L-4/T-2/CE Date : 31/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **CE 443** (Geotechnical Engineering IV)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Define 'stress-path' as used in geotechnical engineering. Mention the parameters that are used to represent stress-paths. **(6)**

   (b) Draw qualitative stress-paths for a soil element – **(8)**

   (i) at the bottom of an excavation

   (ii) at the side of an excavation

   (iii) below the centre of a footing

   (iv) below the centre line of an embankment.

   (c) For a conventional consolidated drained triaxial test, determine the slope of the stress-path in q ~ p space at the shearing stage. **(5)**

   (d) What happens to a soil element as shear loading continues along a stress path? Also explain the changes to the Mohr's circles. **(4 1/3)**

2. (a) Draw typical effective stress failure envelopes that are obtained from consolidated undrained triaxial test on – **(5)**

   (i) normally consolidated clay

   (ii) overconsolidated clay

   Also show the corresponding shear strength parameters.

   (b) Why consolidated drained test is not usually done for clay soils? How can we obtain drained strength parameters from consolidated undrained test? **(6 1/3)**

   (c) A CU test was conducted on a saturated clay soil by isotropically consolidating the specimen using a cell pressure of 150 kPa and then incrementally applying the deviator load while keeping the cell pressure constant. Failure was observed when the deviator load reached 172 N. The specimen was 37 mm in diameter and 75 mm long. The pore-water pressure at failure was 54 kPa. Determine – **(12)**

   (i) the major principal stresses (total and effective) at failure

   (ii) the undrained shear strength

   (iii) the drained angle of internal friction

   (iv) the orientation of failure plane with the horizontal if a drained test is performed and show it on an element.

   Also schematically plot the total and effective stress Mohr's circles.

Contd P/2

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3. (a) Draw qualitative plots showing the state boundary surfaces and other controlling lines as represented in Critical State Theory. **(5 ⅓)**

   (b) Describe with sketches, how critical state theory represents the stress-strain behaviour of overconsolidated (both lightly and heavily) clays under undrained loading. **(10)**

   (c) An UU test was conducted on a saturated clay specimen. The cell pressure was 100 kPa and failure occurred under a deviator stress of 150 kPa. **(8)**

   (i) Determine the undrained shear strength

   (ii) Plot the Mohr's circle at failure and show the controlling ordinates

   (iii) Draw the failure envelope

   (iv) If another test is performed under a cell pressure of 150 kPa, what will be the axial stress at failure?

4. (a) What 'SHANSEP' stands for? Write the stapes followed to design foundations by 'SHANSEP' method. **(8)**

   (b) Discuss the advantages of triaxial tests over other common laboratory shear tests on soil. **(7)**

   (c) Define the two pore-water pressure parameters and state their significance in triaxial tests on soil samples. Also discuss their magnitude along with governing factors. **(8 ⅓)**

SECTION – B

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

5. (a) Explain Simplified Method of Estimation of Liquefaction Resistance Factor. **(11)**

   (b) An embankment is to be constructed over a layer of clay 9 m thick, with a impermeable lower boundary. Construction of the embankment will increase the total vertical stress in the clay layer by 55 kPa. For the clay layer, C_v = 3.9 m^2/yr; C_h = 7.1 m^2 /yr and m_v = 0.19 m^2/MN. The design requirement is that all but 23 mm of the settlement due to consolidation of the clay layer will have talun place after 5 months. Determine the spacing in a triangular pattern of 250 mm diameter sand drains to achieve the above requirements. **(12 ⅓)**

6. Write short notes on: **(23 ⅓)**

   (a) Liquefaction Potential Index.

   (b) Countermeasure for Building Foundations Against Liquefaction.

   (c) Dynamic Consolidation.

   (d) Compaction Pile.

Contd P/3

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7. (a) Describe the process of Vibroflotation with neat sketch. **(10)**

(b) Estimate liquefaction potential index at a construction site for a 7.0 magnitude earthquake producing a peak ground acceleration of 0.41 g. Consider the water table to be at a depth of 1.75 m. The saturated unit weight of solid is 18 kN/m^3. The required data is provided below: **(13 ⅓)**

Depth (m)	1.5	3.0	4.5	6.0	7.5	9	10.5	12	13.5	15	16.5	18	19.5	21	22.5	24	25.5
N-Value	1	1	2	2	3	3	4	5	7	10	2	2	5	8	10	15	20
d_{50} (mm)	0.12	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.2	0.2	0.05	0.06	0.1	0.15	0.16	0.19	0.2

8. (a) Write the names of different types of vertical drains. Discuss a case study with necessary sketches of the application of PVD in Bangladesh. **(10 ⅓)**

(b) For a proposal construction, a 10 m thick normally consolidated clay layer will be subjected to a pressure of 40 kPa in Figure 1. It is decided to improve the soil by applying a surcharge load of 60 kPa for 7 months. What would be reduction in the consolidation settlement due to this surcharge? **(13)**

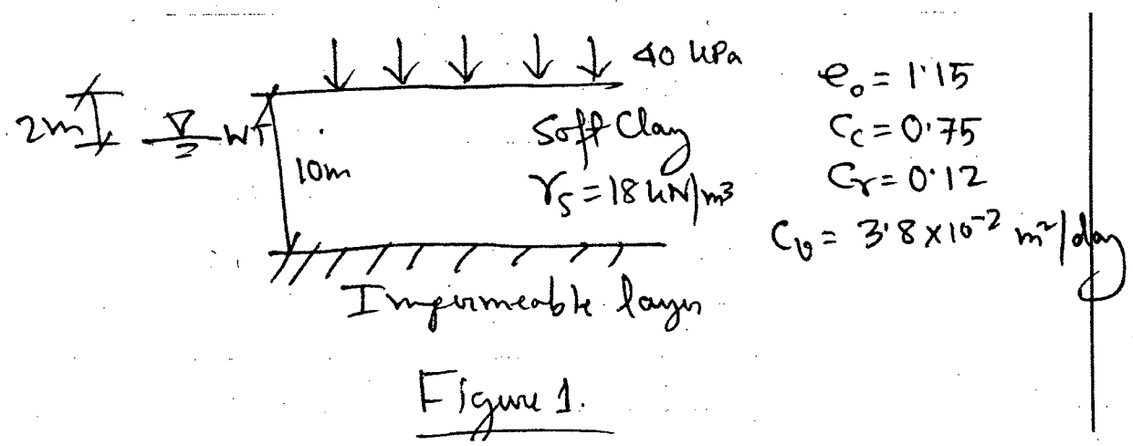

Figure 1.

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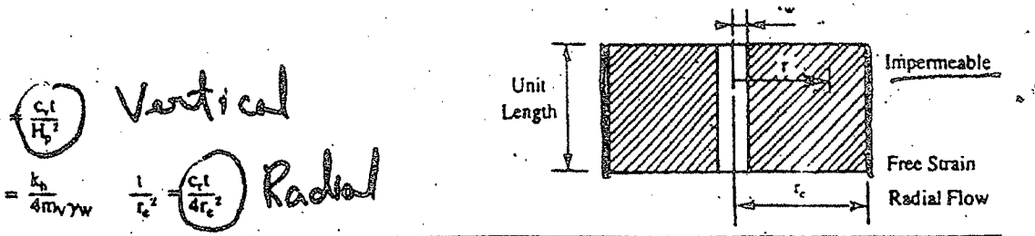
DATA -

$T_v = \left(\frac{c_v t}{H_p^2}\right)$ Vertical

$T_r = \frac{k_h}{4 m_v \gamma_w} \frac{1}{r_e^2} = \left(\frac{c_r t}{4 r_e^2}\right)$ Radial



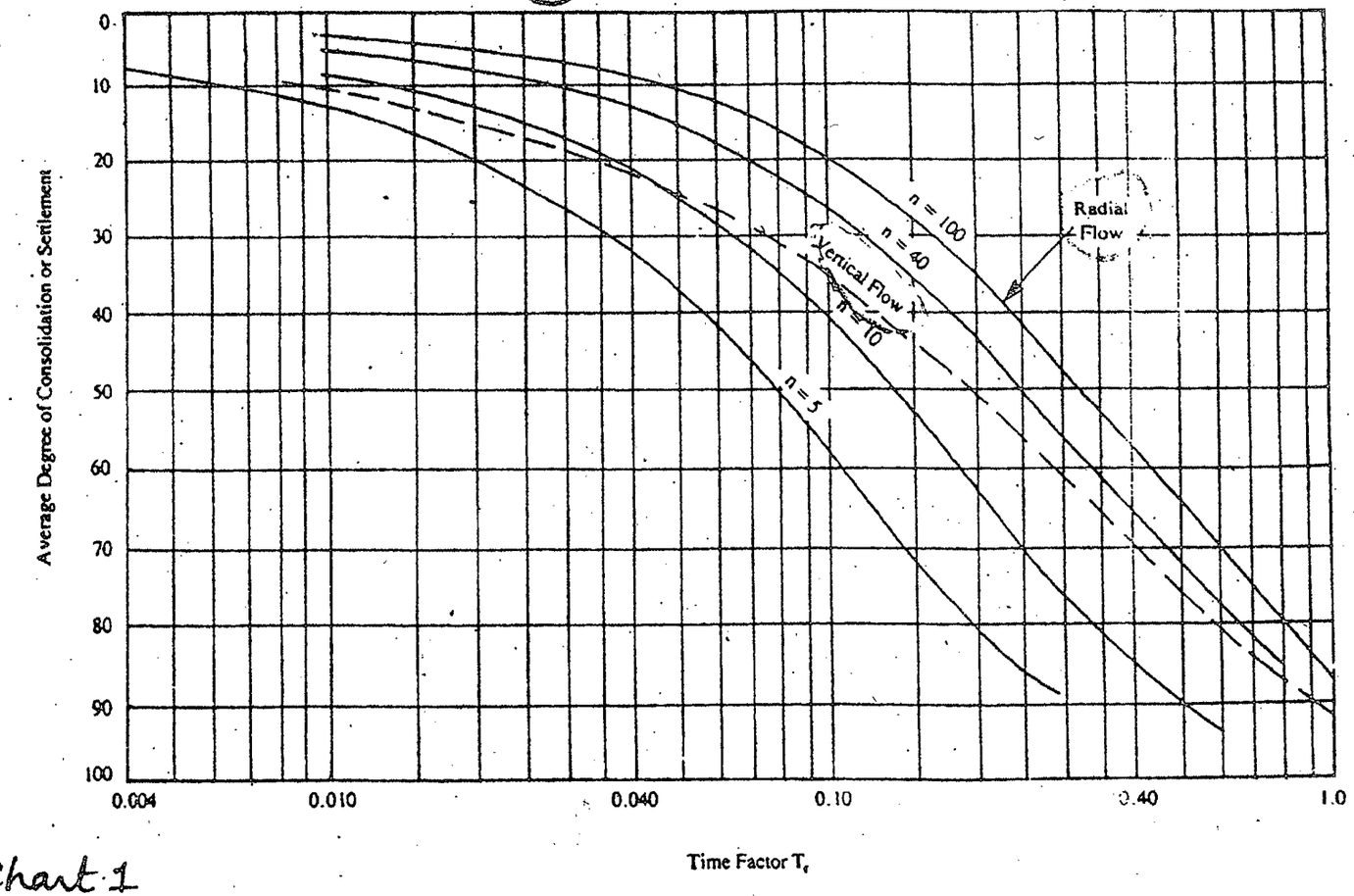


Chart 1

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

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

Assume reasonable value of missing data, if any.

Use attached charts where necessary.

1. (a) Mention the main reasons of non-Darcy behaviour in soils. Also define permeability parameters n and C. **(7)**

   (b) Derive Laplace's equation in two dimensions. Also show that both the potential function and stream function satisfy Laplace's equation. **(8)**

   (c) Mention the assumptions for determining permeability of soils in field by pumping test. With neat figures describe the constant head borehole permeability test to estimate coefficient of permeability in the field. **(8 ⅓)**

2. (a) Mention the basic requirements to be fulfilled for the construction of flow net. What are the possible boundary conditions for drawing flow net in an earth dam? **(6)**

   (b) Draw neatly the entrance and exit requirements of the line of seepage. **(4)**

   (c) 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 of plotting the line of seepage using this method. **(8 ⅓)**

   (d) A test well, 0.5 m in diameter is drilled through an aquifer of 10 m thick up to the underlying impermeable stratum. The original water table is at the ground surface. At steady state, the discharge from the well is 4.2×10^{-2} m^3/sec at a drawdown of 4 m. Determine the coefficient of permeability of soil if the observed radius of influence is 120 m. **(5)**

3. (a) Derive Kozeny-Carman equation for coefficient of permeability of soil. **(8 ⅓)**

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

   (c) With neat sketches, briefly describe the procedure of determining coefficient of permeability in the laboratory by horizontal capillarity test. **(6)**

   (d) Saturated unit weight and effective angle of internal friction (ϕ') of a cohesionless soil are 18 kN/m^3 and 30°, respectively. A slope is to be made of this material. If the factor of safety is to be 1.25, determine the angle of slope when seepage occurs at and parallel to the slope (i.e., water table is at slope surface). **(4)**

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4. (a) A homogeneous earth embankment of height 10 m was built on an impervious foundation with side slopes 1.5 : 1 (horizontal : vertical). The embankment retains water to a height of 9 m. The crest width of the embankment is 2 m. Plot the line of seepage using A. Casagrande's metod (use plain graph paper for plotting). **(10)**

(b) Deduce an expression for critical height of a slope by Culman's method. **(7 ⅓)**

(c) A slope is to be constructed in a silty clay soil to a height of 8 m. The slope angle is 60°. The values of unit weight, cohesion and angle of internal friction of the soil are 19 kN/m^3, 40 kN/m^2 and 15°, respectively. Determine the factor of safety and critical height of the slope. If the same slope is made in a very deep layer of the soil having $\phi = 0$, then what will be the factor of safety of the slope? **(6)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.
Normal and semi-log graph paper should be supplied.

5. (a) Show with neat sketches a typical river bank protection scheme commonly employed in Bangladesh. Explain the functions of each of the components. **(9 ⅓)**

(b) What is a filter cake? How does it form? Do you think after formation of filter cake geotextile filter is not required anymore? Explain. **(7)**

(c) What general criteria should be considered during design of revetment structure? Explain with sketches, wherever applicable. **(7)**

6. (a) How many types of filter materials are available for preventing soil loss from behind a retaining wall. Describe their relative advantages and disadvantages. **(7 ⅓)**

(b) Mention the criteria for (i) granular filter and (ii) geotextile filter design. **(4)**

(c) Define the terms (i) Apparent Opening Size and (ii) Permittivity.

Following data were obtained when glass beads of known size were shaken on a geotextile filter material in the lab: **(4+8)**

% Retained	Glass bead size (mm)
10.0	0.060
20.0	0.100
30.0	0.150
40.0	0.180
50.0	0.200
60.0	0.220
70.0	0.250
80.0	0.270
90.0	0.330
100.0	0.400

Determine the apparent opening size (AOS) of the geotextile.

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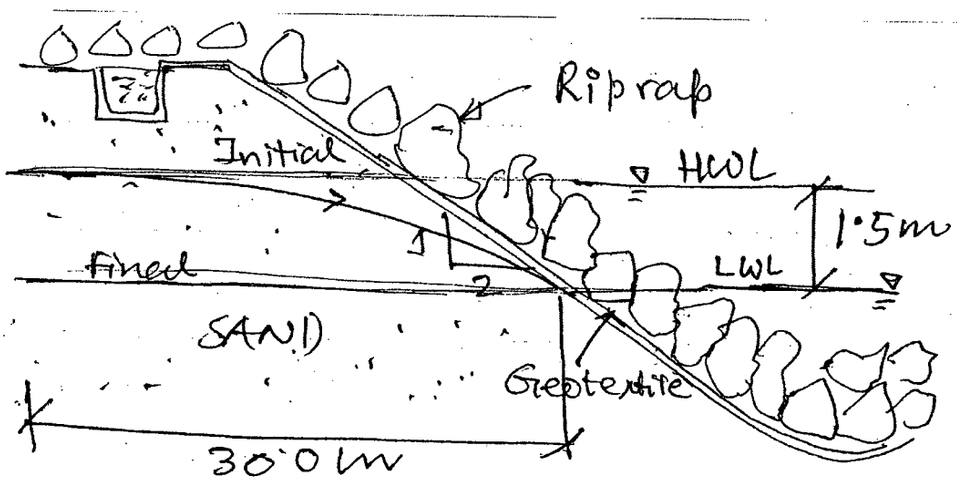
7. (a) **(18 ⅓)**



Given:

- Tidal difference = 1.5 m
- Tide interval = 2 hrs
- Permittivity of candidate geotextile = 0.6 s^{-1}
- AOS of candidate geotextile = 0.25 mm
- d_{50}, d_{90} and porosity of river bank soil = 0.15 mm, 0.45 mm and 0.45, respectively

Determine the filtration adequacy of the candidate geotextile.

(b) Write down the geometric and hydraulic properties of a 500 gsm soil saver (geojute). **(5)**

8. (a) The following data are available for a river in Bangladesh at a given site: **(13 ⅓)**

- Discharge (bank full) = 16.0 cumec
- Average flow velocity = 3.0 m/sec
- Ratio of water depth and revetment size, h/D = 5
- Specific gravity = 2.65
- Slope of bank = 26.5°
- Angle of repose of revetment material = 42°

Determine the size of revetment material and rip rap thickness using Neill's method, JMBA equation and Inglish formula.

(b) Describe how geojute and vegetation establishment can be used for reducing top soil erosion control of an exposed surface. Explain with neat sketches. **(10)**

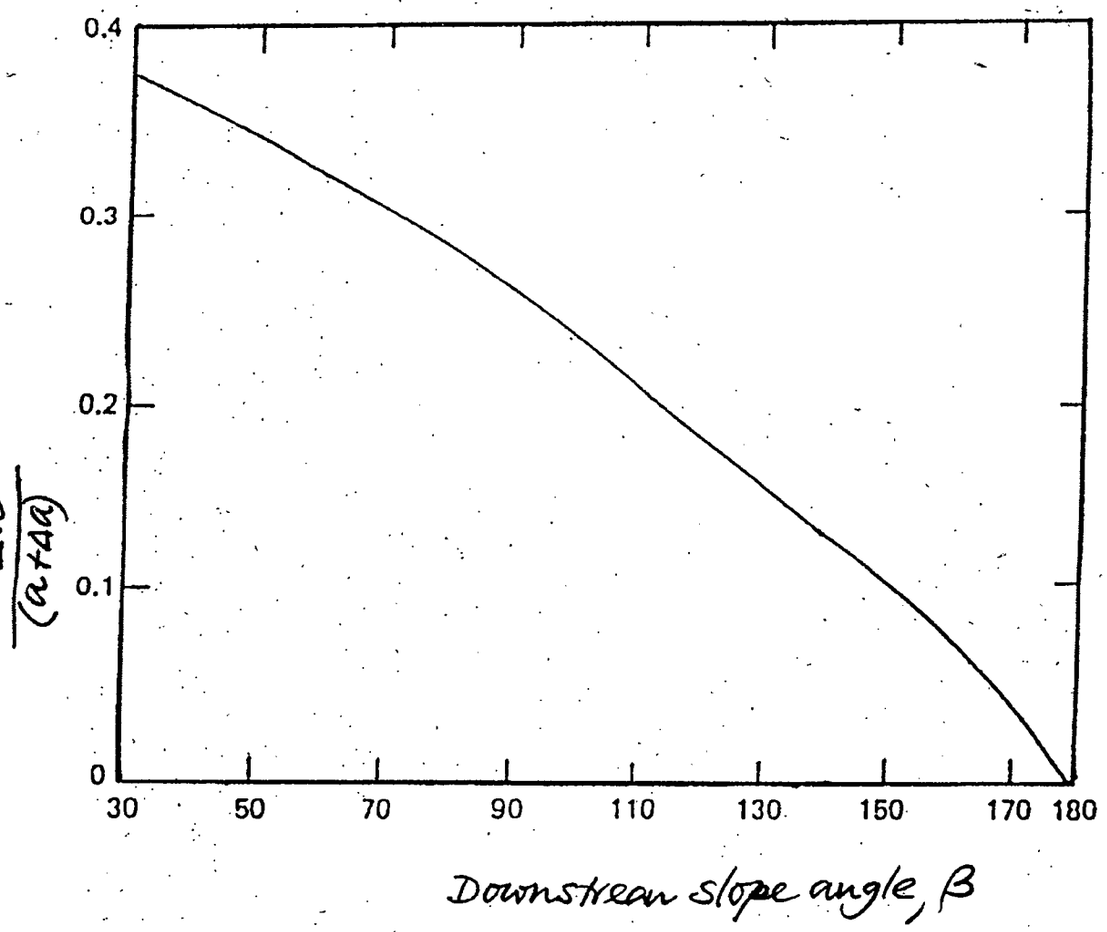


Chart - 1

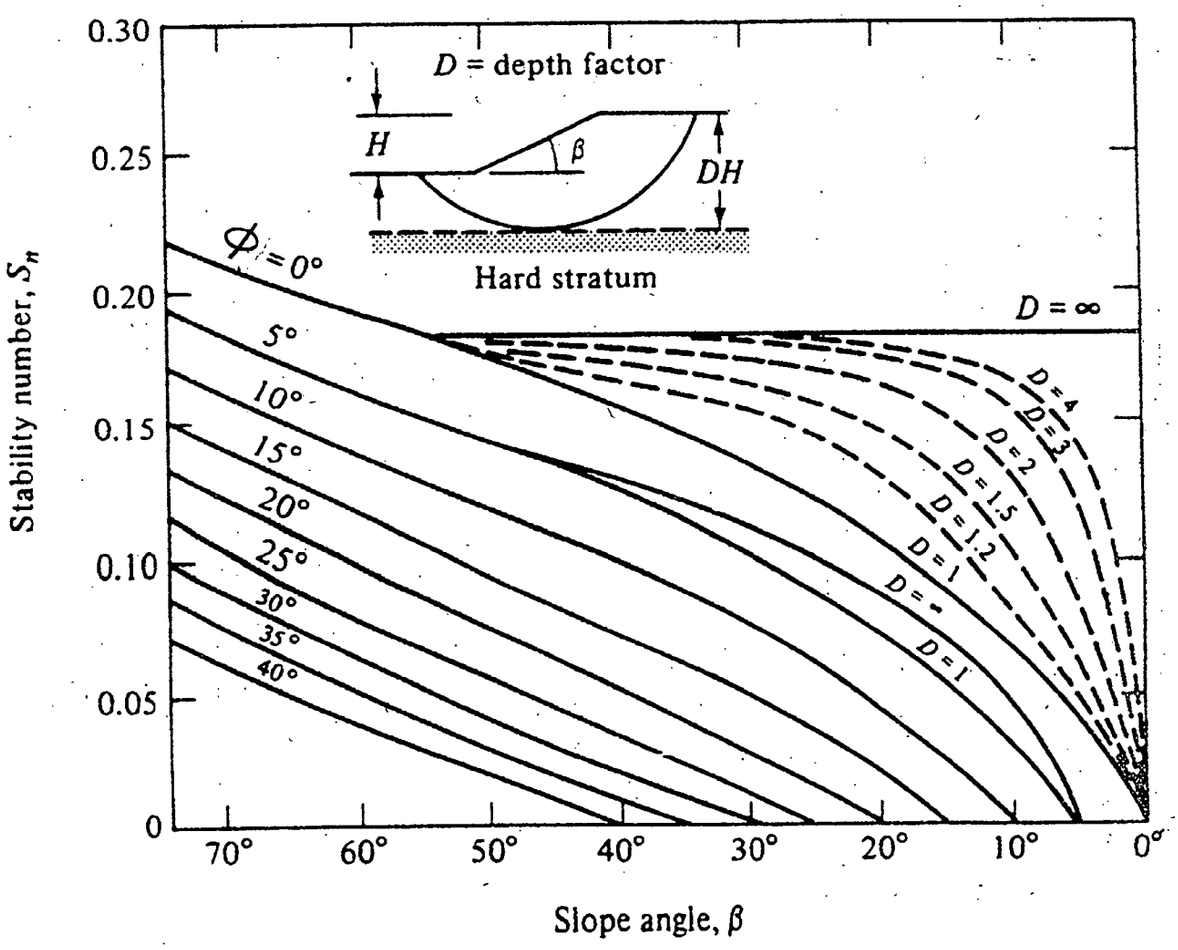


Chart - 2

L-4/T-2/CE **Date : 24/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

The symbols carry their usual meaning.

Assume reasonable values for missing data, if any.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What are the advantages of finite element method? **(6)**

   (b) Describe the basic steps that are followed in Finite Element formulation. **(11 ⅓)**

   (c) What is isoparametric formulation? Why isoparametric formulation is often known to perform better than super parametric formulation? **(6)**

2. (a) What is a constitutive relation? What is its purpose in a FEM program? **(7)**

   (b) Explain the following terms and write down constitutive laws for each of the cases: **(9)**

   (i) Plane stress problem (ii) Plane strain problem (iii) Axisymmetric problem.

   (c) In modeling a 2D space, a triangular element is often superior than a quadrilateral element; while modeling a 3D solid cube, tetrahedral elements are often better than brick elements. Explain. **(7 ⅓)**

3. (a) For the spring system with arbitrarily numbered nodes and elements as shown on Fig. 1, derive the global stiffness matrix (k). In this process show that the derived stiffness matrix is symmetric. Indicate the band width. **(11 ⅓)**

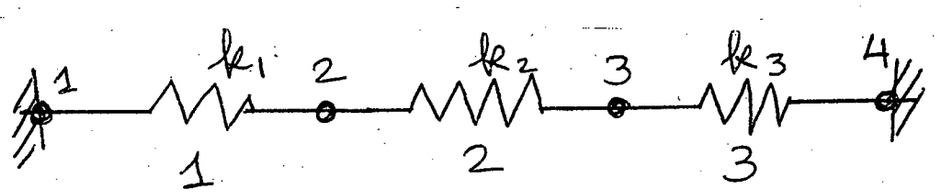


Fig. 1

   (b) What is a numerical error? **(3)**

   (c) Explain the following terms with necessary sketches: **(9)**

   (i) Constant strain triangle (CST) (ii) Linear strain triangle (LST) (iii) Quadratic strain triangle (QST).

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4. (a) Why Gauss quadrate formula is preferred in finite element analysis? Write down also the expression that the Gauss method uses to compute a function at predetermined sampling points. **(7)**

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

   (c) List the important discontinuities that need to be considered in discretizing a structure in FEM. Explain each type with examples. **(11 ⅓)**

SECTION – B

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

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

   (b) Approximate the area of a circle by dividing it into 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. **(12)**

   (c) Write four statements that describe the necessity and application of FEM in engineering. **(5 ⅓)**

6. (a) Discuss with sketches four major discontinuities that may exist in a real structure and the necessity of considering those in discretizing a structure. **(12)**

   (b) "In a displacement based finite element formulation with inadequately defined mesh, a lower bound solution is expected" – Explain. **(7 ⅓)**

   (c) What are the fundamental assumptions in analyzing a structure as a linear elastic problem? **(4)**

7. (a) Explain the term "shape functions". Why polynomial terms are preferred for shape function? **(12)**

   (b) Explain the situation when band solution becomes more expensive than frontal solution technique in terms of memory requirements and storage time. **(11 ⅓)**

8. (a) Introduce reasonable shape functions for a two nodded beam element (Fig. 2) and derive the element stiffness matrix. **(11 ⅓)**

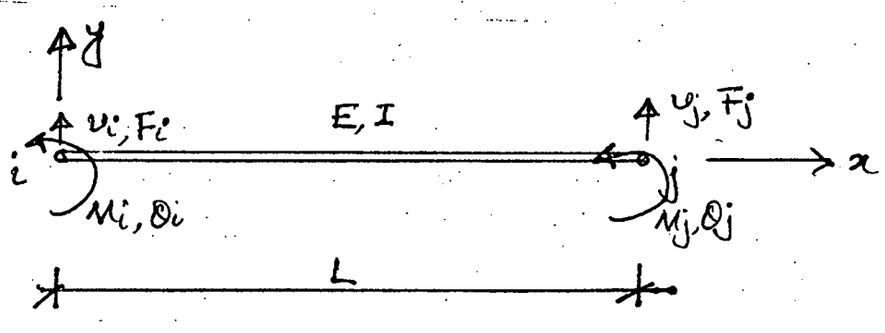

Fig. 2

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(b) A cantilever beam with a span length of 10 ft is subjected to an uniform distributed load 5 kip/ft and a point load of 12 kip as shown in Fig. 3. Write down the global FE equation for the beam and determined **(12)**

(i) deflection and rotation at the free end of the beam

(ii) shear force and bending moment at the fixed end of the beam.

Given, E = 3600 ksi and I = 1440 in^4.

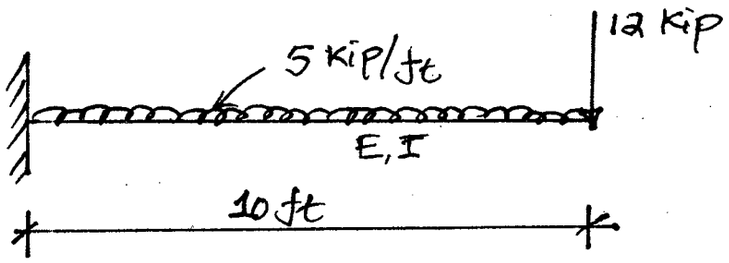

Fig. 3

L-4/T-2/CE

Date : 24/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : CE 417 (Design of Steel Structures)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Differentiate between overall buckling and local buckling. (6)

   (b) Write short note on braced frame and unbraced frame. (4)

   (c) Investigate the stability (adequacy) of the column shown in Fig. 1. The column is subjected to a load of 260 kip. Use A992 steel. (13 1/3)

2. (a) Write short note on unstiffened and stiffened elements. (4)

   (b) Determine whether column shape shown in Fig. 1(a) will have local buckling. Assume A992 steel. (4)

   (c) Select lightest section of A36 steel for a column to carry an axial load of 250 kip. The probable sizes are given below. Assume unbraced length for strong axis bending = 25 ft and unbraced length for weak axis bending = 12.5 ft. (15 1/3)

Size	Ag (in^2)	r_x (in)	r_y (in)
W12 × 58	17.0	5.28	2.51
W10×54	15.8	4.37	2.56
W10×49	14.4	4.35	2.54

3. (a) Discuss on effective net area and block shear failure of a tension member. (8)

   (b) Determine the allowable load carrying capacity of the tension member shown in Fig. 2. Use A36 steel. (15 1/3)

4. (a) A flat bar ($\frac{1}{4}$ ×6) used as a tension member is connected to a gusset plate of $\frac{3}{8}$ inch thickness. The connection is made with 5 inch transverse weld length and 6 inch longitudinal weld length at each side of the member. The gusset plate is A992 steel and the member is A36 steel. The welds are $\frac{3}{16}$ inch fillet welds made with E70XX electrodes. Determine available strength of weld connection. (10)

   (b) Design and detail welded end connection required to transmit dead load of 50 kip and live load of 70 kip through an angle L8×5×$\frac{3}{8}$ to a gusset plate of $\frac{3}{4}$ inch thickness. All materials are of A36 steel. Use E60XX electrode. Assume both transverse and longitudinal weld required. (13 1/3)

Contd P/2

CE 417

SECTION – B

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

Symbols and notation bear their usual meanings.

See the accompanying steel section tables and formulae if needed.

5. (a) Discuss, with neat sketches, the behavior of structural steel at different temperature. (5)

(b) A double-channel shape, 2C8×18.7, is used as a tension member as shown in Fig. 3. The channels are bolted to a $\frac{3}{8}$ inch gusset plate with $\frac{7}{8}$ inch diameter bolts. The tension member is A572 Grade 50 steel (F_y = 50 ksi, F_u = 65 ksi) and the gusset plate is A36 (F_y = 36 ksi, F_u = 50 ksi). If ASD principle is used, how much allowable tensile load can be applied? Consider limit states of the channel and gusset plate only. (8)

(c) Determine the parameter C_b for all segments of the beam shown in Fig. 4. Consider that the beam is laterally supported at all locations of point loads in addition to the ends. (10 ⅓)

6. (a) Qualitatively sketch the moment, M, vs. unbraced-length, L_b curve of a typical compact wide flange section and indicate different characteristic regions with proper symbols and notes. (5)

(b) Determine the net area A_n of the angle shown in Fig. 5. The bolt holes are $\frac{15}{16}$ inch diameter. (8)

(c) For the bolted tension member shown in Fig. 6, determine the shear lag factor, U; the net area, A_n; and the effective area A_e. (10 ⅓)

7. (a) Briefly discuss, with neat sketches, the shear buckling of the web of an I-shaped section. (5)

(b) The beam shown in Fig. 7 is a W14×61 of A992 steel (F_y = 50 ksi, F_u = 65 ksi) and has continuous lateral support. The load P is a service live load. What is the maximum permissible value of P? Follow ASD principle. (8)

(c) Determine the maximum allowable moment of a beam having W14×68 section of A242 steel (F_y = 50 ksi, F_u = 70 ksi) having to an un-braced length of 20 ft with C_b = 1.0. Follow ASD method. (10 ⅓)

8. (a) Briefly discuss the advantages of modern structural bolts over rivets. (5)

(b) Determine the elastic shear stress distribution on a W14×82 beam subjected to a service load shear force of 60 kips acting for major axis bending. Also compute the portion of the shear carried by the flange and that carried by the web. (8)

(c) A double-angle shape, 2L6 × 6 × $\frac{5}{8}$, is connected to a $\frac{5}{8}$ inch gusset plate as shown in Fig. 8. The bolts are $\frac{7}{8}$ inch diameter A325 bearing-type (F_y = 90 ksi, F_u = 120 ksi) having threads in shear plane. A572 Grade 50 steel (F_y = 50 ksi, F_u = 65 ksi) is used for the angle, and A36 steel (F_y = 36 ksi, F_u = 50 ksi) is used for the gusset plate. Determine the maximum total allowable service load that can be applied. Follow ASD principle and consider bolt limit states only. (10 ⅓)

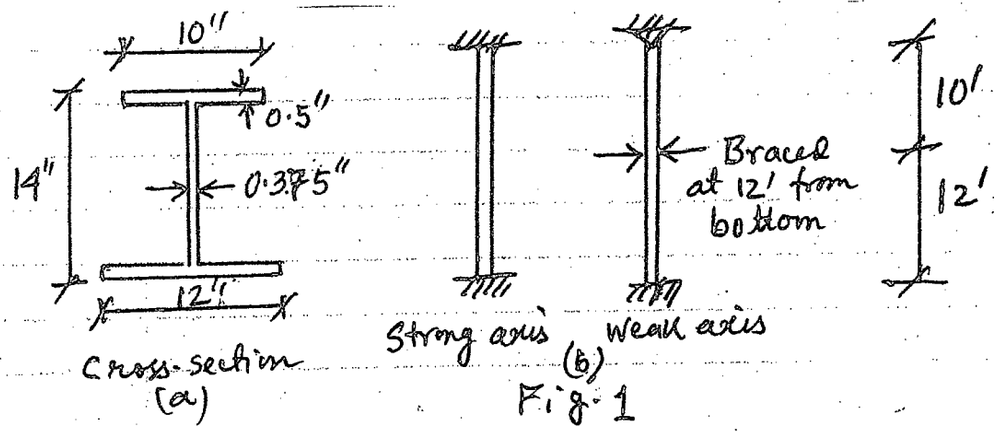

Fig. 1

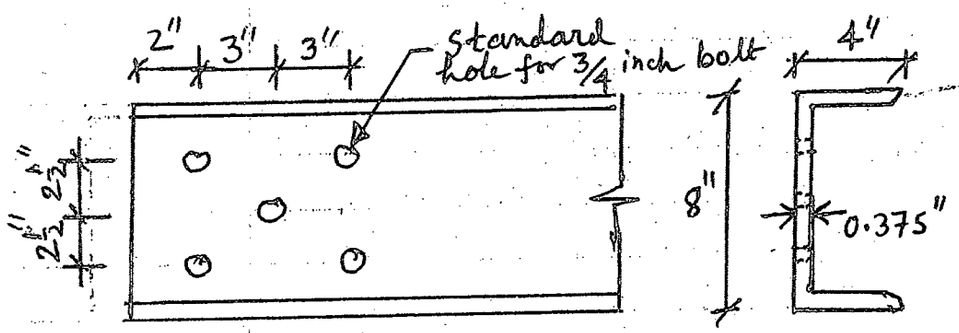

Fig. 2

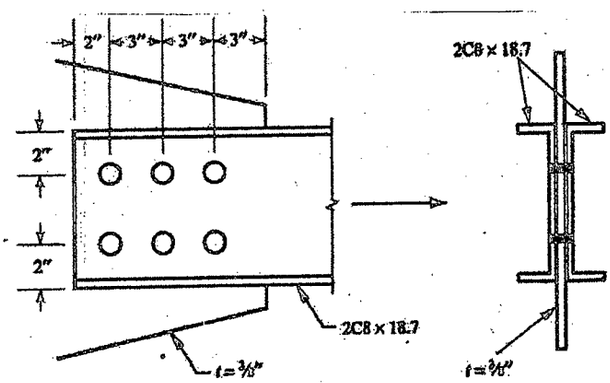

Fig. 3

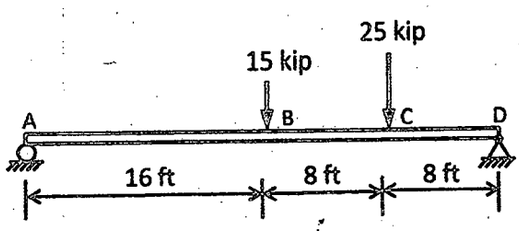

Fig. 4

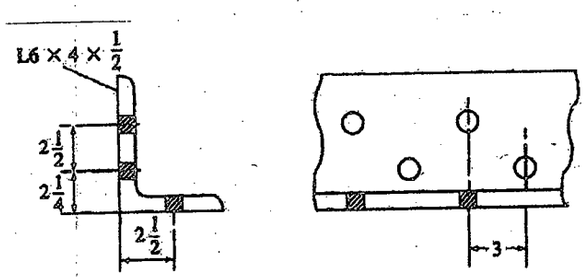

Fig. 5

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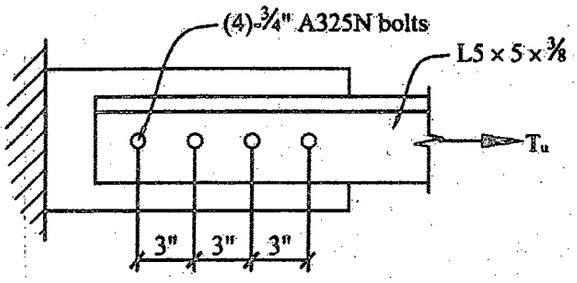


Fig. 6

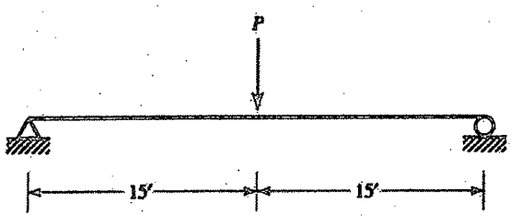
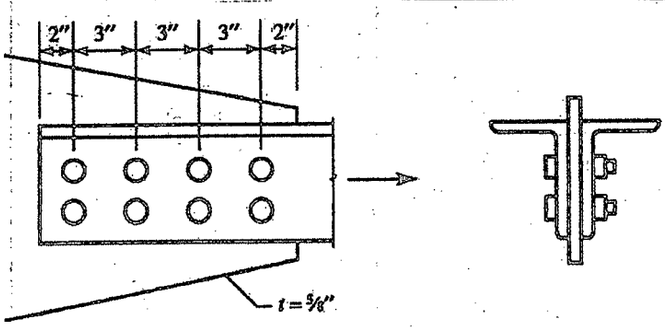


Fig. 7



Side view Section

Fig. 8

L-4/T-2/CE **Date : 17/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **CE 451** (Transportation Engineering III : Traffic Planning and 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**.

Necessary assumptions could be made for any missing data/information.

1. (a) Define and explain the function, hierarchy and classifications of the urban road system. Illustrate your understanding with suitable diagrams and figures stating different functional road types. List the predoniminant functions and activities that are commonly considered for different road types in urban areas. Also list some traffic operational and design improvements that are required to take full advantage of Arterial Street. **(13 ⅓)**

   (b) Why do we need classification of road accidents? Give details of the accident classification system and explain the concepts and usefulness of collision diagram. **(10)**

2. (a) Define and explain different trip categories and discuss the factors affecting individual mode and route choice. Discuss the following: **(11)**

   (i) Congestion factors and characteristics and

   (ii) Diversion curve for traffic assignment.

   (b) Discuss the significance of Non-motorised transport (NMT) in urban areas of Bangladesh both in the present and future context. Briefly outline the various facilities used for safer and convenient movement of pedestrians and bicyclists in urban areas. List some countermeasures for reducing pedestrian-vehicular collisions at intersections. **(12 ⅓)**

3. (a) Define road traffic accident and explain road traffic accident factors with particular reference to Haddon Matrix. Explain the following: **(12 ⅓)**

   (i) Hazardous Road Location (HRL) Program elements

   (ii) Clustering of accidents on the road network.

   (b) What are the fundamental principles for safer road environment? What principles should be followed for designing safer intersections and links (mid-block sections)? State your understanding about the new tool of road safety audit and explain the stages and conduct of road safety audit. **(11)**

Contd P/2

CE 451

4. (a) Define urban bypass and explain briefly the reasons, types and the consequences of the urban bypass. Why and in which way one way streets considered as one of the most cost-effective tools for improving traffic problems? **(11)**

(b) Explain in brief the salient features of the transportation planning process. **(12 ⅓)**

A self-contained town consists of three residential areas A, B, C and two industrial estates X and Y. Generation equations show that for the design year in question, the trips from home to work generated by each residential area per 24 hour day are as follows:

A	1250
B	2250
C	1750

There are 3,700 jobs in industrial estate X and 4500 jobs in industrial estate Y. It is known that attraction between zones is inversely proportional to the square of the journey times between zones. The journey times in minutes from home to work are:

Zones	X	Y
A	16	20
B	14	12
C	12	15

Calculate and tabulate the interzonal trips for journeys from home to work.

Assume $K_{ij} = 1$ for all zones.

SECTION – B

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

5. (a) What are the eight important data items collected for analyzing traffic flow on the road. Compare manual and automated scheme for such data collection. Also, explain and deduce the interrelationship between **(2+5+6 ⅓=13 ⅓)**

(i) Traffic flow and headway

(ii) Time mean speed and space mean speed

(iii) Occupancy and density

(b) Explain linear and logarithmic speed density model with graphs and equations. Also, combining fundamental traffic flow equation with the above model, derive condition for **(5+5)**

(i) Optimum speed and density

(ii) Maximum flow capacity

Finally, comment on their field implication with information technology (IT) support.

Contd P/3

CE 451

6. (a) Explain the two classical volume delay functions with equation. Also, graphically explain their limitation with comments on their application and uses. **(6+4=10)**

(b) 'Urban road network capacity is dictated by intersection capacity' – Discuss. Explain saturation flow and effective green time graphically for a traffic signal. **(3 ⅓ +4+6=13 ⅓)**

A simple four-leg intersection needs a fixed time signal. The critical flows in the N-S and E-W directions are 600 and 400 veh/hr. Saturation flow is 1800 veh/hr and the lost time per phase is observed to be 1.2 s. Determine the cycle length and distribution of green following Webster's method.

7. (a) Explain the geometric elements for traffic circle design with illustration.
What is traffic calming? Explain features and uses of Forced turn island, Speed table, Textured pavement intersection Chicanes and Raised crosswalk. **(3 ⅓ +10)**

(b) What are the likely environmental impacts of large transportation project construction on surface and water? Make reference to these impacts for Padma bridge and Sonadia deep sea port. **(10)**

8. (a) What are the traffic management, Transit management, demand management and restraint measures option for transport system management. Also, explain benefits of separating local function from arterial traffic with schematic diagram. Explain its suitability for Dhaka. **(8+5 ⅓)**

(b) Discuss emission reduction through transport system improvement. **(4+6)**

Make a comparative discussion with schematic drawing for following three

(i) Trumpet Interchange

(ii) Conventional Diamond Interchange

(iii) Single Point Urban Interchange (SPUI).

CE 208

12 + 3 = 15

L-4/T-2/CE **Date : 10/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

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 reasonable values for parameters not given.

1. (a) For a gas-fired power plant, the flow rate of exhaust gas through the stack is 576 kg/sec, and concentration of NO_2 in the exhaust gas is 35 ppmV. The effective stack height is 40 m and the atmosphere is "slightly stable". The measured wind speed at 10 m height is 3.5 m/sec. Estimate, **(14)**

(i) Concentration of NO_2 (in $\mu g/m^3$) at a location 1500 m down-wind on the roof of a building that is 19 m high.

(ii) Ground level concentration of NO_2 (in $\mu g/m^3$) at a location 900 m down-wind and 50 m off the center-line of the plume.

[Given: MW of exhaust gas = 28 g/mol; p = 0.40; Table for estimation of dispersion coefficient provided.]

(b) What do you understand by "thermal NO_x" and "fuel NO_x"? How do SO_x affect building materials? Explain. **(4 1/3)**

(c) What do you understand by "halocarbons"? How do they influence radiative forcing in the troposphere and in the stratosphere? Explain. **(5)**

2. (a) Write down the assumptions of the "point source Gaussian Plume Model". **(9)**

Along a straight highway, cars are traveling at an average speed of 55 km/hr and cars along the highway are 15 m apart. Emission of CO from each car is estimated at 4.0 g/km. The wind speed is 2.0 m/sec perpendicular to the road, and the atmosphere is "neutral". Estimate ground-level CO concentration in a village located 1000 m down-wind of the road due to vehicular emission.

[Table for estimation of dispersion coefficient provided].

(b) What do you understand by $SLCP_s$? What are the major sources of Black Carbon (BC) in Bangladesh? Discuss the "climate effects" and "health effects" of BC. **(7 1/3)**

(c) Calculate the "stoichiometric ratio" for the fuel C_8H_{18}. What do you understand by "leon mixture" and "rich mixture"? Explain, with an appropriate figure, the effect of air-fuel ratio on automotive emission. **(7)**

Contd P/2

CE 433

3. (a) Why an "averaging period" is associated with air quality standards? Explain. On a particular day, air quality data recorded at a CAMS in Dhaka are as follows: **(9)**

PM_{10} (24-hr) = 230 $\mu g/m^3$; $PM_{2.5}$ (24-hr) = 60% of PM_{10};

SO_2 (24-hr) = 450 $\mu g/m^3$; and O_3 (1 hr) = 470 $\mu g/m^3$.

Determine AQI for each parameter and report AQI for that particular day.

[Given: T = 25°C, P = 1 atm; Table for calculating AQI provided].

(b) What do you understand by "photochemical smog"? Discuss its adverse impacts. How does CO promote the formation of O_3 in the atmosphere? Explain with appropriate chemical equations. **(7 1/3)**

(c) What do you understand by "atmospheric radiative window"? Explain the effects of atmospheric aerosol on global warming, distinguishing between positive and negative, and direct and indirect forcings. **(7)**

4. (a) A gravitational settling chamber is to be designed such that all particles with ≥ 40 μm diameter are removed in the chamber with 100% theoretical efficiency. If the length to height ratio of the chamber is 5, estimate the horizontal flow velocity that should be maintained in the chamber. Also estimate the removal efficiency of 5 μm size particles in the chamber. **(7)**

[Given: $\mu = 2.0 \times 10^{-5}$ kg/m-sec; Sp.Gr. of particle = 1.8]

(b) What do you understand by "stable", "unstable" and "neutral" atmosphere? **(10 1/3)**

The ambient atmospheric temperature profile on a particular day is given by the following equations:

$$T(°C) = 25 + 0.05\,z; \quad z \le 90 \text{ m}$$
$$= 29.5 - 0.005\,z; \quad 90 < z \le 350 \text{ m}$$
$$= 27.75 + 0.01\,z; \quad z > 350 \text{ m}$$

where, z = altitude in m.

(i) If a plume is emitted at 29.5°C from the top of a 50 m stack, upto what height (from ground level) it would rise under the existing conditions? Draw (qualitatively) the shape of the plume emitted from the stack.

(ii) If a plume is emitted at 30°C from the top of a 100 m stack, upto what height (from ground level) it would rise? Also draw the shape of the plume emitted from this stack.

(c) What do you understand by aerodynamic diameter of particulate matter (PM)? What are the important mechanisms for deposition of particles in the respiratory system? Explain with appropriate sketches. **(6)**

Contd P/3

CE 433

SECTION – B

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

5. (a) Sketch a typical Streeter-Phelps DO sag curve, label it and indicate on it: **(10 1/3)**

(i) the stretch of river for which the rate of deoxygenation exceeds the rate of reaeration;

(ii) the stretch where rate of reaeration exceeds rate of deoxygenation; and

(iii) the point where the two rates are equal.

(b) A wastewater with a 5-day CBOD of 200 mg/L and a reaction rate constant, k of 0.1 day^{-1} is discharged to a river at a rate of 1.0 m^3/s. Calculate the ultimate CBOD (L_o) of the wastewater before discharge to the river. **(13)**

Assuming instantaneous mixing after discharge, calculate the ultimate CBOD of the river water after it has received the wastewater.

The river has a flowrate of 9.0 m^3/s and a background ultimate CBOD of 2.0 mg/L upstream of the waste discharge. Also calculate the ultimate CBOD and $CBOD_5$ in the river 50 km downstream of the point of discharge. The river has an average width of 20 m and an average depth of 5 m.

6. (a) Discuss the sources and effects of **(8)**

(i) persistent organic pollutants (POPs) and

(ii) thermal pollution in water.

(b) Distinguish between **(6)**

(i) deoxygenation and reoxygenation

(ii) CBOD and NBOD

(c) A stream containing no BOD (ideal condition) has a DO of 6.0 mg/L and a flowrate of 8.7 m^3/s. The temperature of the stream is 18°C at which the DO saturation value is 9.5 mg/L. The average velocity in the stream is 0.4 m/s and the average depth of the stream is 5 m. **(9 1/3)**

(i) Determine reaeration rate constant, Kr, and the rate of reaeration.

(ii) If the stream receives a treated waste discharge of 0.2 m^3/s having a BOD_5 of 12 mg/L, with a BOD rate constant, k of 0.12 day^{-1} at 20°C, what would be the rate of deoxygenation in the stream, assuming that deoxygenation rate constant is the same as the BOD reaction rate constant?

Contd P/4

CE 433

7. A wastewater treatment plant discharges 1.05 m^3/s of treated sewage that has an ultimate BOD of 28.0 mg/L and DO of 1.8 mg/L, into a river. Upstream of the outfall, the river has a flowrate of 7.08 m^3/s and a velocity of 0.37 m/s. At this point, the ultimate BOD and DO in the river are 3.6 mg/L and 7.6 mg/L respectively. The saturation value of DO (at river temperature) is 8.5 mg/L. The deoxygenation rate constant, k_d is 0.61 day^{-1}, and the reaeration rate constant, k_r, is 0.76 day^{-1}. Assume complete mixing and that the velocity in the river is the same upstream and downstream of the outfall. The wastewater has the same temperature as the river water. **(23 1/3)**

   (a) What is the oxygen deficit and the ultimate BOD just downstream of the outfall (before any reaction takes place)?

   (b) Calculate the critical time, t_c and corresponding distance, x_c for this discharge, and the minimum DO at this point.

   (c) Calculate DO at 10 km interval for a 110 km stretch of the river and draw the DO profile on a plain graph paper.

   (d) At what distance downstream the DO will be restored back to 7.6 mg/L?

8. (a) Discuss the processes of eutrophication and thermal stratification in lakes and their effects on water quality. **(10)**

   (b) Discuss "overturn" in deep lakes and discuss how this phenomena affect water quality of lakes in temperature and cold climatic regions. Show with sketches, the annual cycle of stratification, overturn, and circulation in lakes of cold climatic regions. **(13 1/3)**

CE 433

Table for calculation of AQI (for Question No. 3(a))

Breakpoints							AQI
O_3 (ppm) 8-hr	O_3(ppm) 1-hr (i)	$PM_{2.5}$ ($\mu g/m^3$) 24-hr	PM_{10} ($\mu g/m^3$) 24-hr	CO (ppm) 8-hr	SO_2 (ppm) 24-hr	NO_2 (ppm) Annual	
0.000-0.064	--	0.0-15.4	0-54	0.0-4.4	0.000-0.034	(ii)	0-50
0.065-0.084	--	15.5-40.4	55-154	4.5-9.4	0.035-0.144	(ii)	51-100
0.085-0.104	0.125-0.164	40.5-65.4	155-254	9.5-12.4	0.145-0.224	(ii)	101-150
0.105-0.124	0.165-0.204	65.5-150.4	255-354	12.5-15.4	0.225-0.304	(ii)	151 -200
0.125-0.374	0.205-0.404	150.5-250.4	355-424	15.5-30.4	0.305-0.604	0.65-1.24	201-300
(iii)	0.405-0.504	250.5-350.4	425-504	30.5-40.4	0.605-0.804	1.25-1.64	301-400
(iii)	0.505-0.604	350.5-500.4	505-604	40.5-50.4	0.805-1.004	1.65-2.04	401-500

(i) In some cases, in addition to calculating the 8-hr ozone index, the 1 -hr ozone index may be calculated, and the maximum of the two values reported
(ii) NO_2 has no short-term air quality standard and can generate an AQI only above 200
(iii) 8-hr O_3 values do not define higher AQI values (≥301). AQI values of 301 or higher are calculated with 1-hr O_3 concentrations

Table for estimation of dispersion coefficients [for Questions 1(a) and 2(a)]

		$x \leq 1$ km			$x \geq 1$ 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.

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

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

Extra

L-4/T-2/CE Date : 10/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

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Contd P/2

CE 433

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Contd P/3

CE 433

SECTION – B

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(i) the stretch of river for which the rate of deoxygenation exceeds the rate of reaeration;

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(c) A stream containing no BOD (ideal condition) has a DO of 6.0 mg/L and a flowrate of 8.7 m^3/s. The temperature of the stream is 18°C at which the DO saturation value is 9.5 mg/L. The average velocity in the stream is 0.4 m/s and the average depth of the stream is 5 m. **(9 1/3)**

(i) Determine reaeration rate constant, Kr, and the rate of reaeration.

(ii) If the stream receives a treated waste discharge of 0.2 m^3/s having a BOD_5 of 12 mg/L, with a BOD rate constant, k of 0.12 day^{-1} at 20°C, what would be the rate of deoxygenation in the stream, assuming that deoxygenation rate constant is the same as the BOD reaction rate constant?

Contd P/4

CE 433

7. A wastewater treatment plant discharges 1.05 m^3/s of treated sewage that has an ultimate BOD of 28.0 mg/L and DO of 1.8 mg/L, into a river. Upstream of the outfall, the river has a flowrate of 7.08 m^3/s and a velocity of 0.37 m/s. At this point, the ultimate BOD and DO in the river are 3.6 mg/L and 7.6 mg/L respectively. The saturation value of DO (at river temperature) is 8.5 mg/L. The deoxygenation rate constant, k_d is 0.61 day^{-1}, and the reaeration rate constant, k_r, is 0.76 day^{-1}. Assume complete mixing and that the velocity in the river is the same upstream and downstream of the outfall. The wastewater has the same temperature as the river water. **(23 1/3)**

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CE 433

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Table for estimation of dispersion coefficients [for Questions 1(a) and 2(a)]

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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.

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

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Extra

L-4/T-2/CE Date : 07/06/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Describe the types of contracts and write advantages and disadvantages of each. **(16)**

   (b) For the construction of an academic building which contracting method would you choose – give reasons? **(7 1/3)**

2. (a) What is a project? Give examples of projects other than construction projects. **(5)**

   (b) Define project life cycle. Using the level of effort curve, describe the various phases of project life cycle – in reference to Jamuna Bridge Project. **(12)**

   (c) What are the main risks of a project? **(6 1/3)**

3. (a) What items would you include in a project proposal? Draft an outline of a project proposal for modernization of educational system in a public university. **(15)**

   (b) As a BUET graduate you would be entering in the job market. Make a SWOT analysis to forecast your prospect in the market. **(8 1/3)**

4. (a) Describe the tendering process in a flow chart. **(7)**

   (b) What is the purpose of BoQ? Prepare a sample BoQ for masonry works (250 mm) in a building. **(16)**

   (c) Describe the role of a tender evaluation committee. **(7 1/3)**

SECTION – B

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

5. (a) Define communication. Describe the different types of communication activities of a business organization. **(13 1/3)**

   (b) Describe the six components of the process of human communication. **(10)**

Contd P/2

CE 403

6. (a) Define a proposal. Write down the eight steps giving the complete chronology of the entire process of a major proposal. **(13 ⅓)**

   (b) Describe the seven steps for preparing effective oral presentations. **(10)**

7. (a) Define a meeting. Describe the steps followed in solving problems during meetings. **(13 ⅓)**

   (b) Explain the concepts of concreteness, correctness and completeness in written or oral communication. **(10)**

8. (a) Write in your own words the three points given in the preamble of the Code of Ethics for Engineers document as supplied to you. **(3 ⅓)**

   (b) Answer the following question briefly with reference to the different sections of the Code of Ethics for Engineers document as supplied to you. **(5×4=20)**

   (i) According to section 6, when will an Engineer undertake engineering assignments and when will he engage or advise engaging experts?

   (ii) According to section 8, what should an Engineer do when there is a conflict of interest with his employer or client?

   (iii) According to section 11, what should an Engineer avoid when obtaining employment or advancement or professional engagements by competitive bidding?

   (iv) According to section 12, what is the responsibility of the Engineer regarding the professional reputation, prospects of practice or employment of another engineer?

Extra

L-4/T-2/CE Date : 07/06/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Briefly describe the various levels of community participation. **(12)**

   (b) List the Social Impact Assessment (SIA) variables to be addressed in an impact study. **(11 1/3)**

2. (a) What are the key points of the strategic issues of WSS projects for Bangladesh? Explain with reasons. **(12)**

   (b) List the various socio-economic issues in water quality management planning. **(11 1/3)**

3. (a) Define "Participation". Explain the significance of peoples' participation in WSS projects. **(12)**

   (b) What are socio-economic impacts? Explain -why socio-economic impacts of development projects are of great concern. **(11 1/3)**

4. (a) What are the advantages and features of SIA process? Explain. **(12)**

   (b) Explain the methodologies in practice to ensure community participation. **(11 1/3)**

SECTION – B

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

5. (a) Briefly discuss the important features of land acquisition law in Bangladesh. **(5 1/3)**

   (b) List down, in a tabular form, the important differences between Bangladesh Law, and World Bank and ADB's policies on land acquisition and resettlement, with respect to coverage, compensation, minimization of impacts, cut-off dates, consultation, relocation assistance, and livelihood restoration. **(18)**

Contd P/2

CE 405

6. (a) Discuss briefly the weakness of GNI as a development indicator, what do you mean by PPP$? **(10)**

   (b) What are the three indicators that constitute human development index, HDI? What do they represent and how are they measured? How does GDI differs from HDI? **(13 ⅓)**

7. (a) "Sustainable development is about equity – intergenerational and intragenerational" – explain. **(9)**

   (b) List down the economic, social and environmental objectives of sustainable development. **(6)**

   (c) What strategies must be followed in order to reaching the MDGs in 2015? How would Bangladesh look like in 2015 if MDG targets are achieved? **(8 ⅓)**

8. (a) Make a list of large infrastructure development projects in Bangladesh. Also prepare a list of major socio-economic aspects that are relevant to development projects. **(9)**

   (b) What are the four important strategies for successful resettlement? Discuss briefly, how participation of involuntary resettlers and host population in the planning process can lead to successful resettlement for a development project. **(14 ⅓)**

L-4/T-2/CE **Date : 21/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

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 reasonable value of any missing data.

1. (a) Write short notes on (i) Regime concept (ii) Channel forming discharge (iii) Longitudinal stream profile. **(9)**

   (b) Classify rivers according to channel pattern and channel type. **(6)**

   (c) Draw a neat sketch of a regular meander path showing all elements. The width of a meandering river is 100 m. Compute its wavelength, amplitude and radius of curvature. **(8⅓)**

2. (a) Define different diameters for sediment particles. **(4)**

   (b) Derive the formula for computing the fall velocity of a sediment particle and hence compute the fall velocity of a sediment particle with a diameter of 0.5 mm. **(11⅓)**

   (c) Show that the shear stress in an open channel flow varies linearly with depth. **(8)**

3. (a) What is critical shear? Show that the dimensionless critical shear is proportional to the angle of repose of the bed material. **(8⅓)**

   (b) For a river following data are given: **(8)**

   Depth of flow = 4.0 m

   Flow velocity = 1 m/s

   Bed sediment size = 0.2 mm

   Dimensionless Shield stress = 0.045

   Calculate the local scour around a circular pier of diameter 3.0 m.

   (c) Calculate maximum general scour for Q = 20,000 m^3/s and depth of flow = 5.0 m. The bed material size is 0.15 mm. **(7)**

4. (a) Write the causes and effects of degradation in a river. **(6)**

   (b) Distinguish between parallel and rotational degradation. **(8)**

   (c) Design a trapezoidal channel to carry a discharge of 0.5 m^3/s on a slope of 0.01 predetermined by the terrain. The channel has rigid banks with a 1.5 H : 1 V slope. The bed material has d_{75} = 30 mm. Assume Manning's coefficient of 0.025. **(9⅓)**

Contd P/2

WRE 409(CE)

SECTION – B

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

5. (a) What are the objectives of river training and bank protection works? **(8⅓)**

   (b) Describe different structural measures of flood control with their advantages and limitations. **(8)**

   (c) What are the general design considerations of designing an earthen levee? **(7)**

6. (a) Describe the different components of river training for guiding the flow with neat sketches? **(7⅓)**

   (b) Describe different types of temporary measures for river bed control. **(7)**

   (c) Calculate the total volume of stone required in per unit width for the shank portion of a revetment for the given data. Maximum discharge of the river is 6500 cumecs and the correspoinding water depth is 4.2 m. Mean diameter of sediment particle is 12 mm. Assume any other data if needed. **(9)**

7. (a) Describe different types of groynes with neat sketches. **(7⅓)**

   (b) Describe different types of measures for sediment control in a watershed. **(7)**

   (c) Describe the following terms in brief with neat sketches. **(3×3=9)**

   (i) Riprap

   (ii) Gabions

   (iii) Mattresses

8. (a) Describe different types of bed forms with neat sketches. **(8⅓)**

   (b) Write down the names of different types of sediment transport formula with examples. **(7)**

   (c) Calculate bed sediment load using Duboy's bed load formula for the following given data. The channel depth is 5 m and the channel slope is 6.5×10^{-4}. Mean diameter of sediment particle is 12 mm. Assume any other data if needed. **(8)**

L-4/T-2/CE **Date : 14/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

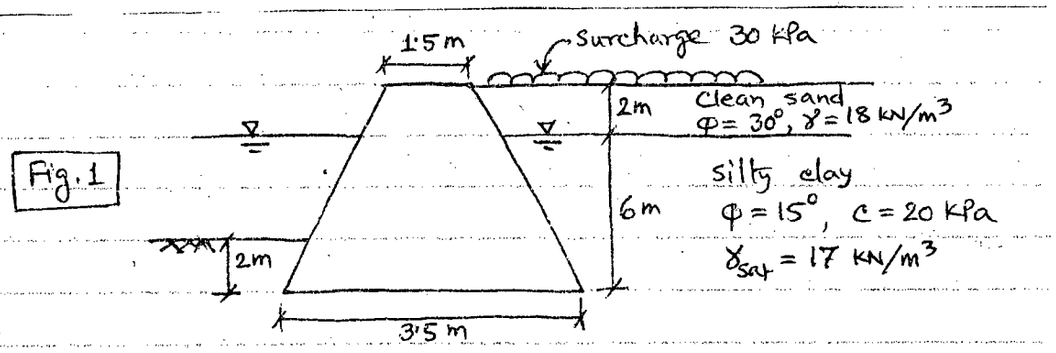
SECTION – A

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

1. (a) Mention different types of rigid retaining walls with neat sketches. Which type of retaining wall is most common? Discuss its advantages. **(10 ⅓)**

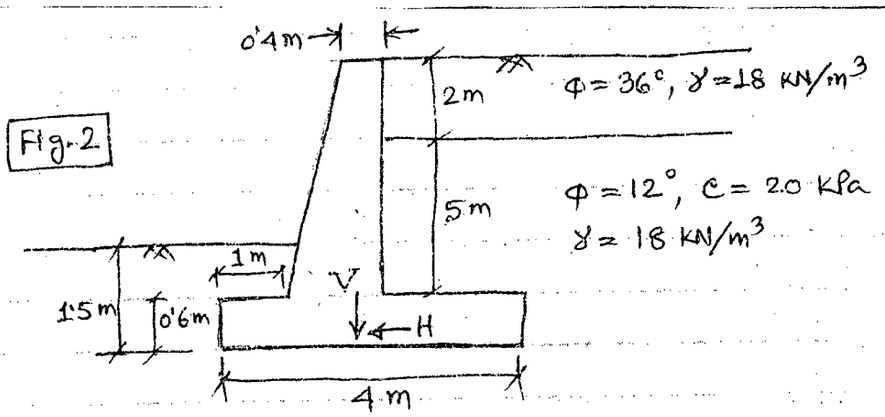
   (b) Analyze the retaining structure shown in Fig. 1 and comment on its safety against failure by overturning. **(13)**

Fig. 1



2. (a) Analysis shows that the retaining wall shown in Fig. 2 is subjected to a horizontal disturbing force of H = 150 kN in addition to a downward force of V = 420 kN per meter of wall. Determine the factor of safety against bearing capacity failure using Meyerhof's method (Use Tables 1 and 2). The water table is far below the base. **(12)**

Fig. 2



   (b) What is the effect of seepage pressure that may exist due to unbalanced water head on two sides of a sheet pile wall and a pervious subsurface layer? How can we take account of this seepage pressure in the analysis? **(6)**

   (c) Discuss the common problems that are encountered during sinking of a caisson. **(5 ⅓)**

3. (a) A cantilever sheet pile wall is to support the sides of a 3 m deep excavation in a cohesive soil deposit having $\varphi = 0$, $q_u = 30$ kPa and $\gamma = 16$ kN/m^3. Design the depth of embedment of the sheet piles. Water table is at great depth. **(12)**

Contd P/2

CE 441

Contd ... Q. No. 3

(b) Analyze the braced excavation system shown in Fig. 3 and comment on the possibility of failure by bottom heaving. **(11 ⅓)**

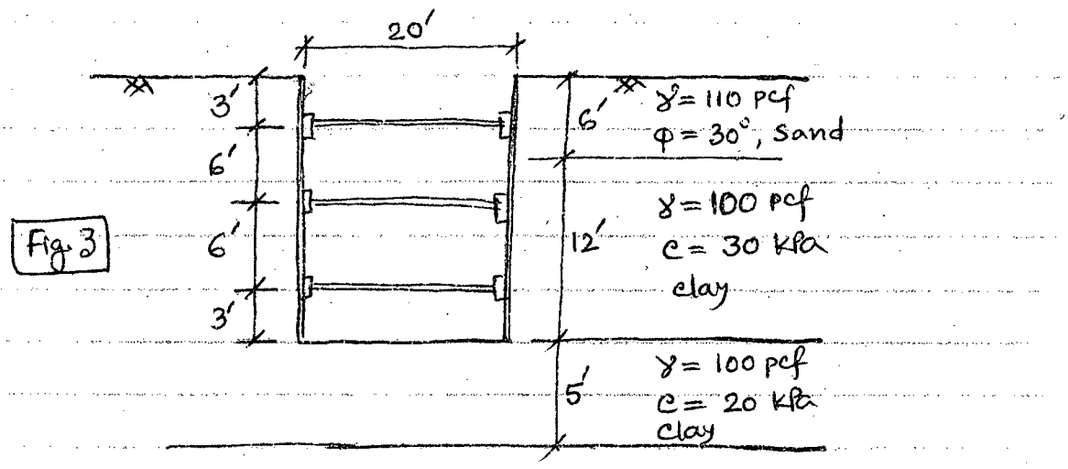


Fig. 3

4. (a) Determine the force in the tie rod for the anchored sheet pile wall (Fig. 4) using free end method. The tie rods are placed 2.5 m center-to- center horizontally. **(13 ⅓)**

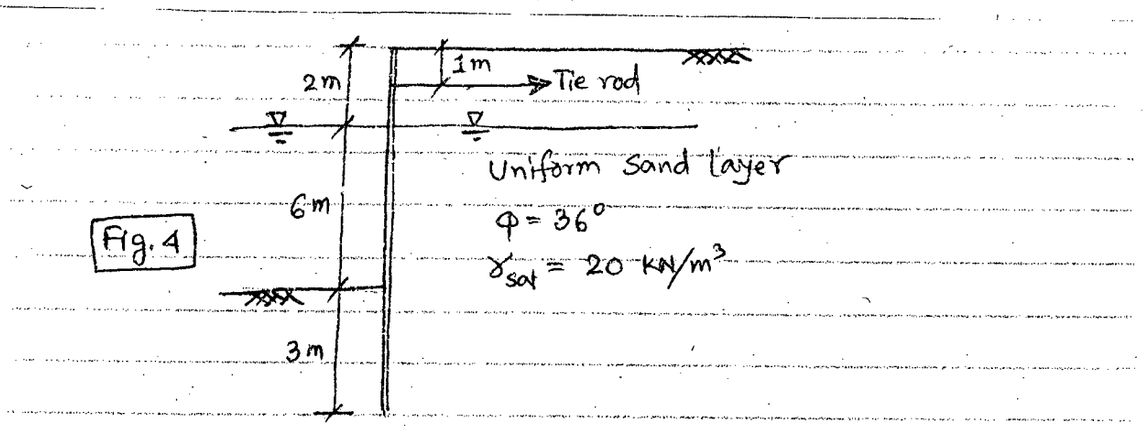


Fig. 4

(b) Discuss the earth pressure that is considered for design of braced excavations in (i) uniform deposits of sand (ii) uniform deposits of clay and (iii) stratified soil deposits. **(10)**

SECTION – B

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

Assume reasonable value of missing data, only if necessary.

5. (a) Describe the composition of slurry and how it works in maintaining stability of trench wall. Also briefly discuss the process of slurry cleaning and circulation during slurry trench-wall construction. Present neat sketches. **(6+5=11)**

(b) Describe pumping methods using multistage well points and deep wells. Show neat sketches. **(8 ⅓)**

(c) What are the different modes of vibration of a rigid foundation block? Which of these modes are coupled and which are uncoupled? **(4)**

Contd P/3

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6. (a) Give a description of all possible waves generated by a vibrating footing. **(7)**

(b) Depending on damping, there are three cases of damped free vibration of a SDOF system-explain with the help of figures. **(5)**

(c) Determine the equivalent viscous damping coefficient for the case of Coulomb (friction) damping. **(4⅓)**

[Given: $C_{eq} = \frac{W_d}{\pi w A_x^2}$]

(d) Determine the number of wells required to dewater a 7 m deep 30 m by 28 m excavation. The ground water table is at a depth of 2 m below G. L. The top sandy soil having a coefficient of permeability of 0.5 mm/sec extends to a depth of 9 m and is underlain by stiff clay. Consider the capacity of each well with a diameter of 150 mm to be 5 litres/sec. Also check the spacing criteria given by Sichadt. **(7)**

[Given: $n_q = \frac{\pi k\left(H^2 - h^2\right)}{\log_e\left(R/r\right)}$, $R = 3000 S\sqrt{k}$, k is in m/sec]

7. (a) Describe how dynamic soil properties may be determined from the following tests (answer any two) : **(7×2=14)**

(i) Surface wave propagation method

(ii) Resonant column test

(iii) Cyclic triaxial compression test.

(b) Explain why the shear modulus changes with strain. Which value of shear modulus should be used for machine foundation design? **(4)**

(c) Draw typical force transmissibility diagram for a machine supported on spring-damper (mechanical isolation) system. With reference to this diagram, discuss desired parameters of spring constant and damping ratio. **(5⅓)**

8. (a) Briefly describe different types of machine foundations as per ACI 351. 3R-04. **(6)**

(b) State important considerations that you would recommend while designing a machine foundation. **(5⅓)**

(c) A 2.5 ×2 m rectangular concrete footing 1 m thick on ground surface supports a machine weighing 20 tonnes. The machine generates a vertical sinusoidal force of 22 kN at a frequency of 18 Hz (constant force excitation). Field SPT values in the silty sand soil at depths of 1.5 m, 3m, 4.5 m, 6 m is given as 8, 10, 12, 13 respectively. Assume Poisson's ratio to be 0.35, unit weight as 16 kN/m^3. Check if the vibration will be troublesome to people. Also determine the acceleration amplitude. **(12)**

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Table-1 Bearing capacity equations by Meyerhof

Vertical load: $q_{ult} = cN_c s_c d_c + \bar{q} N_q s_q d_q + 0.5\gamma B N_\gamma s_\gamma d_\gamma$

Inclined load: $q_{ult} = cN_c d_c i_c + \bar{q} N_q d_q i_q + 0.5\gamma B N_\gamma d_\gamma i_\gamma$

$$N_q = e^{\pi \tan\phi} \tan^2\left(45 + \frac{\phi}{2}\right)$$

$$N_c = (N_q - 1)\cot\phi$$

$$N_\gamma = (N_q - 1)\tan(1.4\phi)$$

Table -2 Shape, depth, and inclination factors for the Meyerhof bearing-capacity equation

Factors	Value	For
Shape:	$s_c = 1 + 0.2K_p\frac{B}{L}$	Any ϕ
	$s_q = s_\gamma = 1 + 0.1K_p\frac{B}{L}$	$\phi > 10°$
	$s_q = s_\gamma = 1$	$\phi = 0$
Depth:	$d_c = 1 + 0.2\sqrt{K_p}\frac{D}{B}$	Any ϕ
	$d_q = d_\gamma = 1 + 0.1\sqrt{K_p}\frac{D}{B}$	$\phi > 10$
	$d_q = d_\gamma = 1$	$\phi = 0$
Inclination:	$i_c = i_q = \left(1 - \frac{\theta°}{90°}\right)^2$	Any ϕ
	$i_\gamma = \left(1 - \frac{\theta°}{\phi°}\right)^2$	$\phi > 0$
	$i_\gamma = 0$	$\phi = 0$

Where $K_p = \tan^2(45 + \phi/2)$

θ = angle of resultant measured from vertical without a sign

Other notations carry their usual meaning

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3

Table ~~7.4~~ Spring constants for rigid footings on an elastic half space.

Motion	Spring constant	Reference
Circular footing, radius r		
Vertical	$k_z = \frac{4Gr}{(1-\upsilon)}$	Timoshenko & Goodier 1951
Horizontal	$k_x = \frac{32(1-\upsilon)Gr}{(7-8\upsilon)}$	Bycroft 1956
Rocking	$k_\psi = \frac{8Gr^3}{3(1-\upsilon)}$	Borowicka 1943
Torsion	$k_\theta = \frac{16Gr^3}{3}$	Reissner & Sagoci 1944
Rectangular footing, 2c × 2d		
Vertical	$k_z = \frac{2G\beta_z(cd)^{1/2}}{(1-\upsilon)}$	Barkan 1962
Horizontal	$k_x = 4(1+\upsilon)G\beta_x(cd)^{1/2}$	Barkan 1962
Rocking	$k_\psi = \frac{8G\beta_\psi cd^2}{(1-\upsilon)}$	Gorbunov-Possadov & Serebrajanyi 1961

4

Table ~~7.5~~ Damping ratios for various modes of vibration—Rigid circular surface footing.

Mode of vibration	Modified mass or inertia ratio	Damping ratio	Reference
Vertical	$B_z = \frac{(1-\upsilon)}{4}\frac{m}{\rho r^3}$	$D_z = \frac{0.425}{B_z^{1/2}}$	Lysmer & Richart 1966
Sliding	$B_x = \frac{(7-8\upsilon)}{32(1-\upsilon)}\frac{m}{\rho r^3}$	$D_x = \frac{0.288}{B_x^{1/2}}$	Hall 1967
Rocking	$B_\psi = \frac{3(1-\upsilon)}{8}\frac{I_\psi}{\rho r^5}$	$D_\psi = \frac{0.15}{(1+B_\psi)B_\psi^{1/2}}$	Hall 1967
Torsional	$B_\theta = \frac{I_\theta}{\rho r^5}$	$D_\theta = \frac{0.50}{(1+2B_\theta)}$	Whitman & Richart 1967

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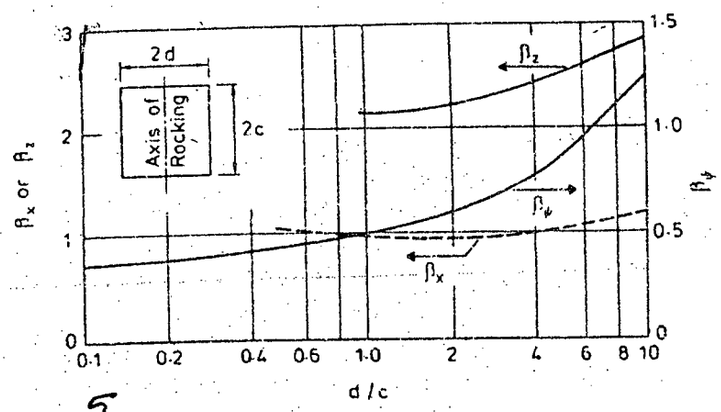

Figure 5. Coefficients β_z, β_x and β_ψ for rectangular footings (after Whitman & Richart 1967; reprinted by permission of the American Society of Civil Engineers).

Table 5. Form of equations for resonant frequency and vibration amplitudes.

Constant force excitation (F_0 = constant)	Rotating mass excitation ($F_0 = m_e e \omega^2$)
Resonant frequency (ω_r)	
$\omega_r = \omega_n(1 - 2D^2)^{1/2}$	$\omega_r = \omega_n(1 - 2D^2)^{-(1/2)}$ (ω_n = relevant natural frequency)
Maximum vibration amplitude (A_{max})	
$A_{max} = \dfrac{F_0}{2Dk(1 - D^2)^{1/2}}$	$A_{max} = \dfrac{m_e e}{m2D(1 - D^2)^{1/2}}$
Amplitude at frequency ω(A)	
$A = \dfrac{F_0}{k((1 - \omega^2/\omega_n^2)^2 + (2D\omega/\omega_n)^2)^{1/2}}$	$A = \dfrac{m_e e(\omega/\omega_n)^2}{m((1 - \omega^2/\omega_n^2)^2 + (2D\omega/\omega_n)^2)^{1/2}}$

CE 441

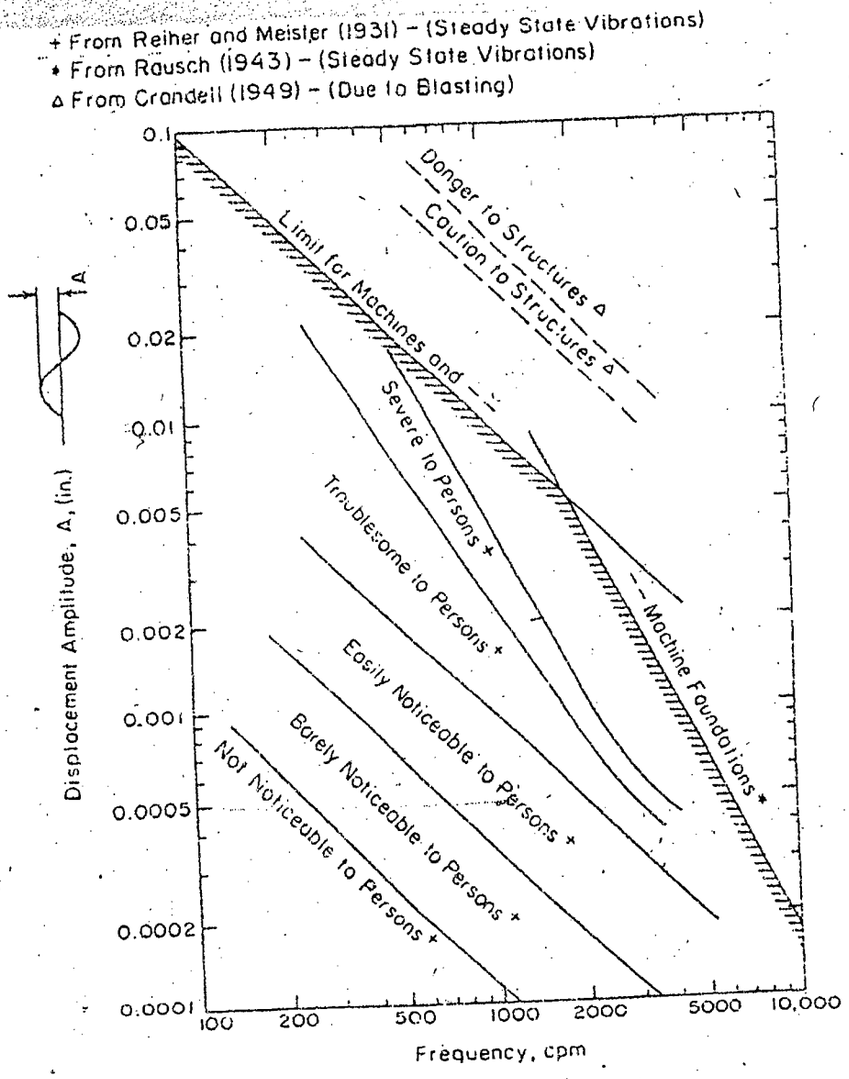
+ From Reiher and Meister (1931) – (Steady State Vibrations)
* From Rausch (1943) – (Steady State Vibrations)
Δ From Crandell (1949) – (Due to Blasting)
Displacement Amplitude, A, (in.)
0.1
0.05
0.02
0.01
0.005
0.002
0.001
0.0005
0.0002
0.0001
100
200
500
1000
2000
5000
10,000
Frequency, cpm
Danger to Structures Δ
Caution to Structures Δ
Limit for Machines and
Severe to Persons *
Troublesome to Persons *
Easily Noticeable to Persons *
Barely Noticeable to Persons *
Not Noticeable to Persons *
Machine Foundations *

Fig. 6

CE 208
8+3=11

L-4/T-2/CE Date : 28/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What are the functional elements of a solid waste management system? Discuss briefly the different stages of solid waste management. **(12)**

(b) Composition of a solid waste collected from BUET campus is given in the following Table: **(11 ⅓)**

Wastes	Wet mass (kg)	Dry mass (kg)	C, kg	H, kg	O, kg	N, kg	S, kg	Ash, kg
Food	45	11.5	3.81	0.95	5.55	0.39	0.06	0.74
Paper	21	19.5	8.48	1.17	8.58	0.06	0.04	1.17
Cardboard	10	9.5	4.18	0.56	4.24	0.03	0.02	0.48
Plastics	10	9.8	5.88	0.71	2.23	-	-	0.98
Garden trim	11	4.5	2.41	0.24	1.52	0.14	0.01	0.18
Wood	3	2.6	0.58	0.24	1.71	0.01	-	0.06

Estimate the energy content of the waste?

2. (a) What are the major risks associate with poor management of solid waste? Explain the rational steps in integrated waste management. **(11)**

(b) Solid wastes from Dhanmondi area are to be collected through stationary container collection system having 4 m^3 containers. Determine the appropriate truck capacity when one-way haul distance is 35 km for the following conditions: **(12 ⅓)**

(i) Container size = 4 m^3
(ii) Container utilization factor = 0.8
(iii) Av. number of containers at each location = 2
(iv) Collection vehicle compaction ratio = 2.25
(v) Container unloading time = 0.1 hr / container
(vi) Av. drive time between container locations = 0.1 hr
(vii) Speed limit = 56 km/hr
(viii) Time from garage to first container location = 0.33 hr
(ix) Time from last container location to garage = 0.25 hr
(x) Number of trips of disposal site per day = 2
(xi) Length of workday = 8 hr
(xii) At-site time per trip = 0.1 hr
(xiii) Empirical haul constant per trip (a) = 0.034
(xiv) Empirical haul constant (b) = 0.018 hr/km
(Assume reasonable value for any missing data)

Contd P/2

CE 431

3. (a) What are the factors that affect the quantities of solid waste generation? Explain the strategic options in waste minimization and hazard reduction at source. **(12)**

(b) Determine the number of containers (in hauled-container collection system) that can be emptied per day, based on an 8-hr workday with the following data:

(i) Av. time to drive from garage to first container location = 15 min.

(ii) Time from last container location to garage = 25 min

(iii) Av. time between container locations = 10 min

(iv) One-way haul distance = 20 km

(v) Speed limit = 40 km/hr

(vi) At -site time = 0.127 hr/trip

(vii) Empirical haul constant (a) = 0.05 hr/trip

(viii) Empirical haul constant (b) = 0.025 hr/km

(ix) Time required to pick up loaded container and deposit empty container = 0.4 hr/trip

(x) Off-route factor = 0.15

(Assume reasonable value for missing data if any)

4. (a) What is the importance of transfer satiations in solid waste management system? What factors should be designer consider for designing transfer stations? **(11)**

(b) Describe the stages of life cycle assessment (LCA). Determine the efficiency of a screen and the effectiveness of a screening operation with the following data:

3000 kg/hr of municipal solid waste with 10% glass is applied to a rotary screen for removal of glass prior to shredding. **(12 ⅓)**

Weight of underflow = 500 kg/hr

Weight of glass in screen underflow = 150 kg/hr.

SECTION – B

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

5. (a) What are the problems associated with indiscriminate dumping of solid wastes in cities? **(5)**

(b) How will you plan a sanitary landfill? Draw a layout plan of a landfill site. **(10)**

(c) Briefly describe the different stages of decomposition of solid wastes in landfills. **(8 ⅓)**

6. (a) What are the methods of estimating the quantity of leachate generated in a landfill? Estimate the percolation of leachate through a landfill of 25 m deep with a 1.5 m cover of silty clay for the following data: **(10)**

Contd P/3

CE 431

Precipitation = 2200 mm/year

Runoff coefficient = 0.30

Evapo-transpiration = 725 mm/year

Refuse field capacity = 250 mm/m

Soil cover field capacity = 300 mm/m

Assume that the applied soil cover and the incoming wastes have moisture contents of 200 mm/m and 140 mm/m respectively.

(b) Briefly describe how will you control leachate in a sanitary landfill. **(5)**

(c) What are the important factors in the design of a leachate treatment system? Design the spacing of laterals for an uncapped landfill for a required maximum leachate head of 40 cm. The top surface of the laterals is 15 cm above the bottom liner. Assume that the hydraulic conductivity of the drainage layer is 120 m/d and the overall vertical hydraulic conductivity through the waste is 1.5×10^{-3} cm/s. Also, determine the flow rate through each lateral. **(8⅓)**

7. (a) What are the potential environmental impacts of landfill gases? **(8)**

(b) Estimate the theoretical volume of methane and carbon dioxide gases that would be expected from the anaerobic digestion of 1000 ton of a waste having the composition $C_{60}\ H_{135}\ O_{45}\ N_2$. Densities of methane and carbon dioxide gases at STP are 0.7167 kg/m^3 and 1.9783 kg/m^3 respectively. Comment on the results. **(7)**

(c) Differentiate between 'Recovery by materials separation' and Recovery by materials conversion' associated with resource recovery from solid wastes.

What are the options for utilization of the recovered resources from solid wastes? **(8⅓)**

8. (a) Sketch the pathways of human exposure to hazardous wastes. **(5)**

(b) What are the problems of landfill or land burial method of hazardous wastes disposal? Draw a double-lined landfill for hazardous wastes after closure. **(10)**

(c) List the general modes of treatment and disposal of hospital wastes. **(8⅓)**

CE 201
1+3

L-4/T-2/CE Date : 28/05/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) According to the United Nations Environment programme - define EIA. **(2⅓)**

   (b) What are the drawbacks of ad-hoc method of EIA Methodologies. **(6)**

   (c) Briefly discuss the EIA Methodology of Environmental Evaluation system. **(15)**

2. (a) How do human activities interact with natural environment? Explain population carrying capacity of a country. **(13⅓)**

   (b) Write short notes on **(10)**

   (i) Sustainable development.

   (ii) Basic demand

   (iii) Secondary demand

   (iv) Poverty level.

   (v) Ecosystem of the Environment.

3. (a) What are the principal factors affecting sustainable development? What are the strategies to be taken to achieve the goal of sustainable development? **(11⅓)**

   (b) Discuss briefly 'Leopold' Matrix and 'Lohani and thanh' Matrix methods with their merits and demerits. **(12)**

4. Discuss briefly the potential positive and negative impacts of a water resources development project. **(23⅓)**

SECTION – B

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

5. (a) Define environmental policy. What are the main objectives of Bangladesh Environmental policy 1992? Name the 15 different sectors for which the Bangladesh Environmental policy was formulated. What legal framework was proposed and institutional arrangements were considered to implement Bangladesh Environmental Policy? **(14⅓)**

   (b) Name one environmental legislation form each of these categories in Bangladesh:

   (i) Wildlife, (ii) Fisheries, (iii) Forestry, (iv) Food, (v) Marine and inland water, (vi) use of Pesticides, (vii) drainage and irrigation (viii) public health and safety. **(4)**

Contd P/2

CE 435

Contd ... Q. No. 5

(c) Write down the answers to the following questions regarding the trial process as per Bangladesh Environment Court Act: **(5)**

(i) What is the rank of the judge?

(ii) What is the rank of the Public Prosecutor?

(iii) Who can enter any place for inspection, search and seizure?

(iv) Who can carry out investigation?

(v) What are the guiding legislations for trial and disposal of cases related to compensation and offence?

6. (a) What are the powers and functions of the Director General of Department of Environment as per ECA 1995? **(8)**

(b) What is Public Interest Litigation (PIL)? What is the scope of PIL and who can file a PIL? Describe the nature of the offence (or violations) in the following PIL cases in Bangladesh: **(8)**

(i) Dr. Mohiuddin Farooque vs. Bangladesh and others (Hill Cutting case)

(ii) Dr. Mohiuddin Farooque vs. Bangladesh and others (Gas explosion at Magurachhara)

(iii) Quazi Faruque vs. Ministry of Shipping (life buoys in launches)

(iv) BELA vs. Bnagladesh and others (Buriganga rive)

(v) BELA vs. Bangladesh and others (Jamuna Builders)

(c) Draw the schematic diagram showing the Evironmental Impact Chain approach, with corresponding standards. What are the main benefits and drawbacks of an impact-oriented approach in setting environmental standards? **(7⅓)**

7. (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? **(11⅓)**

(b) What are the general objectives of public participation in the EIA process? What are the merits and demerits of public participation? What could be your potential strategies if you find strong negative reaction from the public concerning a certain project? **(12)**

8. (a) What are the typical contents of an EMP report? How can you integrate the EMP into the project design? Describe the importance of Environmental monitoring in the EMP. **(9)**

(b) Summarize the main construction-related activities related to the realization of the Jamuna Multipurpose Bridge Project. What project activities were considered to be negatively impacting the following environmental compartments and how: **(14⅓)**

(i) soil quality (ii) surface water quality (iii) surface water quantity (iv) health and safety of the workers (v) river navigation.

L-4/T-2/CE **Date : 04/06/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **CE 453** (Transportation Engineering-V, Highway Drainage and Airports)

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** questions.

1. (a) Briefly state the importance of highway drainage. What are the mechanisms of damage to highways due to faulty drainage? **(11⅓)**

   (b) Why is subsurface drainage needed? Show how are the subdrains placed for subgrade drainage and for lowering ground water table. **(12)**

2. (a) Briefly state hydrologic approaches and concepts for design of surface drainage system. **(8⅓)**

   (b) What are the principles of culvert location? What are the general procedures of hydraulic design of culverts? **(10)**

   (c) What are the functions of an airport drainage? **(5)**

3. (a) Showing the definition of terms related to aircraft dimensions, briefly state relevant aircraft characteristics for pavement design. **(11⅓)**

   (b) When is overlaying of airport pavement required? Briefly sate bituminous or flexible overlays on flexible and PCC pavement. **(12)**

4. (a) Briefly state the development of CBR method for flexible airport pavement design. **(12)**

   (b) Briefly state the application of fatigue concept to traffic analysis by PCA. What are the advantages claimed for placing steel in PCC pavements. **(11⅓)**

SECTION – B

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

5. (a) Discuss briefly the guidelines that are provided in an airport master plan for its development. How an airport project plan is different from its master plan? **(9⅓)**

   (b) List the factors that should be considered while selecting a location for an airport. **(4)**

   (c) Determine how runways marked as A, B, C, D, and E would be numbered? **(10)**

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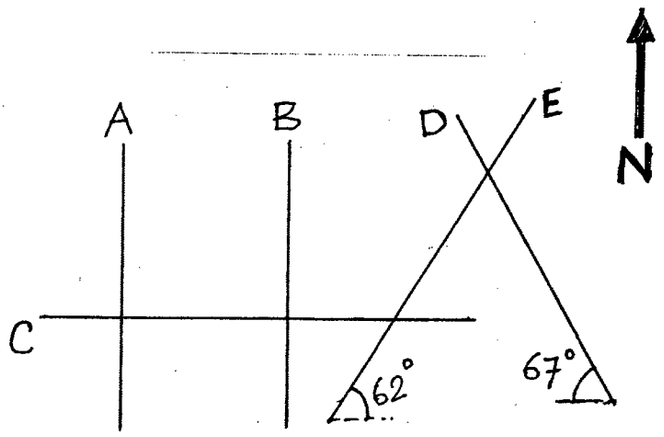
CE 453

Contd ... Q. No. 5(c)



6. (a) Summarize briefly how the size, speed, and productivity of aircrafts have grown over the last 50 years. **(7⅓)**

   (b) Show in a neat sketch the taxiway centerline markings at the following two locations: **(6)**

   (i) intersection of taxiway with runway end, and

   (ii) intersection of taxiway with runway located far away from runway ends.

   Also show the taxiway edge markings. Mention color and dimension of the markings.

   (c) Data shows that the annual number of enplaning passengers at Hazrat Shahjalal International airport in Dhaka is 3,000,000. Determine the followings according to FAA guidelines: **(10)**

   (i) Gross terminal area required, (ii) Total rentable and total non-rentable area, (iii) Space needed for airline operations, (iv) Space needed for shops, tunnels, stairways, and utilities, and (v) Number of public parking spaces required.

7. (a) Define airport configuration. Discuss briefly the typical runway configurations. **(9⅓)**

   (b) Write short notes on runway approach lighting and runway threshold lighting. **(6)**

   (c) Estimate the number and area of ticket counter positions required at an airport passenger terminal complex using the following data. The peak loading on the facilities is about 10 percent of the peak-hour originating passengers and that a maximum queue length of 6 passengers per position is a desirable design goal. Consider a case when there are 3000 peak hour originating passengers. A counter length of 10 to 15 ft for two positions is reasonable. The counter itself requires a 10-ft depth, and a circulation aisle of from 20 to 35 ft is appropriate. A queuing depth of 3 ft per passenger is provided. **(8)**

8. (a) What are the major components of a passenger terminal system of an airport? List the activities and corresponding facilities provided for each of them. **(9)**

   (b) Explain briefly the different steps involved in the evolution and development of an airport terminal design. **(14⅓)**

L-4/T-2/CE **Date : 04/06/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2011-2012

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

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** questions.

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

   (b) Define the terms Goals, Objectives and Criteria with respect to a particular transportation planning study. **(6)**

   (c) Classify the various mode choice models into different categories. **(4⅓)**

   (d) There are 1000 households in a study area. Table 1 shows the distribution of households in that study area with respect to household size and vehicle-availability. The cross-classification trip rates are given in Table 2. Determine the total number of daily trips that are generated in that study area. **(8)**

2. (a) Explain the usefulness of the 4-step travel demand forecasting model in a transportation planning study. **(6)**

   (b) Explain the basic requirements for transportation plans. **(7⅓)**

   (c) A city has a utility function for use in a logit model of the form:
   $U = -0.075\ A - 0.5\ W - 0.04\ R - 0.02\ C$, where A is the access time in minutes, W is the waiting time in minutes, R is the riding time in minutes, and C is the out-of-pocket cost in cents. What modal distribution would you expect using the values for A, W, R, and C given in Table 3? The city is thinking of subsidizing rail and bus by 50%, encouraging biking by constructing bike paths and thus reducing biking time by 20%, and increasing auto costs (through higher parking charges) by 10%. What is likely to be the new modal distribution with these changes? **(10)**

3. (a) Name the factors that are believed to justify a transportation project. **(4)**

   (b) How "all-or-nothing" traffic assignment is different from a "capacity restraint" traffic assignment? Which assignment technique would be more realistic when streets are expected to carry high volumes of traffic with respect to capacity? Why? **(6⅓)**

   (c) Determine the Minimum Tree for each of the 7 zones in the transport network shown in the Figure 1. The inter-zonal trip distribution reveals that there are 200 trips from zone 1 to zone 6; 500 trips from zone 2 to zone 7; 350 trips from zone 4 to zone 7; and 400 trips from zone 7 to zone 1. Assign these trips into the network using all-or-nothing assignment technique and determine the resulting traffic volumes on all links. **(13)**

Contd P/2

CE 455

4. (a) Name the methods that are usually used to determine the economic worth of a transport project. **(4)**

(b) Explain how a "criterion" should be selected to evaluate transportation alternatives. **(4⅓)**

(c) Define the terms:

(i) First cost, (ii) Continuing cost, (ii) Sunk cost, and (iii) Salvage value. **(6)**

(d) The local transportation department has six mutually exclusive proposals including do-nothing option for consideration. Their expected life is 30 years. Details are presented in Table 4. If the largest net benefit is the criterion, which project would you select? **(9)**

SECTION – B

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

Assume missing value/Data (If any)

5. (a) Briefly discuss the classification schemes used for Transportation Engineering. **(5)**

(b) Explain the importances of 3 E's (Engineering, Enforcement and Education) in Traffic Engineering. **(5)**

(c) Explain the relationship of different types of roads and their accessibility and speed characteristics. **(4)**

(d) There are four alternative plan proposals for different areas with different road lengths, population and products served are given below. Work out the utility per unit length for each of the systems and indicate which of the plans yield the maximum utility based on saturation system. **(9⅓)**

Area	Road length	Number of town and villages served with population				Total agricultural and industrial products.
		1000-2000	2001-5000	5001-10000	> 10000	
Faridpur	350	168	82	33	7	220×10^3
Rajbari	420	210	94	62	9	290×10^3
Magura	510	250	114	74	11	330×10^3
Khulna	570	255	115	75	13	340×10^3

Utility for population: 1001-2000 (0.25), 2001-5000 (0.5), 5001-10000 (1.00), >10000 (2.55). Utility for production: 1000 tones (1.0).

6. (a) Compare following Road Patterns: **(6)**

(i) Rectangular or black pattern

(ii) Radial or star and circular pattern

(b) State the responsibility for Traffic Engineering function. Explain the typical functional organization chart for traffic engineering in cities. **(8⅓)**

(c) What are the factors to be considered during assessing the character of an area? **(5)**

(d) Explain the importance of Freight movements in urban area. **(4)**

Contd P/3

CE 455

7. (a) Discuss typical issues and problems related to urban goods movement. Explain the problems related to movement of trucks in urban area. **(8)**

   (b) Define following: **(8)**

   (i) public transportation, (ii) service frequency (iii) line capacity (iv) passengers loads.

   (c) Discuss the effects of road congestion on public transportation. List the factors affecting choice of form of public transport. **(7⅓)**

8. (a) Design a Bus operation system from the following information: **(11⅓)**

   Distance between O - D = 18 km.
   Operating time = 35 minutes.
   Peak hour demand = 550 passenger/hr.
   Vehicle capacity = 50 seaters bus with 25 standees
   Minimum terminal time = 8 minutes.

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

   (i) Automated Highway Systems (AHS) (ii) Advantages of Electronic Toll Collection System (ETC)

   (c) What are the professional input and public input during project development process? **(4)**

Question: 1 (d)

Table 1: Distribution of households in the study area (number of households)

Persons per household	Vehicles available per household		
	0	1	2 or more
1	50	210	20
2	30	160	130
3	20	100	130
4 or more	10	80	60

Question: 1 (d)

Table 2: Trip rates (trips per household per day)

Persons per household	Vehicles available per household		
	0	1	2 or more
1	1.02	1.90	2.10
2	2.12	3.25	3.70
3	2.15	3.75	3.90
4 or more	3.96	5.00	6.54

Question: 2 (c)

Table 3: Utility model parameters

Mode	A	W	R	C
Auto	6	1	25	300
Rail	7	10	15	75
Bus	10	15	35	60
Bike	1	0	45	10

Question: 4 (d)

Table 4: Alternative development projects

Project	1	2	3	4	5
Cost (million $)	980	2450	6900	750	4750
Annual maintenance cost (million $)	50	70	250	30	180
Annual benefit(million $)	150	50	120	95	85

Question: 3(c)

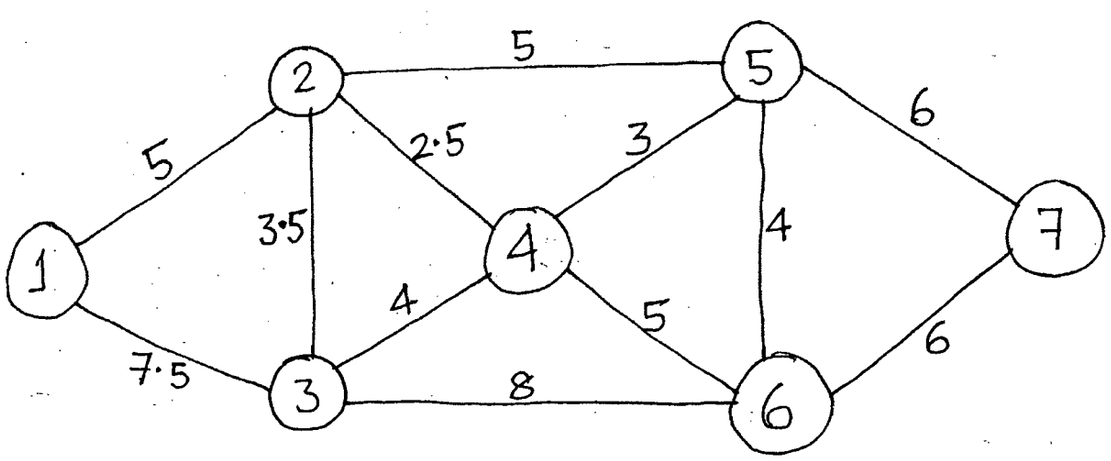


Figure 1: Transport network
(Travel times are in minutes)

L-4/T-2/CE **Date : 11/06/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations 2012-2013

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

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** questions.

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

   (b) A prestressed concrete beam shown in Fig. 1 is posttensioned with 800 mm^2 of high tensile steel to an initial prestressed of 1100 MPa immediately after prestressing. Compute the initial deflection at midspan due to prestress and the beam's own weight, assuming $E_c = 25 \times 10^3$ MPa. Estimate the deflection after two months, assuming a creep coefficient $C_C = 2.0$ and an effective prestress of 850 MPa at that time. Assume any data (if missing) appropriate for you calculate. **(15⅓)**

2. (a) Why the shear capacity of prestressed concrete beam is higher than the corresponding R.C beam? Explain. **(5⅓)**

   (b) Check shear strength of the beam shown in Fig. 2 at sec. 1 –1 which is 4.0 m from the left support. Given that the section is adequate for w_u = 75 kN/m (including self wt.) on the basis of flexural strength. Use both equations (Web shear cracking and inclined flexural creacking) for shear strength in evaluation and compare the results. Given: Effective prestress with 20% loss = 1200 kN; f'_c = 30.0 MPa and non composite section. **(9)**

   (c) Determine the bearing plate area required for the tendons shown in Fig. 3. Follow the specification of the PTI (Post-tensioning Institute) for allowable bearing stresses in concrete. Use f'_{ci} = 28 MPa; f'_c = 35 MPa; maximum jacking force = 2000 kN and force at service load = 1500 kN. **(9)**

3. (a) Explain the importance of transfer bond in a pretensioned concrete member. **(5)**

   (b) Explain the importance of transverse tension in the anchorage zone of a post tensioned concrete beam. **(5)**

   (c) Determine the ultimate moment capacity of the section (Fig. 4) of a prestrerssed and reinforced concrete combination system. Use f'_c = 30 MPa; E_p = 200000 MPa; E_c = 30000 MPa; f_{pu} = 1860 MPa; f_y = 414 MPa; and effective prestress, f_{se} = 1000 MPa. Follow any method for your calculation. You can assume stress-strain behavior for both mild steel and high strength steel (if required). **(13⅓)**

Contd P/2

CE 415

4. Design a composite prestressed concrete structural system for a simply supported 25 m span. The beam will be Type III standard AASHTO-PCI section (Fig. 5) with 125 mm thick slab. Design loads for the structure are; dead load of the composite system (normal weight concrete). W_{cr}, additional load W_D = 1100 Pa; live load, W_L = 2000 Pa. Use f'_{ci} = 30 MPa; f'_c = 35 MPa; and for the slab, f'_c = 28 MPa. Design for unshored beams in construction following the ACI code for the critical section at midspan. Assume total loss of prestress to be 22% for this section and the initial force for 12.7 mm diameter 7-wire strand is 128 kN. Assume appropriate value for any missing data. **(23 ⅓)**

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

   (ii) Find the maximum spacing of the beams for this structural system based on allowable stress at service load. Section properties for precast beam (Type III) are given :

   $A = 36.13 \times 10^4$ mm^2; $I = 522 \times 10^8$ mm^4; C_b = 515 mm

SECTION – B

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

5. (a) Make a preliminary design for section of a prestressed concrete beam to resist total moment of 700 kN-m. Assume effective prestress for steel to be 940 MPa and allowable concrete stress of -13 MPa. M_G = 150 kN-m. Make a trial depth of 42 $\sqrt{M_T}$ (mm), where M_T in kN-m. **(8 ⅓)**

   (b) Prepare the final design for the preliminary section obtained from the above solution allowing and considering tension in concrete. Given: f'_t = 2.4 MPa; f'_b = 2.1 MPa; and f_0 = 1080 MPa. **(15)**

6. (a) What are the different sources of stress loss that makes up the total prestressing loss in prestressed concrete structure? Compare them with reference to pretensioned and posttensioned prestressed concrete. What is the AASHTO alternative suggestion? **(8 ⅓)**

   (b) An overhanging beam (Fig. 6) is to be posttensioned from the Anchor end 'A'. Compute the percentage loss of prestress due to friction from the support 'A' to the free end. Solve using (i) simple approximate method and (ii) more exact friction formula method.

   Given: Friction co-efficient (μ) = 0.40 and Wooble effect (k) = 0.0033/m. **(15)**

7. (a) A post tensioned simple beam on a span of 14 m is shown in Fig. 7. It carries a superimposed load of 9.0 kN/m in addition to its own weight. The initial prestress in the steel is 980 MPa readucing to 840 MPa after deducting all losses but assuming no

Contd P/3

CE 415

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

bending of the beam. Compute the stress in the steel at midspan, assuming steel to be bonded by grouting. Assume, n = 6, A_{ps} = 1400 mm^2, and $\nu_{con.}$ = 25 kN/m^3.

(b) For the above problem [7(a)], determine the total uniform load that can be supported by the beam without causing any tension at the bottom fibre. Also, determine the cracking moment for this beam section if modulus of rupture of concrete is 4.5 MPa.

8. Fig. 8 shows the midsection of a composite beam. The precast section is an inverted T-section 900 mm in depth and is postensioned with a initial force of 2800 kN which reduces to 2450 kN after losses. The beam is simply supported on 24 m span. The top slab 150 ×1000 mm is cast in place after errection of the precast element. After hardening of the floor slab, the composite section has to carry a maximum live load moment of 600 kN-m and superimposed DL moment of 150 kN-m at midspan. Compute the stresses at midspan section at various stages. Given:

f'_c = 49 MPa; A_{ps} = 2580 mm^2, $\nu_{con.}$ = 25 kN/m^3. **(23 ⅓)**

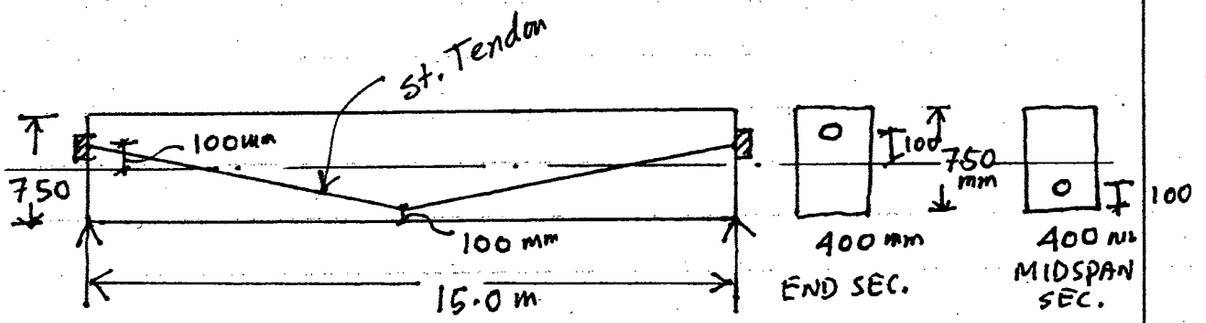


Fig. 1

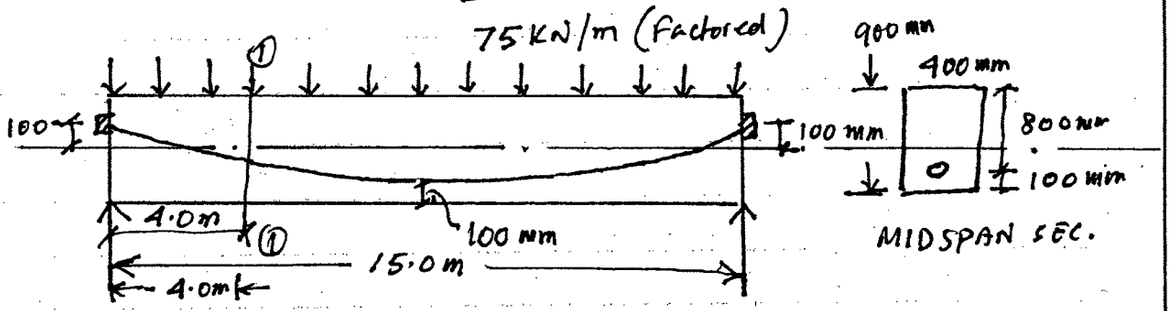


Fig. 2

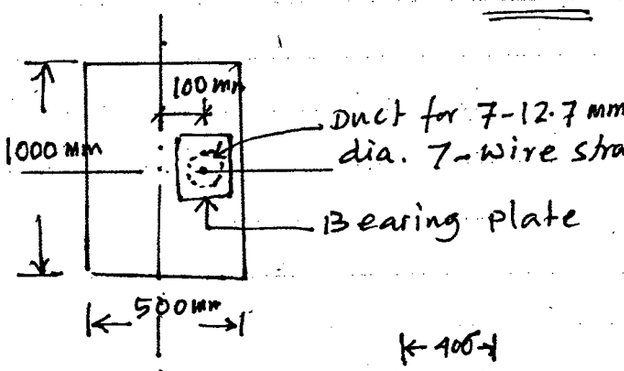


Fig. 3

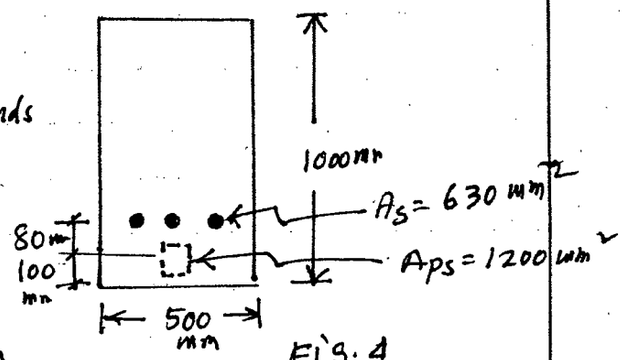
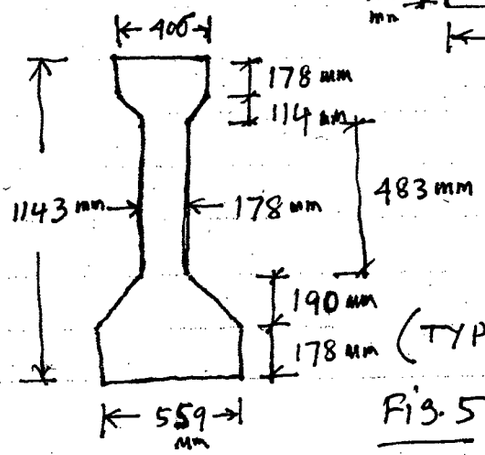


Fig. 4



(TYPE III AASHTO-PCI SECTION)

Fig. 5

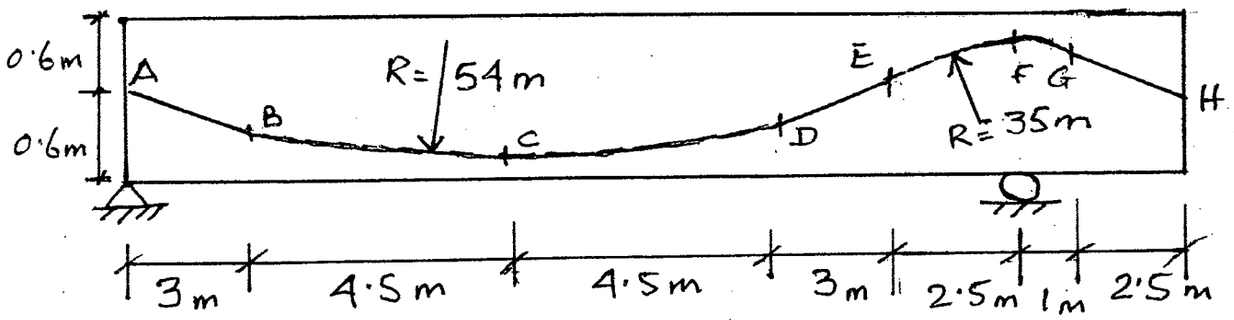


Fig.6

Note:
AB, DE, GH - Straight line
BCD, EFG - Curved line

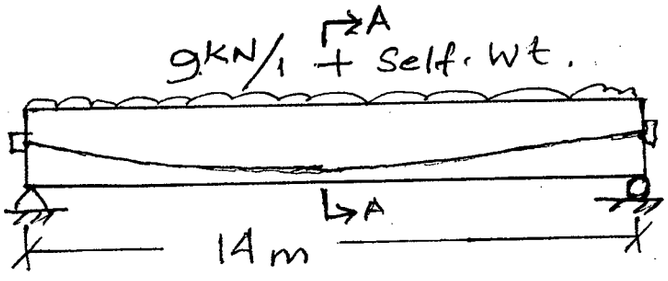
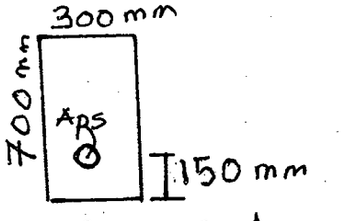


Fig.7



Sec. A-A.
at Midspan

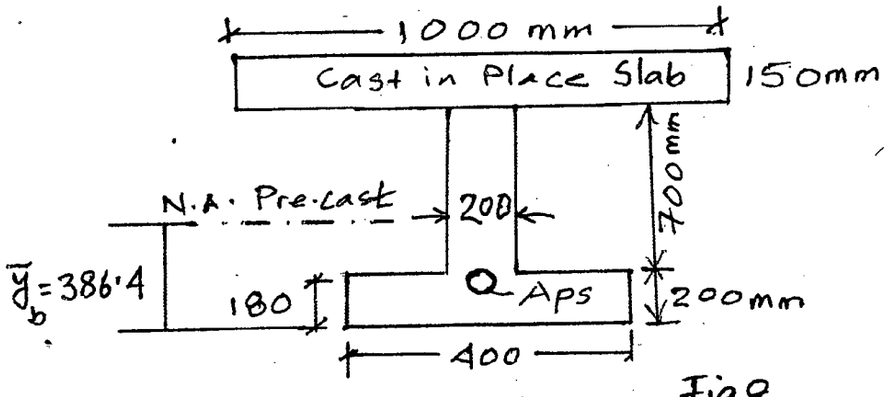


Fig.8