE **Date: 30/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

Sub: **CE 413** (Introduction to Steel Concrete Composite 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 **FIVE** questions in this section. Answer any **FOUR**.

Assume reasonable values for missing data, if any.

For standard steel section properties use Table-1, attached in Annexture-I.

1. (a) State the advantages and disadvantages of steel concrete composite beams over conventional reinforced concrete beams. **(4)**

   (b) Determine the midspan deflection of the fully composite beam shown in Fig. 1, for unshored construction. The steel shape is W18×35. The floor has 3.0 inch normal weight concrete on metal deck with 2.5 inch ribs. This is an interior beam; spacing of the beam is 8 ft. Calculate the total vertical deflection for composite as well as for precomposite stage and compare the values with the allowable limits for total deflection (i.e. L/240) specified in AISC guide. The calculated uniformly distributed service loads on the beam is 0.7 k.ft for self weight of slab, deck and beam; 0.1 k/ft for construction live load; 0.2 k/ft for floor finish; 0.4 k/ft for partition walls and 1 k/ft floor live load. **(13.5)**

   Given: For concrete $f_c' = 3\ ksi$ and $E_c = 3000\ ksi$; for steel $F_y = 50\ ksi$ and $E_s = 29000\ ksi$.

2. (a) List the design consideration for serviceability limit state for composite beams. **(4)**

   (b) Evaluate the design ultimate moment capacity of the composite beam shown in Fig. 2 in positive bending. Assume full interaction between steel and concrete at their interfaces. Use AISC-LRFD method. **(13.5)**

   Given: $f_c' = 4\ ksi$ and $E_c = 3600\ ksi$; $F_y = 50\ ksi$ and $E_s = 29000\ ksi$.

3. A typical bay of composite floor system is illustrated in Fig. 3(a)

   (a) Check whether the composite deck detailing for this floor system as shown in Fig. 3(b), satisfies the requirements of AISC specification. **(4)**

   (b) Calculate the service load flexural stresses in concrete and steel of the secondary composite beam SB (W18×50) as shown in Fig. 3(a), for shored construction. In addition to the self-weight of the RC slab, steel deck and beam consider 60 psf of partition wall load, 30 psf for floor finish, 20 psf for construction live load and 80 psf for service live load. Consider shear type of connections at both ends of the beam and full interaction between steel and concrete. **(13.5)**

   Draw the flexure stress distribution diagram across the depth of the composite beam.

   Given: $f_c' = 4\ ksi$ and $E_c = 3600\ ksi$; $F_y = 50\ ksi$ and $E_s = 29000\ ksi$.

Contd P/2

CE 413

4. (a) Evaluate the design ultimate moment capacity of the secondary beam SB (W18×50) as shown in Fig. 3(a) in positive bending for 70% composite action. **(10)**

Given: $f_c^{'} = 4\ ksi$ and $E_c = 3600\ ksi$; $F_y = 50\ ksi$ and $E_s = 29000\ ksi$.

(b) Determine the number and placement of the 0.75 inch diameter stud type shear connectors for this beam SB (W18×50) to develop the design moment capacity under 70% composite action. Use AISC-LRFD method for design of composite beams. **(7.5)**

Assume $R_p = 0.75$, $R_g = 0.85$ and $F_u = 65$ ksi for shear connectors.

5. (a) Differentiate between full and partial composite action in steel concrete composite beams. **(4)**

(b) For the main beam MB (W21×55) in the composite floor system as shown in Fig. 3(a),

(i) Calculate the section properties by transforming the composite beam section into equivalent steel section. **(8)**

(ii) Find the yield moment capacity of the beam (W21×55) in positive bending. **(5.5)**

Given: For concrete $f_c^{'} = 4\ ksi$ and $E_c = 3600\ ksi$; for steel $F_y = 50\ ksi$ and $E_s = 29000\ ksi$.

SECTION - B

There are **FIVE** questions in this section. Answer any **FOUR**.
Necessary tables & formulae are provided in ANNEXURE.

6. (a) State the advantages and disadvantages of Concrete Filled Tubular (CFT) columns over other composite columns. **(5)**

(b) A Concrete Filled Tubular (CFT) column section shown is in Figure 4. Check whether the geometric and material properties of the given section satisfies the AISC code specified limits. **(2 ½)**

Given: $f_y = 50\ ksi$, $f_c^{'} = 3.5\ ksi$; and $E_s = 29000$ ksi $E_c = 3600$ ksi.

(c) Calculate the design axial compressive and axial tensile capacity of the given Concrete Filled Tubular (CFT) section. Consider the effective length of the column to be 15'. Use AISC-LRFD method. **(10)**

7. (a) Define Partially Encased Composite (PEC) column. Name the two types of PEC columns commonly used. Differentiate between the behavior of these two PEC columns. **(5)**

(b) A Partially Encased Composite (PEC) column is shown in Figure 5. **(12 ½)**

(i) Check the material and geometric properties of the given PEC column with the code specified limits.

(ii) Determine the axial capacity of the column.

Given: f_y = 350 MPa, f'_c = 35 MPa, E_s = 200 GPa, E_c = 24 GPa and effective length of the column = 14 ft.

Contd P/3

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8. (a) State the assumptions used in Plastic Stress Distribution method for developing P-M interaction diagram of composite column. **(5)**

(b) For the Fully Encased Composite (FEC) column section shown in Figure 6, calculate the nominal axial force and bending moment for balanced failure condition of P-M diagram about weak axis bending using plastic stress distribution method. The length of the column is 12 ft and the column is pin-pin connected in both axes. Use AISC-LRFD method. **(12 ½)**

Given: $F_y = F_{yr} = 60$ ksi, $f'_c = 3$ ksi; and $E_s = 29000$ ksi $E_c = 3600$ ksi.

9. (a) Calculate the nominal axial load and bending moment for he four points in the P-M interaction diagram about strong axis bending of the Fully Encased Composite (FEC) column shown in Figure 6 using plastic stress distribution method. Show the diagram in a neat sketch. Use the data provided in Question 8(b) as required. **(12 ½)**

(b) Determine the design P-M interaction diagram for the FEC column including the global slenderness effect. Use AISC-LRFD method. **(5)**

10. (a) Check the design adequacy of the Concrete Filled Tubular (CFT) section shown in Figure 4 for a factored axial compressive load of 250 kips and a factored bending moment of 200 kip-ft about strong axis using interaction equation and simplified version of plastic stress distribution method. Use the data provided in Question 6 as required and follow AISC-LRFD method. **(12 ½)**

(b) Provide your comments on the adequacy check using the two methods. Slenderness effects must be considered. **(5)**

Contd.... P/4

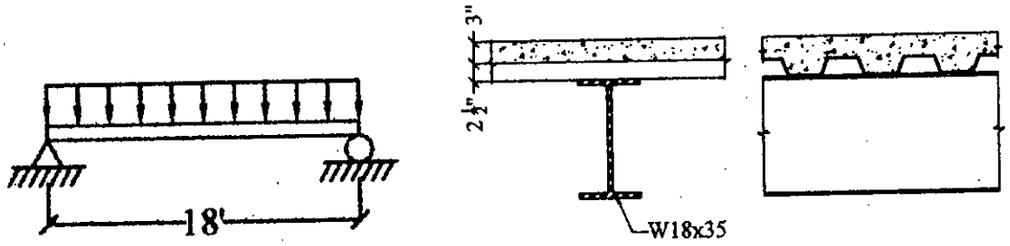


Fig. 1

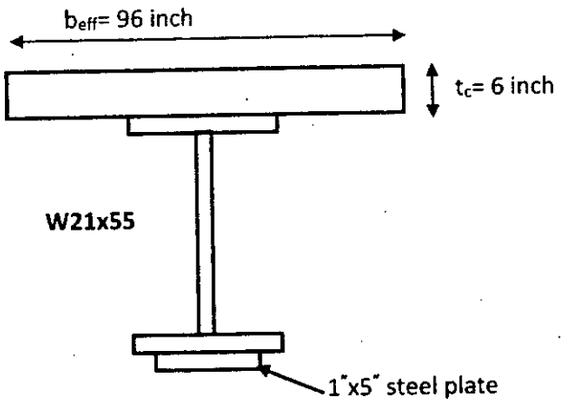


Fig. 2

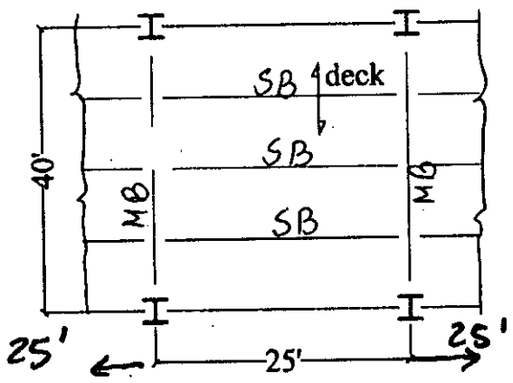


Fig. 3 (a)

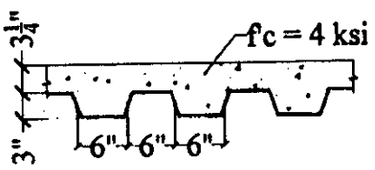


Fig. 3 (b)

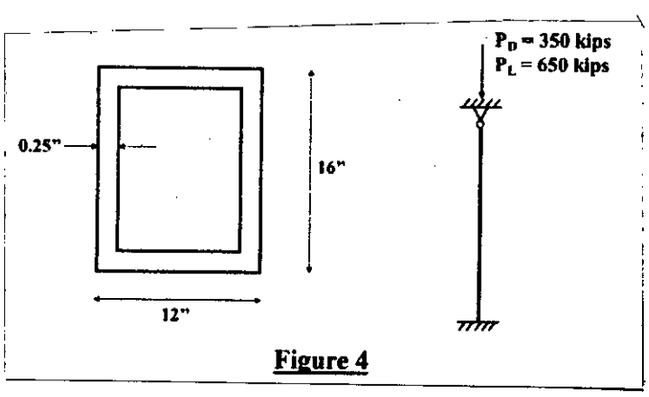


Figure 4

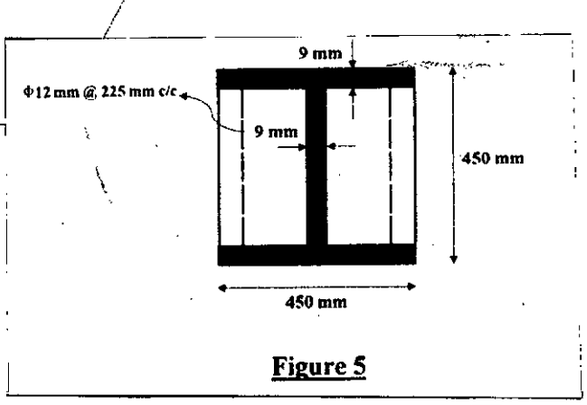


Figure 5

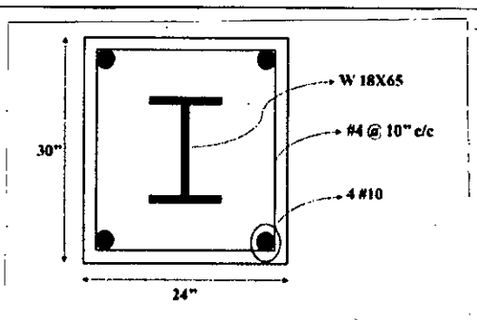


Figure 6

Contd... P/5

Annexure – I

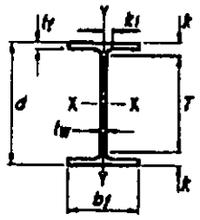


Table 1–1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance				
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Thickness, t_f		k		k_1	T	Work-able Gage
											k_{det}	k_{det}			
	in.²	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W21×93	27.3	21.6	21 5/8	0.580	9/16	5/16	8.42	8 3/8	0.930	15/16	1.43	1 5/8	15/16	18 3/8	5 1/2
×83[c]	24.3	21.4	21 3/8	0.515	1/2	1/4	8.36	8 3/8	0.835	13/16	1.34	1 1/2	7/8		
×73[c]	21.5	21.2	21 1/4	0.455	7/16	1/4	8.30	8 1/4	0.740	3/4	1.24	1 7/16	7/8		
×68[c]	20.0	21.1	21 1/8	0.430	7/16	1/4	8.27	8 1/4	0.685	11/16	1.19	1 3/8	7/8		
×62[c]	18.3	21.0	21	0.400	3/8	3/16	8.24	8 1/4	0.615	5/8	1.12	1 5/16	13/16		
×55[c]	16.2	20.8	20 3/4	0.375	3/8	3/16	8.22	8 1/4	0.522	1/2	1.02	1 3/16	13/16		
×48[c,j]	14.1	20.6	20 5/8	0.350	3/8	3/16	8.14	8 1/8	0.430	7/16	0.930	1 1/8	13/16	↓	↓
W21×57[c]	16.7	21.1	21	0.405	3/8	3/16	6.56	6 1/2	0.650	5/8	1.15	1 5/16	13/16	18 3/8	3 1/2
×50[c]	14.7	20.8	20 7/8	0.380	3/8	3/16	6.53	6 1/2	0.535	9/16	1.04	1 1/4	13/16	↓	↓
×44[c]	13.0	20.7	20 5/8	0.350	3/8	3/16	6.50	6 1/2	0.450	7/16	0.950	1 1/8	13/16		
W18×311[h]	91.6	22.3	22 3/8	1.52	1 1/2	3/4	12.0	12	2.74	2 3/4	3.24	3 7/16	1 3/8	15 1/2	5 1/2
×283[h]	83.3	21.9	21 7/8	1.40	1 3/8	11/16	11.9	11 7/8	2.50	2 1/2	3.00	3 3/16	1 5/16		
×258[h]	75.9	21.5	21 1/2	1.28	1 1/4	5/8	11.8	11 3/4	2.30	2 5/16	2.70	3	1 1/4		
×234[h]	68.8	21.1	21	1.16	1 3/16	5/8	11.7	11 5/8	2.11	2 1/8	2.51	2 3/4	1 3/16		
×211	62.1	20.7	20 5/8	1.06	1 1/16	9/16	11.6	11 1/2	1.91	1 15/16	2.31	2 9/16	1 3/16		
×192	56.4	20.4	20 3/8	0.960	15/16	1/2	11.5	11 1/2	1.75	1 3/4	2.15	2 7/16	1 1/8	↓	
×175	51.3	20.0	20	0.890	7/8	7/16	11.4	11 3/8	1.59	1 9/16	1.99	2 7/16	1 1/4	15 1/8	
×158	46.3	19.7	19 3/4	0.810	13/16	7/16	11.3	11 1/4	1.44	1 7/16	1.84	2 3/8	1 1/4		
×143	42.1	19.5	19 1/2	0.730	3/4	3/8	11.2	11 1/4	1.32	1 5/16	1.72	2 5/16	1 3/16		
×130	38.2	19.3	19 1/4	0.670	11/16	3/8	11.2	11 1/8	1.20	1 3/16	1.60	2 1/16	1 3/16		
×119	35.1	19.0	19	0.655	5/8	5/16	11.3	11 1/4	1.06	1 1/16	1.46	1 15/16	1 3/16		
×106	31.1	18.7	18 3/4	0.590	9/16	5/16	11.2	11 1/4	0.940	15/16	1.34	1 13/16	1 1/8		
×97	28.5	18.6	18 5/8	0.535	9/16	5/16	11.1	11 1/8	0.870	7/8	1.27	1 3/4	1 1/8		
×86	25.3	18.4	18 3/8	0.480	1/2	1/4	11.1	11 1/8	0.770	3/4	1.17	1 5/8	1 1/16		
×76[c]	22.3	18.2	18 1/4	0.425	7/16	1/4	11.0	11	0.680	11/16	1.08	1 9/16	1 1/16	↓	↓
W18×71	20.8	18.5	18 1/2	0.495	1/2	1/4	7.64	7 5/8	0.810	13/16	1.21	1 1/2	7/8	15 1/2	3 1/2[g]
×65	19.1	18.4	18 3/8	0.450	7/16	1/4	7.59	7 5/8	0.750	3/4	1.15	1 7/16	7/8		
×60[c]	17.6	18.2	18 1/4	0.415	7/16	1/4	7.56	7 1/2	0.695	11/16	1.10	1 3/8	13/16		
×55[c]	16.2	18.1	18 1/8	0.390	3/8	3/16	7.53	7 1/2	0.690	5/8	1.03	1 5/16	13/16		
×50[c]	14.7	18.0	18	0.355	3/8	3/16	7.50	7 1/2	0.570	9/16	0.972	1 1/4	13/16	↓	↓
W18×46[c]	13.5	18.1	18	0.360	3/8	3/16	6.06	6	0.605	5/8	1.01	1 1/4	13/16	15 1/2	3 1/2[g]
×40[c]	11.8	17.9	17 7/8	0.315	5/16	3/16	6.02	6	0.525	1/2	0.927	1 3/16	13/16	↓	↓
×35[c]	10.3	17.7	17 3/4	0.300	5/16	3/16	6.00	6	0.425	7/16	0.827	1 1/8	3/4		

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Contd.... P/6

Annexure - I

Table 1–1 (continued)
W Shapes
Properties

W21 – W18

Nominal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
93	4.53	32.3	2070	192	8.70	221	92.9	22.1	1.84	34.7	2.24	20.7	6.03	9940
83	5.00	36.4	1830	171	8.67	196	81.4	19.5	1.83	30.5	2.21	20.6	4.34	8630
73	5.60	41.2	1600	151	8.64	172	70.6	17.0	1.81	26.6	2.19	20.5	3.02	7410
68	6.04	43.6	1480	140	8.60	160	64.7	15.7	1.80	24.4	2.17	20.4	2.45	6760
62	6.70	48.9	1330	127	8.54	144	57.5	14.0	1.77	21.7	2.15	20.4	1.83	5960
55	7.87	50.0	1140	110	8.40	126	48.4	11.8	1.73	18.4	2.11	20.3	1.24	4980
48	9.47	53.6	959	93.0	8.24	107	38.7	9.52	1.66	14.9	2.05	20.2	0.803	3950
57	5.04	46.3	1170	111	8.38	129	30.6	9.35	1.35	14.8	1.68	20.4	1.77	3190
50	6.10	49.4	984	94.5	8.18	110	24.9	7.64	1.30	12.2	1.64	20.3	1.14	2570
44	7.22	53.6	843	81.6	8.06	95.4	20.7	6.37	1.26	10.2	1.60	20.2	0.770	2110
311	2.19	10.4	6970	624	8.72	754	785	132	2.95	207	3.53	19.6	176	76200
283	2.38	11.3	6170	565	8.61	676	704	118	2.91	185	3.47	19.4	134	65900
258	2.56	12.5	5510	514	8.53	611	628	107	2.88	166	3.42	19.2	103	57600
234	2.76	13.8	4900	466	8.44	549	558	95.8	2.85	149	3.37	19.0	78.7	50100
211	3.02	15.1	4330	419	8.35	490	493	85.3	2.82	132	3.32	18.8	58.6	43400
192	3.27	16.7	3870	380	8.28	442	440	76.8	2.79	119	3.28	18.6	44.7	38000
175	3.58	18.0	3450	344	8.20	398	391	68.8	2.76	106	3.24	18.5	33.8	33300
158	3.92	19.8	3060	310	8.12	356	347	61.4	2.74	94.8	3.20	18.3	25.2	29000
143	4.25	22.0	2750	282	8.09	322	311	55.5	2.72	85.4	3.17	18.2	19.2	25700
130	4.65	23.9	2460	256	8.03	290	278	49.9	2.70	76.7	3.13	18.1	14.5	22700
119	5.31	24.5	2190	231	7.90	262	253	44.9	2.69	69.1	3.13	17.9	10.6	20300
106	5.96	27.2	1910	204	7.84	230	220	39.4	2.68	60.5	3.10	17.8	7.48	17400
97	6.41	30.0	1750	188	7.82	211	201	36.1	2.65	55.3	3.08	17.7	5.86	15800
86	7.20	33.4	1530	166	7.77	186	175	31.6	2.63	48.4	3.05	17.6	4.10	13800
76	8.11	37.8	1330	146	7.73	163	152	27.6	2.61	42.2	3.02	17.5	2.83	11700
71	4.71	32.4	1170	127	7.50	146	60.3	15.8	1.70	24.7	2.05	17.7	3.49	4700
65	5.06	35.7	1070	117	7.49	133	54.8	14.4	1.69	22.5	2.03	17.6	2.73	4240
60	5.44	38.7	984	108	7.47	123	50.1	13.3	1.68	20.6	2.02	17.5	2.17	3850
55	5.88	41.1	890	98.3	7.41	112	44.9	11.9	1.67	18.5	2.00	17.5	1.66	3430
50	6.57	45.2	800	88.9	7.38	101	40.1	10.7	1.65	16.6	1.98	17.4	1.24	3040
46	5.01	44.6	712	78.8	7.25	90.7	22.5	7.43	1.28	11.7	1.58	17.5	1.22	1720
40	5.73	50.9	612	68.4	7.21	78.4	19.1	6.35	1.27	10.0	1.56	17.4	0.810	1440
35	7.06	53.5	510	57.6	7.04	66.5	15.3	5.12	1.22	8.06	1.52	17.3	0.506	1140

Contd... P/7

ANNEXURE

Design Specifications According to AISC 2010

For CFT Columns:

TABLE I1.1A
Limiting Width-to-Thickness Ratios for Compression Steel Elements in Composite Members Subject to Axial Compression
For Use with Section I2.2

Description of Element	Width-to-Thickness Ratio	λ_p Compact/ Noncompact	λ_r Noncompact/ Slender	Maximum Permitted
Walls of Rectangular HSS and Boxes of Uniform Thickness	b/t	$2.26\sqrt{\frac{E}{F_y}}$	$3.00\sqrt{\frac{E}{F_y}}$	$5.00\sqrt{\frac{E}{F_y}}$
Round HSS	D/t	$\frac{0.15E}{F_y}$	$\frac{0.19E}{F_y}$	$\frac{0.31E}{F_y}$

TABLE I1.1B
Limiting Width-to-Thickness Ratios for Compression Steel Elements in Composite Members Subject to Flexure
For Use with Section I3.4

Description of Element	Width-to-Thickness Ratio	λ_p Compact/ Noncompact	λ_r Noncompact/ Slender	Maximum Permitted
Flanges of Rectangular HSS and Boxes of Uniform Thickness	b/t	$2.26\sqrt{\frac{E}{F_y}}$	$3.00\sqrt{\frac{E}{F_y}}$	$5.00\sqrt{\frac{E}{F_y}}$
Webs of Rectangular HSS and Boxes of Uniform Thickness	h/t	$3.00\sqrt{\frac{E}{F_y}}$	$5.70\sqrt{\frac{E}{F_y}}$	$5.70\sqrt{\frac{E}{F_y}}$
Round HSS	D/t	$\frac{0.07E}{F_y}$	$\frac{0.31E}{F_y}$	$\frac{0.31E}{F_y}$

(a) For *compact sections*

$$P_{m} = P_p$$

where

$$P_p = F_y A_s + C_2 f_c'\left(A_c + A_{sr}\frac{E_s}{E_c}\right)$$

$C_2 = 0.85$ for rectangular sections and 0.95 for round sections

(b) For *noncompact sections*

$$P_{m} = P_p - \frac{P_p - P_y}{(\lambda_r - \lambda_p)^2}(\lambda - \lambda_p)^2$$

where

λ, λ_p and λ_r are slenderness ratios determined from Table I1.1a

P_p is determined from Equation I2-9b

$$P_y = F_y A_s + 0.7 f_c'\left(A_c + A_{sr}\frac{E_s}{E_c}\right)$$

Contd.... P/8

ANNEXURE

(c) For slender sections

$$P_{no} = F_{cr} A_s + 0.7 f_c' \left(A_c + A_{sr} \frac{E_s}{E_c} \right)$$

where

(i) For rectangular filled sections

$$F_{cr} = \frac{9 E_s}{\left(\frac{b}{t}\right)^2}$$

(ii) For round filled sections

$$F_{cr} = \frac{0.72 F_y}{\left(\left(\frac{D}{t}\right)\frac{F_y}{E_s}\right)^{0.2}}$$

$$EI_{eff} = E_s I_s + E_s I_{sr} + C_1 E_c I_c$$

$$C_1 = 0.6 + 2\left(\frac{A_s}{A_c + A_s}\right) \le 0.9$$

$$If \ldots \frac{P_{no}}{P_e} \le 2.25 \quad P_n = P_{no}\left[0.658^{\left(\frac{P_{no}}{P_e}\right)}\right]$$

$$Else \ldots \frac{P_{no}}{P_e} > 2.25 \quad P_n = 0.877 P_e$$

For FEC Columns:

$$P_o = A_s F_y + A_{sr} F_{yr} + 0.85 A_c f_c'$$

$$EI_{eff} = E_s I_s + 0.5 E_s I_{sr} + C_1 E_c I_c$$

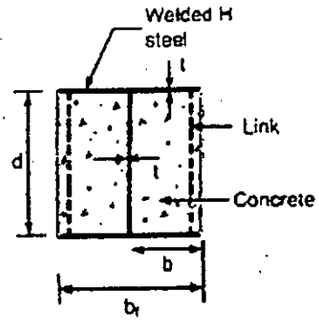
$$C_1 = 0.1 + 2\left(\frac{A_s}{A_c + A_s}\right) \le 0.3$$

$$If \ldots \frac{P_o}{P_e} \le 2.25 \quad P_n = P_o\left[0.658^{\left(\frac{P_o}{P_e}\right)}\right]$$

$$Else \ldots \frac{P_o}{P_e} > 2.25 \quad P_n = 0.877 P_e$$

ANNEXURE

For PEC columns with Non-compact section:



$C_r = A_{sc} F_y + 0.85 A_c f_c'$

$A_{sc} = (d - 2t + 2b_e)t$

$b_e = \frac{b_f}{\left(1 + \lambda_p^{2n}\right)^{1/n}} \le b_f$ where, n = 1.5

$\lambda_p = \frac{b}{t}\sqrt{\frac{12(1-\nu_s^2)F_y}{\pi^2 E_s k}}$

$k = \frac{0.9}{(s/b_f)^2} + 0.2(s/b_f)^2 + 0.75, \quad (0.5 \le s/b_f \le 1)$ where, s = link spacing

AISC Interaction Equations:

(a) When $\frac{P_r}{P_c} \ge 0.2$

$$\frac{P_r}{P_c} + \frac{8}{9}\left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \le 1.0$$

(b) When $\frac{P_r}{P_c} < 0.2$

$$\frac{P_r}{2P_c} + \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}}\right) \le 1.0$$

L-4/T-2/CE **Date: 30/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

B. Sc. Engineering Examinations 2017-2018

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 reasonable values for any missing data.

1. (a) Show the stress distribution in prestressed concrete beam section for different locations of compressive force 'C' based on elastic theory. **(5)**

   (b) Briefly describe the losses of prestress in pretentioned prestressed concrete member from each individual source. **(5)**

   (c) An overhanging beam (Fig. 1) is to be post-tensioned from the Anchor end 'A'. Compute the percentage loss of prestress due to friction from support 'A' to the free end. Solve using (i) simple approximate method and (ii) more exact conventional friction formula method. Given: Friction co-efficient, μ = 0.40 and wobble effect factor, K = 0.0033 per metre length.' **(13 1/3)**

2. (a) Describe the procedure for the evaluation of web shear cracking stress (v_{cw}) and inclined flexural shear cracking stress (v_{ci}) for a prestressed concrete beam subjected to uniformly distributed load (UDL). **(10)**

   (b) Determine the bearing plate area required for a tendon consisting of 15-12.7 mm dia 7-wire strand anchored at the end of a beam as shown in Fig. 2. At the time of post-tensioning, assume $f'_{ci} = 30$ MPa and at service load after all losses, $f'_c = 42$ MPa. The tendon force for design is 2050 kN due to maximum jacking force and 1700 kN at service load after all losses have taken place. Allowable bearing stress on concrete as per Post-Tensioning Institute (PTI) is **(13 1/3)**

   At service load: $f_{cp} = 0.6 f'_c \sqrt{A'_b / A_b} \le f'_c$

   At transfer of presrtess: $f_{cp} = 0.8 f'_c \sqrt{\frac{A'_b}{A_b} - 0.2} \le 1.25 f'_{ci}$

   The symbols carray their usual meaning.

3. (a) Make a preliminary design for a presressed concrete section 950 mm in depth to carry a dead and live load moment of 550 kN-m using steel with an ultimate strength of 1640 MPa and concrete with $f'_{ci} = 28$ MPa. Use ultimate state design with appropriate safety/load factors. **(10)**

Contd P/2

CE 415

(b) A a prestressed concrete beam shown in Fig. 3, is posttensioned with 900 mm^2 of high tensile steel to an initial prestress of 1030 MPa immediately after prestressing. Compute the initial deflection at mid-span due to prestress and the beam's own weight, assuming $E_{ci} = 28\times10^3$ MPa, $\gamma_{conc} = 24$ kN/m^3. **(13 1/3)**

Finally, estimate the deflection after three months, when superimposed UDL of 2.5 kN/m and a point load at centre span of 75 kN acts. Assume a creep coefficient $C_c = 2.2$, $E_c = 33\times10^3$ MPa and an effective prestress of 875 MPa at that time.

4. (a) Make an initial design for section of a prestressed beam to resist a total moment (M_T) of 750 kN-m of which M_G = 160 kN-m. Assume f_c = 15 MPa, f_{se} = 950 MPa, and a trial depth of 40 $\sqrt{M_T}$ (in mm) when M_T is in kN-m. **(10)**

(b) Make the final design from the initial section obtained above. Given: f_b = -18 MPa, f_t' = 1.6 MPa, f_o = 1080 MPa and allow no tension. **(13 1/3)**

SECTION - B

There are **FOUR** questions in this section. Answer any **THREE**.
Assume reasonable values for any missing data

5. (a) The simply supported I-beam shown in Fig. 4 is to carry a uniform dead and live load totaling 8 kN/m over 12m span in addition to its own weight. The position of straight strand with e = 132 mm is as shown. The prestress force PF_i immediately after transfer is 752kN. Time dependent losses due to shrinkage, creep and relaxation are total 15% of the initial prestress force. Find the flexural stresses in concrete at mid-span and at support sections under initial and final conditions. **(10)**

(b) Using the strain compatibility method, find the ultimate moment capacity for the beam of Fig. 4. Given:, f_c' = 28 MPa, E_c = 24,890 MPa, ultimate strain capacity $\varepsilon_{cu} = 0.003$; $\beta_1 = 0.85$. The beam is pretensioned with seven ordinary grade 1725:12.5 mm seven wire strand (area = 92.90 sq. mm) with effective prestress force of 641 kN. The stress-strain diagram of strand is as given in Fig. 4. **(13 1/3)**

6. (a) A post-tensioned one-way slab is 300mm thick and it has to carry a superimposed load of 12KPa (0.012 MPa) over a simply supported span of 10 m. Determine the appropriate prestressing cable and cable profile. Assume that after all losses, effective prestress in 12.5 mm strand is 118 kN. ACI code provision has to be satisfied. f_c' = 35 MPa. Specify minimum bonded reinforced required considering unbounded tendon. **(15 1/3)**

Contd P/3

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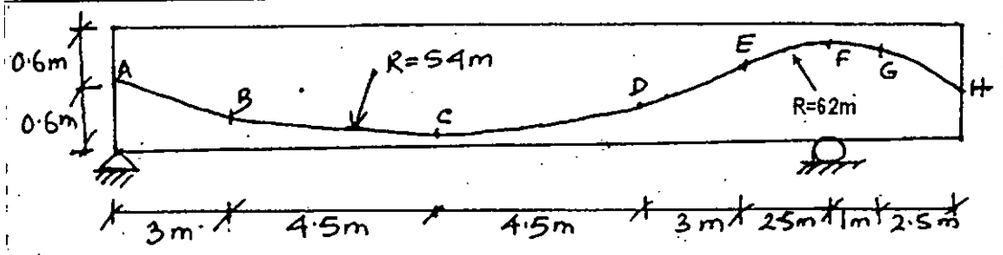
(b) Write in brief the difference between the pre-tensioned and post-tensioned system of prestressing. Show sketches of stress distribution along length of prestressing tendon in each case. **(8)**

7. (a) Describe the factors that make use of prestressing in cantilever beams rather complicated than simple beams. Show sketches of typical tendon layouts for possible combinations and range of anchor and cantilever spans. **(8 1/3)**

(b) A double cantilever beam as shown in Fig. 5 is to be designed so that its prestress will exactly balance the total uniform load of 23.3 kN/m normally carried on the beam. Design the beam using least amount of prestress, assuming that the c.g.s. must have a concrete protection of at least 76.2 mm. Show tendon layout for the required effective prestress. **(15)**

8. (a) The two span continuous beam shown in Fig. 6 is prestressed with 1420 kN force along a parabolic cable profile. Compute the extreme fiber stresses at the center support for DL+LL=23.0 kN/m (including self-weight). Use the balance load method. (Moment at mid support is $wl^2/8$). **(18)**

(b) Discuss the advantages and disadvantages of prestressed concrete over reinforced concrete. **(5 1/3)**



Note: AB, DE --- Straight Line
BCD & EFGH --- curved line

Fig. 1

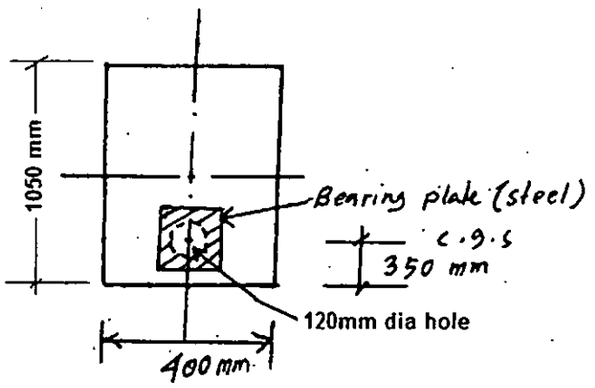


Fig. 2

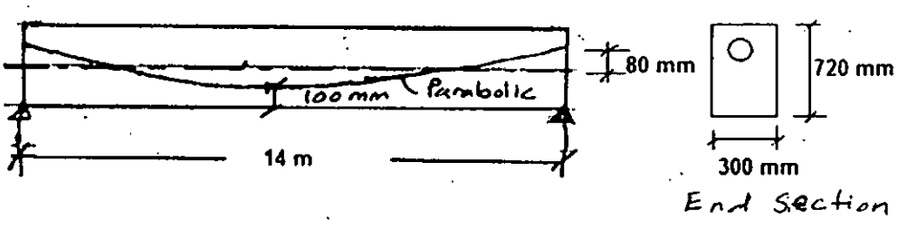


Fig. 3

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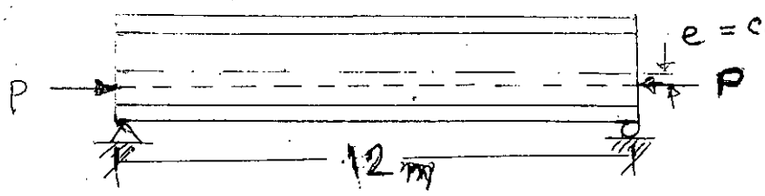
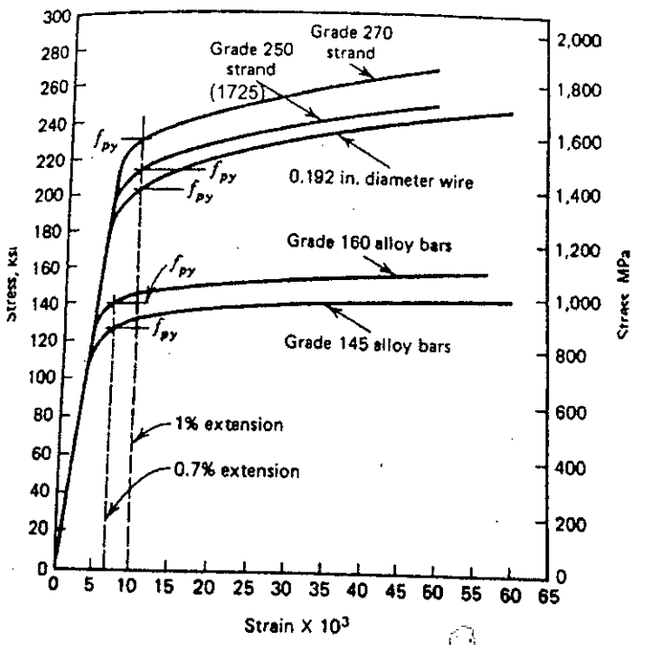




$E_p \approx 29{,}000$ ksi = 200 kN/mm² for wires
$E_p \approx 27{,}000$ ksi = 186 kN/mm² for strand
$E_p \approx 27{,}000$ ksi = 186 kN/mm² for bars

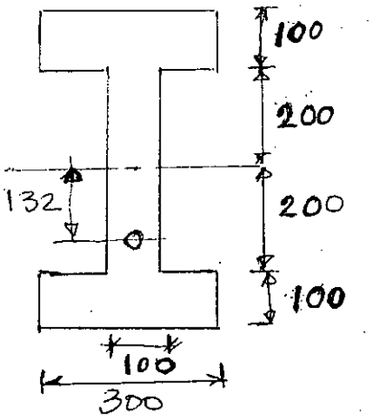


Fig. 4

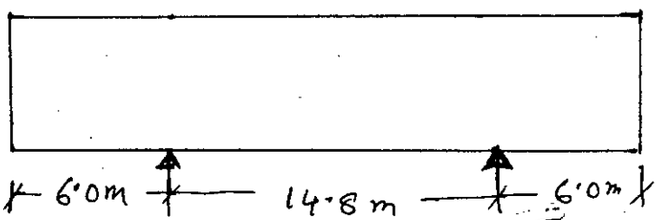
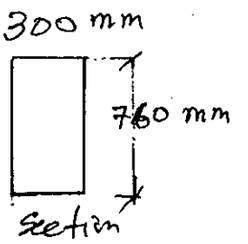


Fig. 5



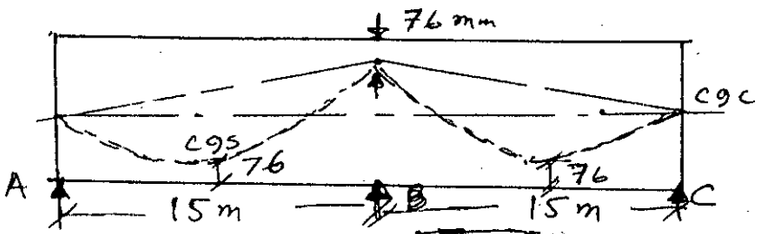
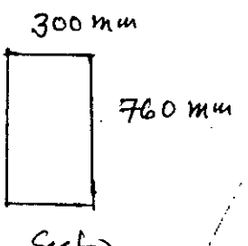


Fig. 6



L-4/T-2/CE **Date : 27/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

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.

Assume reasonable values for missing data, if any. Symbols carry their usual meanings.

SECTION – A

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

1. (a) Explain isoperimetric concept in finite element analysis. **(9)**

   (b) Determine shape functions for 4 noded rectangular elements. Use natural Coordinate system. In this process show that shape function for in 4 th node can be written generally as: **(14⅓)**

   $N_i = \frac{1}{4}(1+\xi\xi_i)(1+\eta\eta_i)$ for i = 1, 2, 3, and 4.

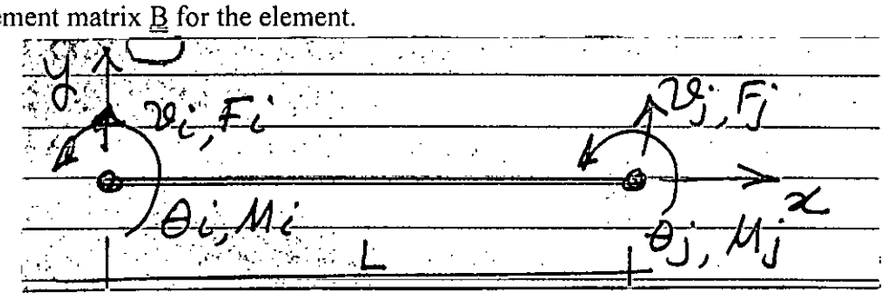
2. (a) "An inadequately defined displacement based finite element mesh may produce a lower bound solution" – Explain. **(10⅓)**

   (b) Discuss convergence criteria for isoparametric elements. **(8)**

   (c) Write a short note on the effect of element aspect ratio on accuracy. **(5)**

3. (a) The beam element shown in Figure 1 has two degrees of freedom per node, i.e., i and j. Assume necessary shape functions for these degrees of freedom and derive strain displacement matrix B for the element. **(11⅓)**

   Fig. 1



   (b) List four major discontinuities that may exist in a real structure and the necessity of considering the same in discritizing a structure. Draw necessary sketches. **(12)**

4. (a) Distinguish between isoparametric, superparametric and subparametric elements. **(8⅓)**

   (b) Write short notes on: **(8)**

   (i) Jacobian matrix

   (ii) Gaussian quadrature integration technique.

   (c) Explain the following terms, explain their significance in a finite element method. **(7)**

   (i) Shape function (ii) Constitutive laws.

Contd P/2

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SECTION – B

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

5. (a) Is FEM an exact method of analysis? Explain why? **(5)**

(b) For the spring system shown in Fig. 2, find the global stiffness matrix. **(12)**

(c) A shear wall is subjected to vertical and lateral loads as shown in Fig. 3. What constitutive law will you use for the problem? Will there be any strain in z-direction? **(6⅓)**

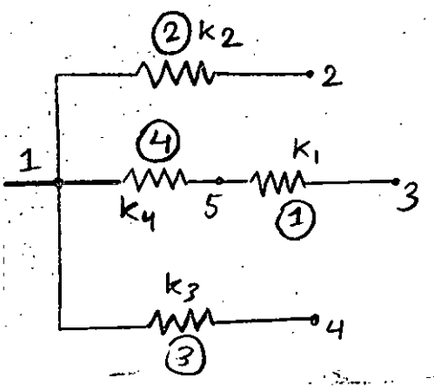

Fig. 2

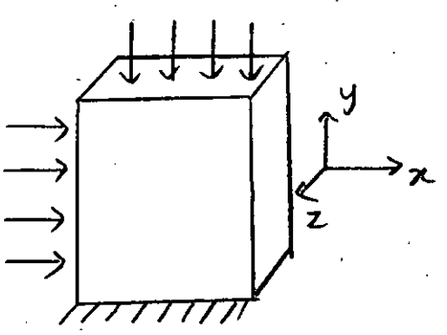

Fig. 3

6. (a) What are the assumptions of linear static problems? **(3)**

(b) For the bars shown in Fig. 4, find the stresses. The bar is loaded with force, P and constrained at two ends. Use 1-D bar elements. **(20⅓)**

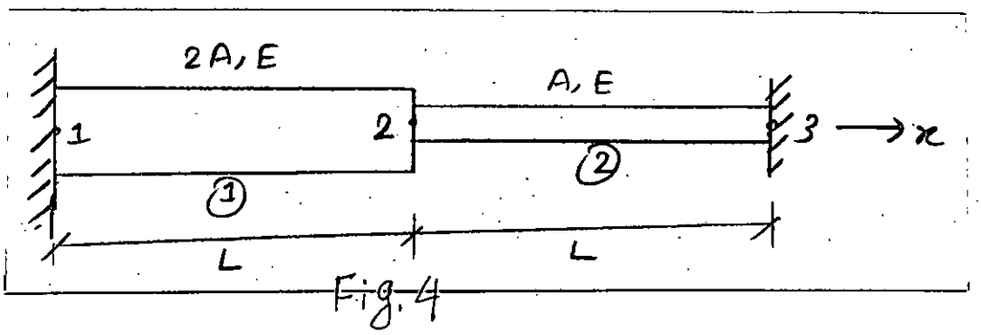

Fig. 4

7. (a) Summarize the basic procedural steps that are followed in analyzing a structure using finite element methods. **(6)**

(b) When there are several FEM packages available, is there any need to study this method? Discuss. **(5)**

(c) State two problems where classical solutions will yield poorer results than FEM solutions. **(5)**

(d) Approximate the area of a circle by dividing it in to a number of triangles. In this process show that $S_N = \pi R^2$ when $N \rightarrow \infty$. Where, R = radius of the circle, N = number of triangles, S_N = Area of the circle. **(7⅓)**

Contd P/3

8. (a) Explain the situation when band solution becomes more expensive than frontal solution technique in terms of memory requirement and computation time. **(10⅓)**

(b) Describe the sequence of the development of front in terms of letters used for nodes as the front creeps forward one element after another as shown in Fig. 5. Roman numbers indicate the element and sequence. **(13)**

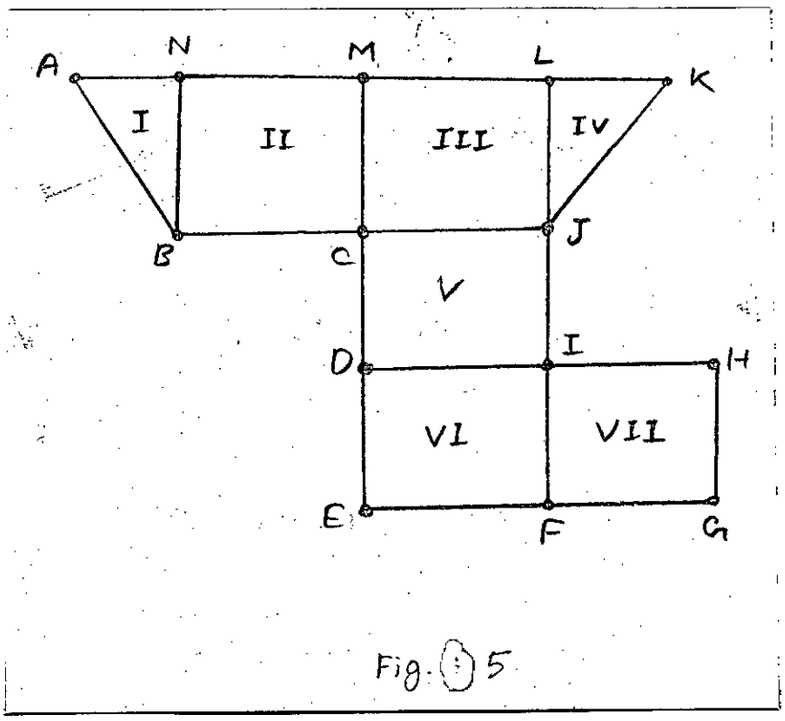

Fig. (5)

L-4/T-2/CE **Date : 27/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **CE 421** (Dynamics of Structure)

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 is response spectrum? Write short notes on deformation, pseudo-velocity, and pseudo-acceleration response spectrum. **(10⅓)**

   (b) The single-bay frame shown in Fig. 1(a) having a rigid beam with flexible columns is subjected to EL Centro ground motion. The columns are fixed at base. Determine the peak displacement of the frame and plot the bending moment diagram of the columns at the instant of peak response. Assume 2% damping of the system. Use response spectrum graph (Fig. 1(b)) given herewith. Given: for Q12 × 53 column: I = 425 in^4, E = 30,000 ksi . **(13)**

2. (a) Express the periodic loading shown in Fig. 2(a) as a Fourier series. Determine only the first four terms of the Fourier coefficients a_o, a_n and b_n. Hence, determine the steady state response of the system shown in Fig. 2(b) subjected to this periodic loading. **(20)**

   (b) Describe briefly about the dynamic magnification factor of a damped SDOF system subjected to harmonic excitation. **(3⅓)**

3. (a) The tower subjected to the blast loading history is shown in Fig. 3. Determine the response time history of this system upto 0.1 sec by the Newmark's Beta method (constant average acceleration method) using h = Δt = 0.01 sec. Given, initial displacement $v_o = 0$ and initial velocity, $v_o = 0$. Use equation 1 to 4 given herewith. Assume damping equal to 20% of the critical damping. **(18⅓)**

$$\tilde{k}_c = k + \frac{2c}{h} + \frac{4m}{h^2} \qquad (1)$$

$$\tilde{p}_{1c} = p_1 + c\left(\frac{2c_o}{h} + \dot{v}_o\right) + m\left(\frac{4v_o}{h^2} + \frac{4}{h}\dot{v}_o + \ddot{v}_o\right) \qquad (2)$$

$$\dot{v}_1 = \frac{2}{h}(v_1 - v_o) - \dot{v}_o \qquad (3)$$

$$\ddot{v}_1 = \frac{1}{m}(p_1 - c\dot{v}_1 - kv_1) \qquad (4)$$

   (b) What do you mean by Equivalent Static Force in Earthquake Engineering? **(5)**

Contd P/2

CE 421

4. (a) Determine the natural frequency and mode shape of the two DOF shear frame as shown in Fig. 4. Draw the mode shapes also. **(20)**

   (b) Describe briefly about the Eigenvlue problem. **(3⅓)**

SECTION – B

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

Assume any reasonable data if missing

5. (a) The elevated water tower tank with a capacity for 5000 gallons of water shown in Fig. 5 has a natural period in lateral vibration of 1.0 sec when empty. When the tank is full of water, its period lengthens to 2.2 sec. Determine the lateral stiffness k of the tower and the weight W of the tank. Neglect the mass of the supporting columns (one gallon of water weighs approximately 8.34 lb). **(11⅓)**

   (b) A platform of weight W = 4000 lb is being supported by four equal columns that are clamped to the foundation as well as to the platform. Experimentally it has been determined that a static force of F = 1000 lb applied horizontally to the platform produces a displacement of Δ = 0.10 in. It is estimated that damping in the structures is of the order of 5% of the critical damping. Determine for this structure the following: **(12)**

   (i) Undamped natural frequency, (ii) damping coefficient, (iii) Logarithmic decrement, (iv) number of cycles and the time required for the amplitude to be reduced from 0.1 to 0.01 in.

6. (a) The steel frame shown in Fig. 6 supports a rotating machine that exerts a horizontal force at the girder level, f(t) = 200 sin 5.3 t lb. Assuming 5% of critical damping, determine, (i) the steady-state amplitude of vibration, (ii) the maximum steady-state flexural stress in the column and (iii) the total horizontal displacement at time t = 2.0 sec, if the system is initially at rest. Assume the girder is rigid. **(18)**

   Given: Section modulus, S = 17.0 in^3, I = 69.2 in^4, and E = 30,000 ksi

   (b) Derive the free vibration response of the frame shown in Fig. 6. Given, initial condition , u(0) = 0.1 inch and $\dot{u}(0) = 0$. **(5⅓)**

7. (a) Derive the response of an un-damped SDOF dynamic system under rectangular pulse loading. Given, initial condition, $u(0) = \dot{u}(0) = 0$. **(7⅓)**

   (b) What is the unit-impulse response function? **(6)**

   (c) In the vibration testing of a structure, an impact hammer with a load cell to measure the impulse force is used to cause excitation, as shown in Fig. 7. Assuming m = 5 kg, k = 2000 N/m, c = 10 N-s/m, and impulse, I = 20 N-s, find the response of the system due to this impulse. **(10)**

Contd P/3

CE 421

8. (a) Describe about a method to evaluate the damping in an SDOF dynamic system. **(6)**

(b) Derive the equation of motion of an SDOF system due to ground excitation with neat sketch. **(7⅓)**

(c) The tower shown in Fig. 5 has weight, W = 38.6 kip and stiffness k = 100 k/in. It is subjected to a base excitation that has an acceleration amplitude of 0.2g and is idealized as simple harmonic motion with a frequency of 2 Hz. Determine the motion of the tower relative to the motion of the foundation. What is the maximum shear force at the foundation if the damping is assumed to be 5 percent critical? **(10)**

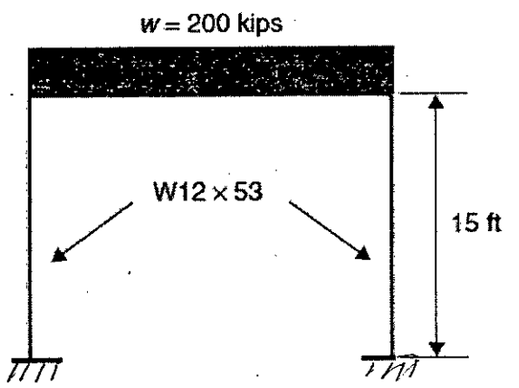

Fig. 1 (a)

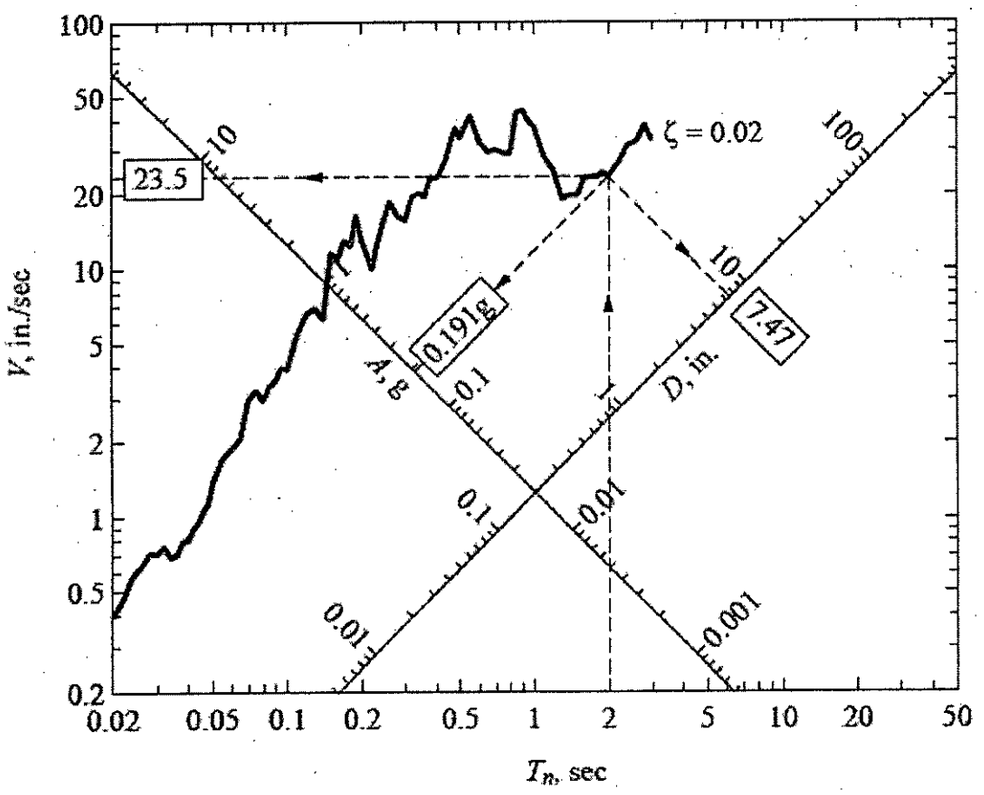

Fig. 1 (b)

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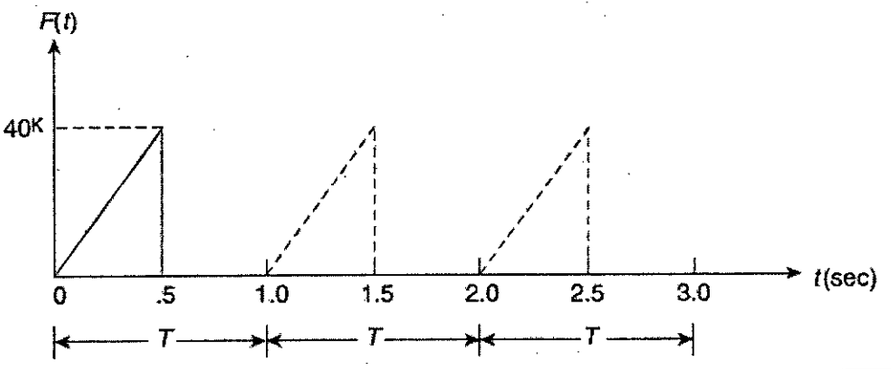

Fig. 2 (a)

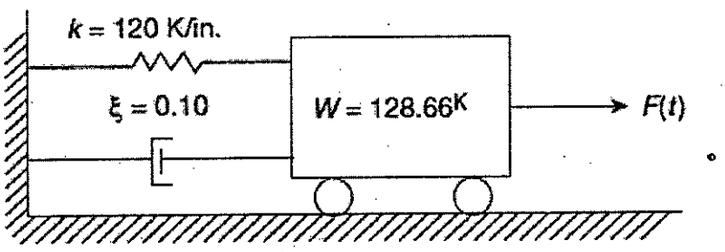

Fig. 2 (b)

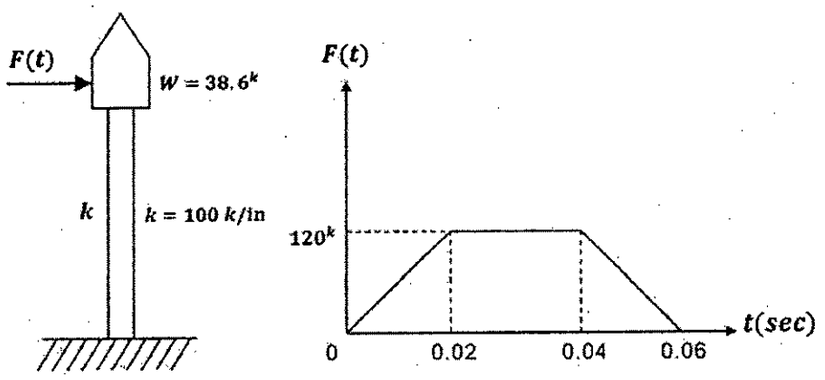

Fig. 3

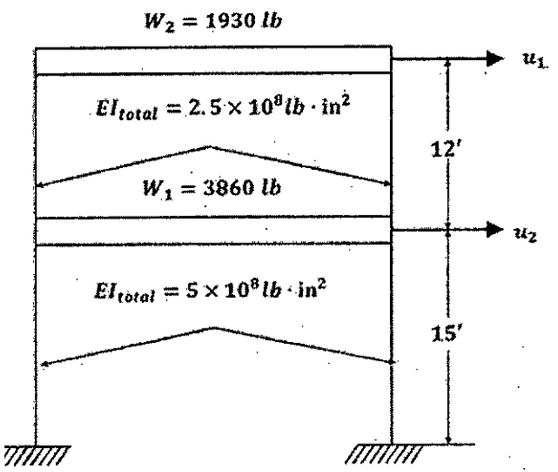

Fig. 4

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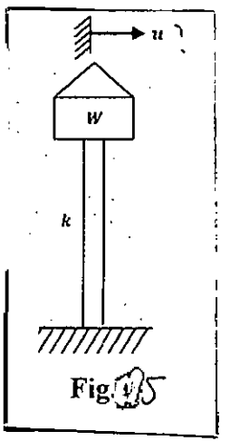

Fig. 5

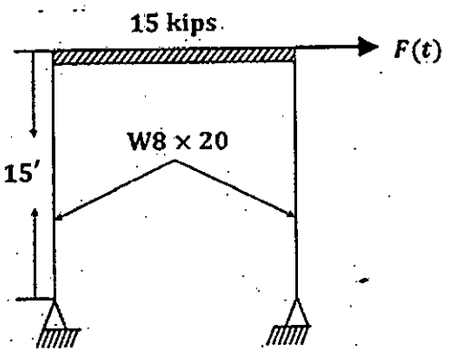

Fig. 6

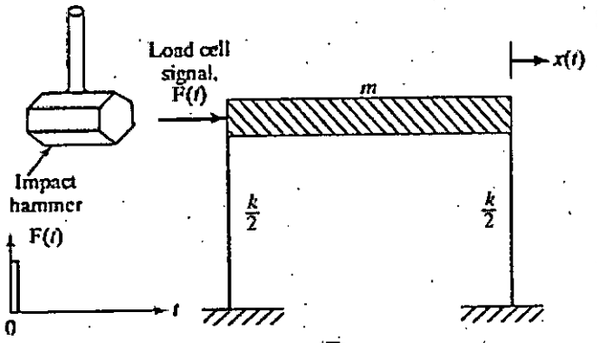

Fig. 7

L-4/T-2/CE **Date : 23/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B.Sc. Engineering Examinations 2017-2018

Sub : **CE 445** (Elementary Soil Dynamics)

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) The displacement amplitude u_0 of an SDF system due to harmonic force is known for two excitation frequencies. At $\omega = \omega_n$, $u_0 = 5$ in; at $\omega = 5\omega_n$, $u_0 = 0.02$ in. Estimate the damping ratio of the system. **(5)**

(b) A mass $\mathbf{m_1}$ hangs from a spring **k** and is in static equilibrium. A second mass $\mathbf{m_2}$ drops through a height ***h*** and sticks to $\mathbf{m_1}$ without rebound (**Fig. 1**). Determine the subsequent motion **u(t)** measured from the static equilibrium position of $\mathbf{m_1}$ and **k**. **(10 1/3)**

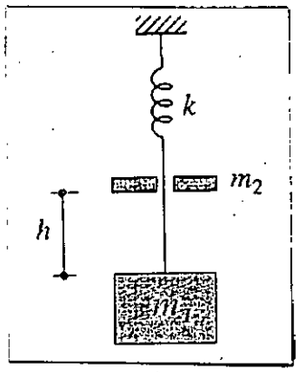

Fig. 1

(c) A free vibration test is conducted on an empty elevated water tank. A cable attached to the tank applies a lateral (horizontal) force of 16.4 kip and pulls the tank horizontally by 2 in. The cable is suddenly cut and resulting free vibration is recorded. At the end of four cycles, the time is 2.0 sec and the amplitude is 1 inch. From these data, compute the following: (i) damping ratio, (ii) natural period of undamped vibration, (iii) effective stiffness; (iv) effective weight; (v) damping coefficient; and (vi) number of cycles required for the displacement amplitude to decrease to 0.2 in. **(8)**

2. (a) Define briefly, with sketches and one usage, the types of motion in damped free vibration. Differentiate between dynamic equilibrium from the static case. **(6)**

(b) How is the acceleration response factor $\mathbf{R_a}$ related to the respective displacement response factor, $\mathbf{R_d}$. Establish the relationship starting with writing the expression of $\mathbf{R_a}$ for eccentric-mass excitation? **(12 1/3)**

Determine the acceleration amplitude at resonance in case of constant-amplitude excitation.

Contd P/2

CE 445

Contd... Q. No. 2

(c) A one-story reinforced concrete building has a roof mass of 500 kip/g, and its natural frequency is 4 Hz. This building is excited by a vibration generator with two weights, each 50 lb, rotating about a vertical axis at an eccentricity of 12 inch. When the vibration generator runs at a natural frequency of the building, the amplitude of roof acceleration is measured to be 0.02g. Determine the damping of the structure. **(5)**

3. (a) Derive for a damped-free vibration: **(10 1/3)**

$$u = u_0 e^{\frac{-\omega_n D t}{\sqrt{1-D^2}}} \sin(\omega_{nd} t + \Phi)$$

Where, the symbols have their usual meanings.

(b) State how stress-reversal helps soil attaining a quasi-elastic state. Describe the characteristics phenomenon in stress-reversal during dynamic loading while giving emphasis on its specialty over monotonic loadings cases. **(8)**

(c) Deduce the principle of determining damping ratio from 'half-power band width' method. **(5)**

4. (a) Write down the inference of the displacement response factor for the following cases: **(9 1/3)**

- When r >>1 in case of forced vibration by constant-amplitude exciting force
- When r <<1 in case of forced vibration by constant-amplitude exciting force
- When r >=2 in case of forced vibration by rotary-mass exciting force

(b) For the system represented by the following equation: **(5)**

$$m\frac{d^2z}{dt} + c\frac{dz}{dt} + kz = m_e e\omega^2 \sin \omega t$$

State:

- the various forces, internal and external quantifying its vectoral values/limits, acting in the system given by the above expression.
- the solutions for complimentary and particular functions of the system, as well as the total solution in the perspective of displacement vector.
- the corresponding solution of motion for displacement at steady state conditions.
- why the steady-state condition is so-named.

(c) Describe briefly (if necessary, with neat sketches) the steps for the field determination of dynamics soil properties stated below (**any three**): **(9)**

- Natural frequency using forced vibration
- Damping ratio by free vibration
- Coefficient of attenuation from block vibration test
- Coefficient of Elastic Uniform Compression (C_u) of soil from block resonance test C_u from Cyclic Plate Load Test.

Contd P/3

CE 445

SECTION - B

There are **FOUR** questions in this section. Answer any **THREE**.
Use attached chart where necessary.

5. (a) Describe different types of faults with neat sketches. **(12 1/3)**

   (b) Estimate the probability of seismic hazard for a power plant for a return period of (i) 100 yr, (ii) 200 yr, (iii) 475 yr and (iv) 2475 yr. **(11)**

6. (a) Write short notes on: **(12)**
   (i) Plate Tectonics
   (ii) Surface Waves
   (iii) Microtremors

   (b) Differentiate between magnitude and intensity of an earthquake. **(6 1/3)**

   (c) Explain vulnerability class and damage grade. **(5)**

7. (a) What are the collateral effects of an earthquake? Explain one of them. **(2+2 1/3)**

   (b) Write down the factors on which local site effect depends. Explain one of them. **(2+2)**

   (c) For the following data, shown in Table 1, estimate Liquefaction Resistance Factor and Liquefaction Potential Index for a_{max} = 0.28g for M = 7.5. Ground Water Table is located at a depth of 1.5m from the EGL. **(15)**

Table 1

Soil Layer Thickness (m)	Soil Profile	d_{50} (mm)	SPT-N Value
0-9	Coarse Sand	1.0	12
9-12	Medium Sand	0.5	8
12-21	Fine Sand	0.15	10

8. (a) Write short notes on: **(12 1/3)**
   (i) Attenuation Laws
   (ii) Earthquake Source Models
   (iii) Gutenberg Richter Relationship

   (b) There are four seismoactive zones (Table 2) in and around a nuclear power plant site. Estimate SDE and SSE on the basis of cumulative intensity-frequency relation. **(11)**

Table 2

Zones	a	b	I_{max}	Attenuation Value
1	1.57	0.516	X	1.2
2	0.07	0.345	IX	1.3
3	0.39	0.456	XI	2.0
4	1.20	0.565	IX	1.8

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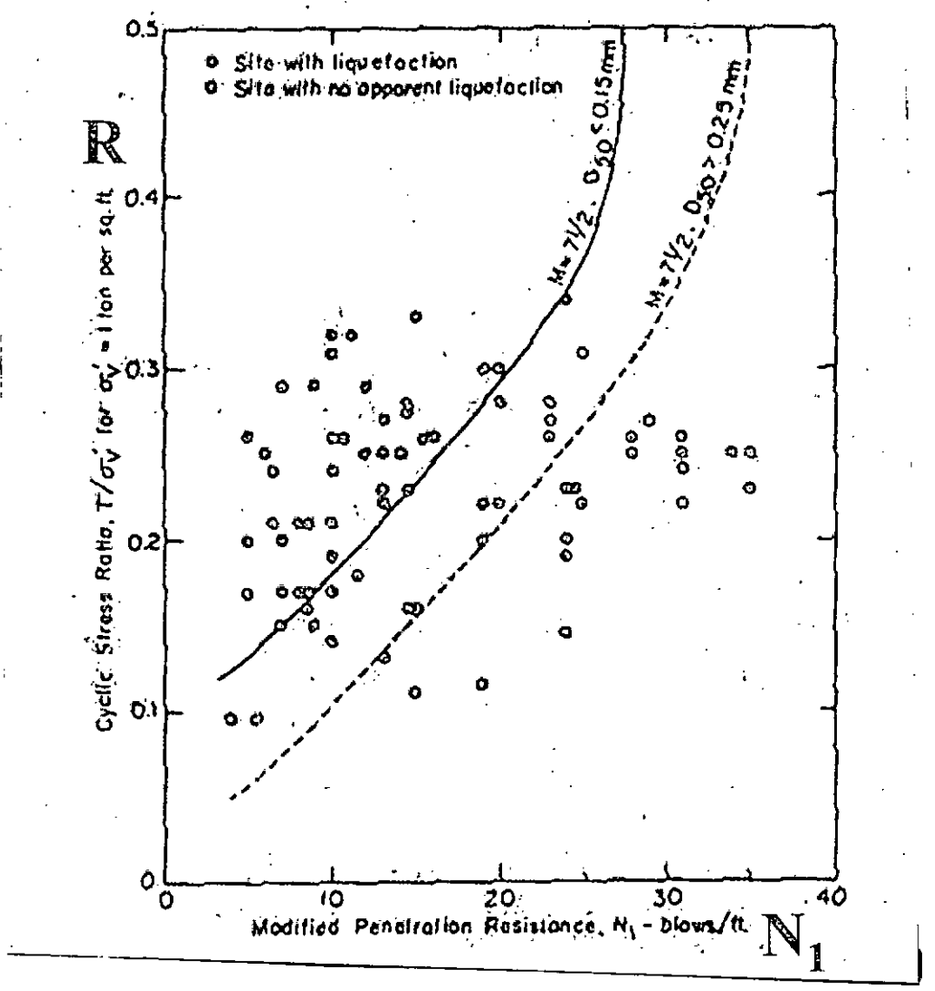
Site with liquefaction
Site with no apparent liquefaction
M=7½, D_{50} ≤ 0.15 mm
M=7½, D_{50} ≥ 0.25 mm
Cyclic Stress Ratio, τ/σ_v' for σ_v' = 1 ton per sq. ft.
R
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Modified Penetration Resistance, N_1 - blows/ft.
N_1

L-4/T-2/CE **Date : 23/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B.Sc. Engineering Examinations 2017-2018

Sub : **CE 447** (Soil-Water Interaction)

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 reasonable value of missing data, if any.

Use attached chart where necessary. Graph paper will be provided.

1. (a) Derive Kozeny-Carman equation for prediction of coefficient of permeability of soil. Also mention the limitations of this equation. **(8 1/3)**

(b) What are the basic assumptions for determining permeability of soils in field by pumping test? With neat diagrams briefly describe the variable head borehole permeability tests for the following cases: **(10)**

(i) Cased borehole with soil flush with the bottom of the borehole.

(ii) Cased borehole with uncased or perforated extension to certain length of the borehole.

(iii) Uncased borehole.

(c) A 10m thick aquifer is confined at the top and bottom by an impervious stratum. The top impervious stratum is 8 m thick. A test well was sunk up to the lower impervious stratum. The maximum drawdown produced by steady pumping from the well is 3 m. The diameter and maximum radius of influence of the well are 0.3 m and 200 m, respectively. If the coefficient of permeability of the aquifer is 5×10^{-4} cm/sec, calculate the rate of flow of the well. **(5)**

2. (a) Define system function and potential function. Also show that potential function satisfies Laplace's equation in two dimensions while the stream function satisfies both the Laplace's equation and equation of continuity in two dimensions. **(6)**

(b) What are the basic requirements to be fulfilled for drawing flow net in an earth dam? Also with neat sketches state the possible boundary conditions for drawing flow net in an earth dam. **(6 1/3)**

(c) A homogenous earth dam of height 12 m was built on an impervious foundation with side slopes 3:1 (horizontal: vertical). The dam retains water to a height of 10 m. The crest width of the dam is 3 m. The coefficient of permeability of dam soil is 5×10^{-5} m/s, calculate the rate of seepage through the dam using Schaffernak and Van Iterson's method. **(5)**

(d) List the criteria for identifying soils susceptible to downslope migration. Also draw neatly the recommended filter systems for soils susceptible to downslope migration. **(6)**

Contd P/2

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3. (a) A homogenous earth embankment was constructed on an impervious foundation with side slopes 4:1 (horizontal: vertical). The embankment retains water to a height of 9 m and the full height of the embankment is 10 m. The crest width of the embankment is 2 m. Plot the line of seepage (phreatic line) using A. Casagrandes method (use plain graph paper for plotting). **(7 1/3)**

(b) Derive an expression for the Factor of safety (F.S) for an infinite slope in cohesion less soil with seepage parallel to the slope and occurring throughout the slope (i.e., water table is at slope surface) **(5)**

(c) A saturated cohesive deposit of clay of height 4 m exists in an infinite slope. Seepage is parallel to the slope and occurring throughout the slope (i.e., water table is at slope surface). The values of saturated unit weight, effective cohesion (c′) and effective angle of internal friction (ϕ′) of the clay are 20 kN/m^3, 25 kN/m^2 and 30°, respectively. The slope angle is 20°. Find the following: **(7)**

(i) Factor of safety of the slope with respect to sliding

(ii) Factor of safety of the slope with respect to cohesion assuming friction has been fully mobilized.

(iii) Critical height of the slope

(d) List the different types of revetment with at least three examples of each type. **(4)**

4. (a) With neat sketch briefly describe a direct method of determining soil suction. **(4)**

(b) Derive an expression for determining the rate of seepage through an earth dam resting on an impervious base using Leo Casagrande's method. Also state the procedure for plotting the line of seepage (phreatic line) using this method. **(7 1/3)**

(c) What general criteria should be considered for design of a revetment structure? **(4)**

(d) The following data were obtained for the design of bank revetment using CC blocks for the Bhairab Bazar site on the Meghna river: **(8)**

- Average flow velocity = 2.5 m/s
- Specific gravity of CC block = 2.2
- Mass density of CC block = 2200 kg/m^3
- Angle of repose of CC block = 28°
- Ratio of water depth to revetment size = 5
- Slope of river bank = 2:1 (horizontal: vertical)
- Shield's constant = 0.05; Damage coefficient = 6
- Strength coefficient = 4
- Wind speed = 30 m/s; Minimum wid duration = 1.5 hour.
- Fetch length = 10 km. (Wave characteristics are shown in Table1)

Estimate the size (thickness) of CC blocks capable of withstanding the actions of currents and waves.

Contd P/3

CE 447

SECTION - B

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

5. (a) Discuss, along with the forces involved, the mechanism of water related stability problems that may occur to a slope. **(10)**

   (b) Discuss the importance of segregation analysis for the design and construction of hydraulic fills. **(7 1/3)**

   (c) Specify the laboratory tests (including the materials), and parameters that are required for the design of granular filters? **(6)**

6. (a) Show different components of revetment work with neat sketch of the cross section of a river bank. Also justify the necessity of these components. **(5-7=12)**

   (b) List various information that need to be collected for the design and construction of a hydraulic fill. **(6)**

   (c) Identify and explain, along with the phenomena and soil type, the foundation problems relevant to soil water interaction that may occur to infrastructures as a result of earthquake. **(5 1/3)**

7. (a) Explain, with sketches, the different modes of river bank failure relevant to the soil condition and river characteristics of Bangladesh. **(10)**

   (b) Discuss the general characteristics of as placed hydraulic fills for different types of source materials. **(8)**

   (c) Explain how the use of drains and filters in flood protection embankment makes the design safe and economic. **(5 1/3)**

8. (a) State the criteria for granular filter design. Discuss soil conditions for which a single layer of granular filter may not fulfill these criteria. What can be done for such cases? **(4+3+2=9)**

   (b) Show, with sketches, the use of geotextiles as filters behind retaining walls. **(7 1/3)**

   (c) Discuss considerations for the selection of an appropriate method for improvement of hydraulic fills. **(7)**

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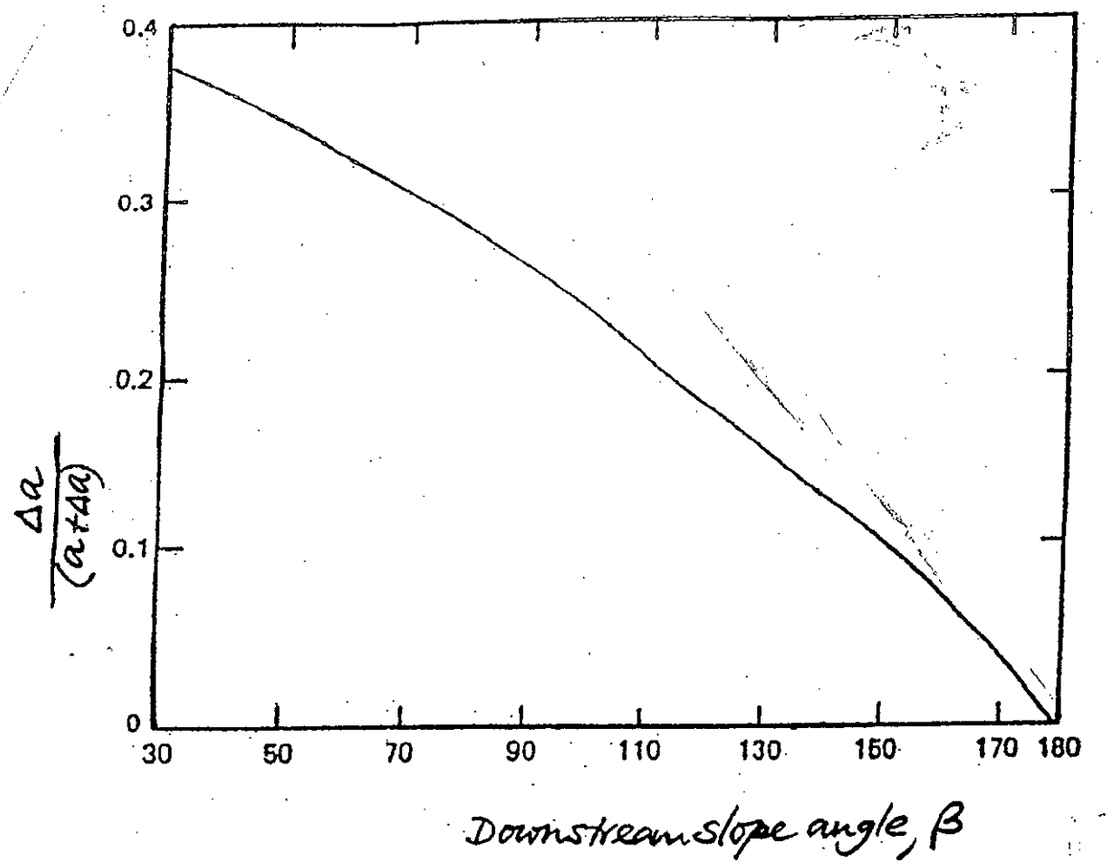

Chart - 1

Table 1 Characteristics of Waves

Wind speed (m/sec)	Minimum duration of wind (hour)	Fetch length (km)	Wave height (m)	Wave period (sec)
15	1.00	5.0	0.7	2.8
	1.75	10.0	0.9	3.3
	2.25	15.0	1.2	3.8
30	0.75	5.0	1.3	3.5
	1.50	10.0	1.8	4.5
	2.00	15.0	2.0	5.0

L-4/T-2/CE **Date : 16/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **CE 405** (Business and Career Development)

Full Marks : 210 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) What do you understand about an organization in terms of its peculiarities, failure and way of explaining organizational problem? **(17½)**

   (b) To reframe an organization, what are your challenges and how you can tackle the challenges under the human resource frame? **(17½)**

2. (a) Explain the five forces that defines the industry structure. **(17½)**

   (b) Explain how you can be benefited from developing a complementary mindset. **(17½)**

3. (a) What do you understand by aligning business model for Innovation and why is it necessary? **(17½)**

   (b) Explain, when and why you should select interdependent architecture on modular architecture. **(17½)**

4. (a) What are the type, source and characteristics of good opportunity for an entrepreneur? **(17½)**

   (b) How can you design value proposition utilizing the value map? **(17½)**

SECTION – B

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

5. (a) Define career. Explain the value of effective career development. **(17)**

   (b) What is meant by external and internal dimensions of a career? Describe external and internal career dimensions of the first two stages of a career. **(18)**

6. (a) Describe briefly the five steps for successful networking. **(17)**

   (b) What is internship? Describe very briefly the tips for internship success. **(18)**

7. (a) What is marketing management? Describe briefly the major marketing management tasks. Draw a sample segmentation analysis matrix. **(17)**

   (b) What is brand? Show diagrammatically the various stages of brand development with the branding objectives at each stage. **(18)**

8. (a) What are the various steps of the job search process? Briefly explain the first three. **(17)**

   (b) Write down the steps for preparation before an interview. Describe the three step STAR process showing how to prepare for questions in an interview. **(18)**

L-4/T-2/CE **Date : 16/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **CE 403** (Socio Economic Aspects of Development Projects)

Full Marks : 210 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 example of arsenic mitigation program for the rural areas of Bangladesh. **(20)**

   (b) What is a client Centered approach? Explain this as a strategic issue for the WSS policies of Bangladesh. **(15)**

2. (a) What are the major difficulties in conducting socio economic assessments in developing countries? Explain with examples. **(20)**

   (b) Briefly discuss methodologies in practice to ensure community participation. **(15)**

3. (a) Write down the advantages and features of Social Impact Assessment (SIA) process. **(20)**

   (b) Explain the following terms with explanations in the context of a WSS project in Bangladesh: **(15)**

   (i) Clientele groups (ii) Clientele need (iii) Clientele demand (iv) Absorptive Capacity.

4. (a) Define "Participation". What is the significance of peoples' participation in WSS projects? **(15)**

   (b) Explain why socio-economic aspects of development projects are of great concern? **(20)**

Contd P/2

CE 403

SECTION – B

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

5. (a) What is development? Explain the concept of Human Development. List and explain the elements of Human Developments. **(20)**

   (b) Explain the differences between Economic Development and Economic Growth. **(15)**

6. (a) Explain 'Development Indicators' with examples. What are the importance and limitations of Development Indicators? **(20)**

   (b) What are GNI and GDP? What are the differences between these two? Explain the weaknesses of GNI as a development indicator. **(15)**

7. (a) What is HDI? What are the principles for constructing HDI? **(20)**

   (b) Explain the process of HDI calculation procedure clearly. Give an example with respect to Bangladesh. **(15)**

8. (a) Write short notes on (i) IHDI, (ii) GDI, (iii) GII, (iv) MPI **(15)**

   (b) What is Sustainable Development? Write the principles of Sustainable Development. What are the objectives of Sustainable Development? **(20)**
