L-3/T-1/CE **Date : 08/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 443** (Earth Retaining Structures)

Full Marks: 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

Assume reasonable value of missing data, only if necessary.

1. (a) List advantages and disadvantages of slurry trench wall construction. **(8)**

   (b) With neat sketches, describe dewatering techniques using well points. Comment on available modern pumps for well points. **(8⅓)**

   (c) Using Broms method, determine the ultimate capacity of a 18 inch dia 20 ft long free standing pile in a sandy soil, subjected to a horizontal load 1 ft. above ground level. Assume worst case scenario regarding ground water table (GWT). Soil properties are: Unit weight (above GWT) = 108 pcf, Unit weight (below GWT) = 115 pcf, Angle of internal friction = 32^0. Give your personal opinion on the use of Broms method for lateral load capacity of piles. **(7)**

2. (a) Write short notes (with neat sketches) on the following: **(4×3=12)**

   (i) Effect of wall movement on lateral earth pressure

   (ii) Tremie concreting for diaphragm wall

   (iii) Raker Bracing

   (b) Derive an expression for minimum stability number required for sheet pile design in cohesive soils. **(4⅓)**

   (c) Fig. 1 shows the section of a braced excavation in clay. Given: C = 650 pcf, γ = 115 pcf. **(7)**

   Draw the earth pressure envelope and determine the strut loads. Also determine the maximum moment developed in one of the wales.

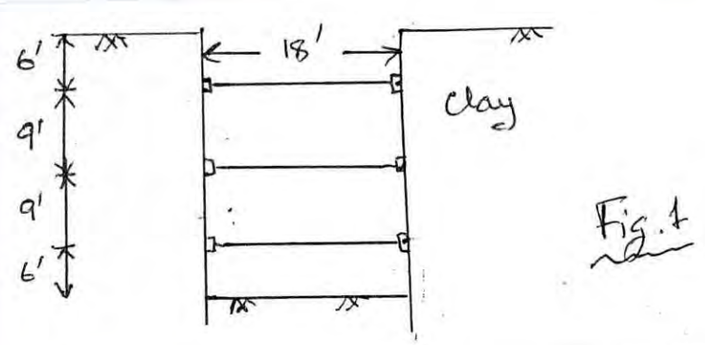


Fig. 1

Assume that the struts are placed laterally at 12 ft centre to centre.

Contd P/2

CE 443/CE

3. (a) With neat sketches, show appropriate location of deadman in homogeneous and layered soils. Also show earth pressures acting on the deadman (anchor). **(7⅓)**

(b) Determine the required length of cantilever sheet pile (Fig. 2) retaining granular backfill over cohesive soil. Consider short term loading. **(16)**

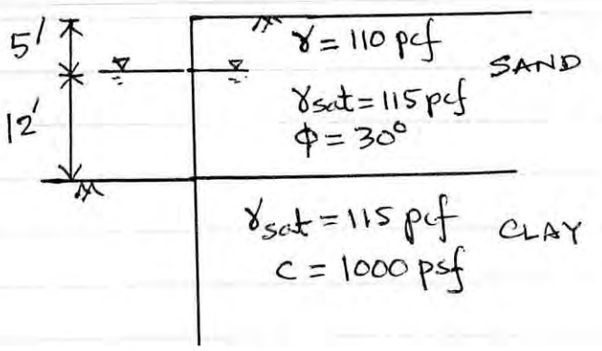


Fig. 2

4. (a) List advantages of the use of steel sheet piles. Show typical sections of them. **(6⅓)**

(b) Determine the required length of the anchored sheet pile shown in Fig. 3. Also determine the force in the tie rod. Use free end method. **(17)**

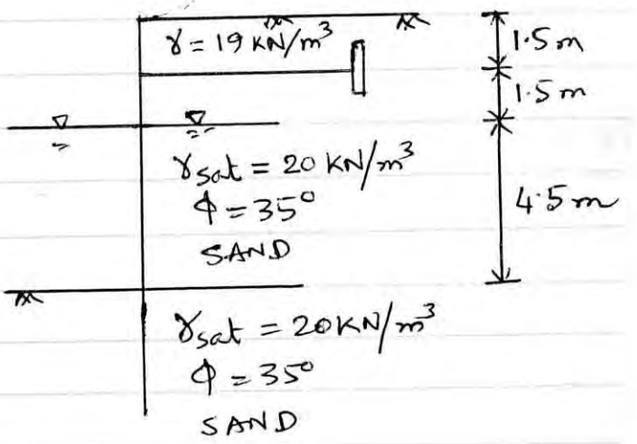


Fig. 3

SECTION – B

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

Assume reasonable value if necessary.

5. (a) List the causes that may induce lateral load to foundations. **(3)**

(b) Show the common proportions of cantilever retaining wall and counterfort retaining wall in schematic diagrams. What is the main difference between counterfort retaining wall and buttressed retaining walls? Draw necessary diagrams. **(4)**

(c) Check the stability against sliding and bearing failure for the square footing (2.2m × 2.2m) shown in the Fig. 4. If the factor of safety against sliding is not sufficient what can be done? (Use bearing capacity factors presented in Table 1). **(16⅓)**

Contd P/3

CE 443/CE

6. (a) Mention the types of structures for which caissons are normally used? Also state the situations for which caisson is advantageous over other types of deep foundations. **(3)**

(b) List the steps of retaining wall design. **(3)**

(c) Fig. 5 shows the cross-section of a retaining wall. Analyze the stability against overturning and sliding. (Given, $\gamma_{conc.} = 23kN/m^3$). **(17 ⅓)**

7. (a) Draw qualitative earth pressure diagrams for design of braced cofferdams in sand and clay. Show the controlling ordinates. **(3)**

(b) Does the lateral earth pressure on braced cofferdam in stiff clay remain unchanged over time? What are the relevant considerations for design and analysis of such a braced cofferdam? **(4)**

(c) A bracing system for an open cut is shown in Fig. 6. Determine the force in the struts A, B and C. The struts are spaced at 10 ft center to center horizontally. **(16 ⅓)**

8. (a) Draw schematic diagrams of open caisson, pneumatic caisson and box caisson. **(3)**

(b) Describe briefly the permanent loads for designing caissons. **(4)**

(c) Will the circular caisson shown in the Fig. 7 be self sinking? If not determine (i) the required amount of ballast and (ii) thickness for self sinking. Assume reasonable value if necessary. (Given, $\gamma_{conc.} = 22.6\ kN/m^3$). **(16 ⅓)**

CE 443

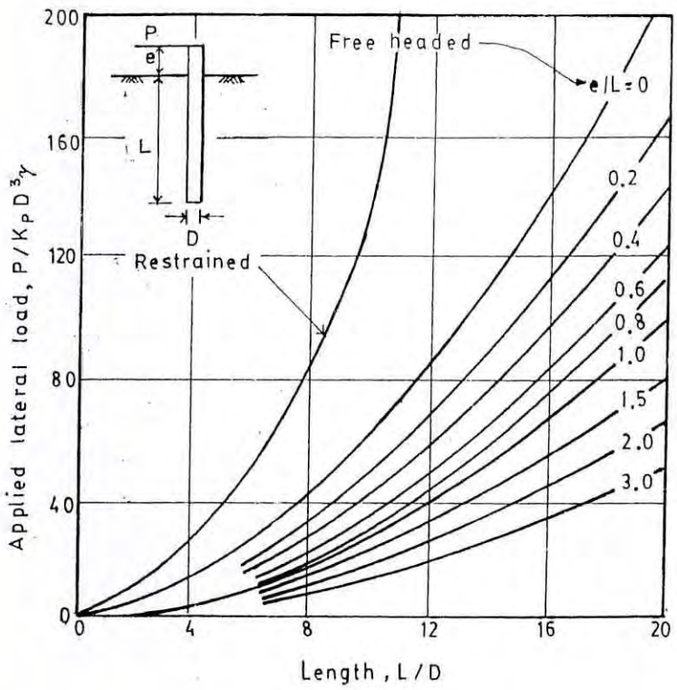


Chart 1

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

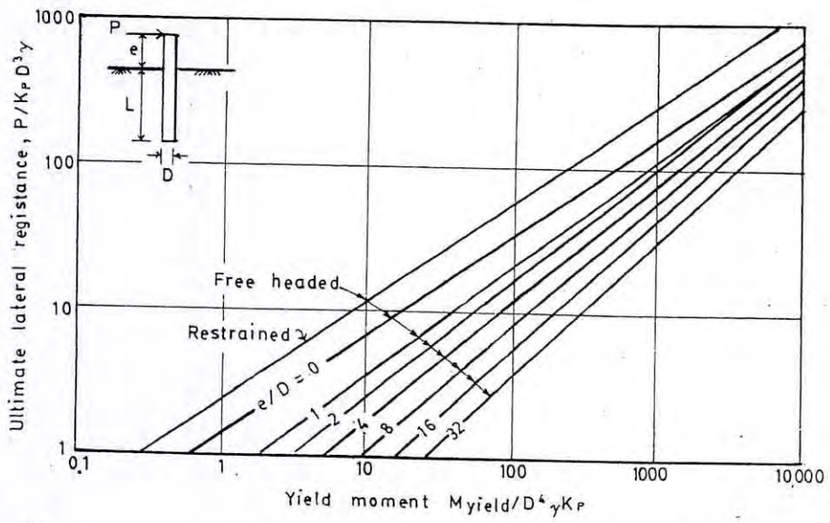


Chart 2

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

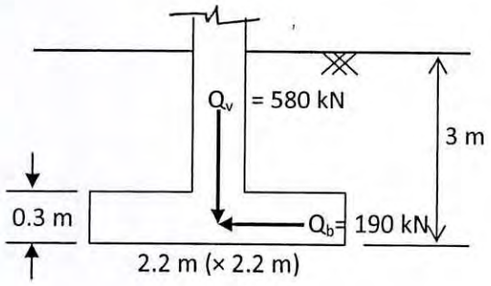
TABLE 1

Bearing-capacity factors for the Terzaghi equations

Values of N_γ for ϕ of 0, 34, and 48° are original Terzaghi values and used to back-compute $K_{p\gamma}$

ϕ, deg	N_c	N_q	N_γ	$K_{p\gamma}$
0	5.7*	1.0	0.0	10.8
5	7.3	1.6	0.5	12.2
10	9.6	2.7	1.2	14.7
15	12.9	4.4	2.5	18.6
20	17.7	7.4	5.0	25.0
25	25.1	12.7	9.7	35.0
30	37.2	22.5	19.7	52.0
34	52.6	36.5	36.0	
35	57.8	41.4	42.4	82.0
40	95.7	81.3	100.4	141.0
45	172.3	173.3	297.5	298.0
48	258.3	287.9	780.1	
50	347.5	415.1	1153.2	800.0

*$N_c = 1.5\pi + 1$. [See Terzaghi (1943), p. 127.]



Uniform soil layer
γ=17.0 kN/m^3
ϕ=25°
c=28 kPa

For square footing:
s_c= 1.3 and s_γ=0.8

Fig. 4 for Q. 5(c)

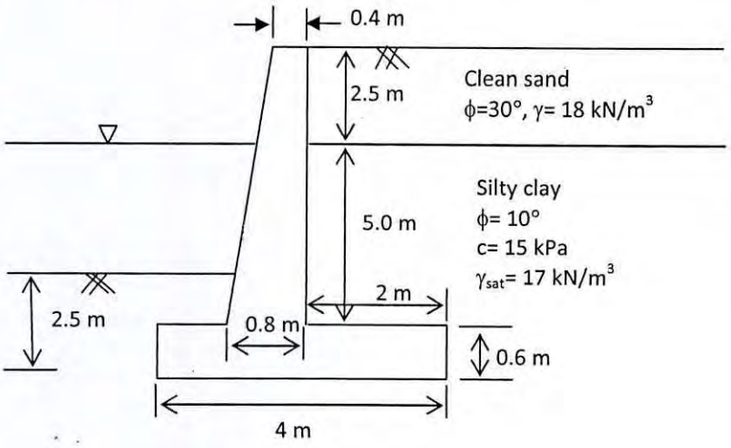


Fig. 5 . for Q. 6(c)

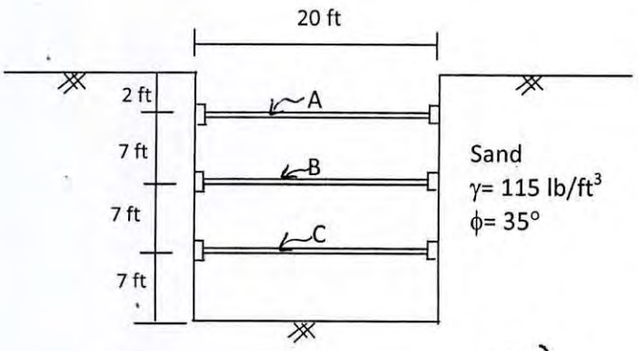


Fig. 6 . for Q. 7(c)

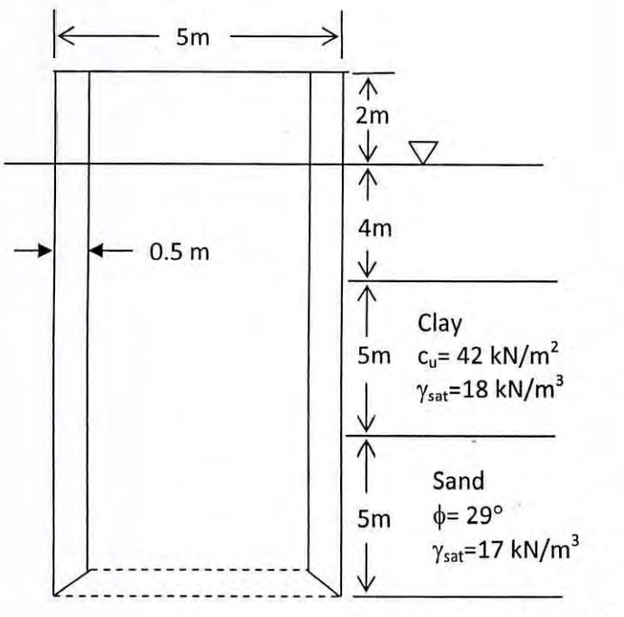


Fig. 7 for Q. 8(c)

L-3/T-1/CE **Date : 08/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 331** (Environmental Engineering-I)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) Write short notes on: (i) Ecology and Environment (ii) Climate change (iii) Green house gases and its effect (iv) Biodiversity. **(16)**

   (b) What do you mean by the term "per capita demand of water"? The population of a city was 20 million in 1970, 24 million in 1980, 34 million in 1990, 51 million in 2000, and 73 million in 2010. Estimate the probable population of the city in 2020 by the geometric progression method and the change in increase rate method respectively? Determine also the water demand for fire fighting for the city in 2020? **(19)**

2. (a) What are the different sources of water for water supply system? Show the essential elements of a surface water based water supply system in a neat sketch. **(12)**

   (b) State the hydraulics of groundwater flow towards a well. Deduce the mathematical expressions for the yield of wells in an unconfined and in a confined aquifers respectively. **(23)**

3. (a) Briefly compare the major design aspects (at least 7 design parameters) of old PSFs and Modified new MSFs. **(15)**

   (b) Design a tubewell with the following sieve analysis data of a soil sample: **(20)**

Sieve No.	Sieve size (mm)	Wt. of material retained (gm)
30	0.60	0
40	0.425	4.5
50	0.30	11.5
100	0.15	62.3
200	0.075	19.4
Pan	--	2.3

   The diameter of the strainer is 100 mm and the opening area of the strainer is 10% of the total surface area of the strainer.

4. (a) How "Tube Settler Technique" affects the performance of "Plain Semimentation Process"? Explain with diagram. **(9)**

   (b) What are the three 'disinfection' theories? Why pre-chlorination is required? **(8)**

   (c) How can Arsenic removal be ensured from low iron content groundwater? How does increase of pH value through lime addition affect Arsenic removal process? **(8)**

   (d) What are the adverse effects of presence of Fluoride and Nitrate in a groundwater supply system? **(10)**

Contd P/2

CE 331/CE

SECTION – B

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

5. (a) What are the causes of "Odor" and "Taste" in water? **(10)**

   (b) What are the factors affecting "Coagulation and Flocculation" processes? **(10)**

   (c) How pH value and Alkalinity of water affect on "precipitation softening" process? **(15)**

6. (a) What are the major problems and drawbacks of the previously (1978-1985) developed "Community Based Arsenic, and Iron Removal Units"? **(12)**

   How Arsenic and Manganese removal can be ensured in low cost (without using chemicals) Arsenic-Manganese-Iron Removal units?

   (b) How you will differentiate between "Activated carbon" and "plain charcoal"? **(3)**

   (c) How "Negative Head and Air-binding" affect "Sand Filtration Process"? **(10)**

   (d) Discuss briefly the characteristics of centrifugal pumps with necessary diagrams. **(10)**

7. (a) Drinking water is supplied to a pourashava from ground water extracted via DTWs and through a piped distribution with good quality control measures in place. The ground water contains high concentrations of both iron (10 mg/L) and Arsenic (1.0 mg/L). There is risk of ingress of contamination when there is low/no pressure in the system. Ignoring any control measures, calculate "raw risk" score and category for these three hazardous events: (i) high Fe conc. in ground water, (ii) high As conc. in ground water; and (iii) ingress of contaminants to the distribution system. **(35)**

   Use rating of likelihood as almost certain (5), likely (4), possible (3), unlikely (2), Rare (1); And rating of impact as Insignificant (1), Minor (2), Moderate (3), Major (2), Catastrophic (5) with justification.

8. (a) Discuss briefly the factors which induce the corrosion of metallic pipes of water. What are the means employed to minimize corrosion? **(15)**

   (b) Discuss briefly various water distribution systems with their merits and demerits. **(10)**

   (c) An elevated cylindrical water tank of 1,00,000 U.S. gallon capacity has to be designed. Concrete work per sft in the floor and wall of shell costs Tk. 1200/- and Tk. 1800/- respectively. What would be the most economical dimensions for the water tank? **(10)**

L-3/T-1/CE **Date : 04/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 301** (Professional Practice and Communication)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) With the help of suitable example(s) describe the guideline of PPR for preparation of technical specification of goods item. **(15)**

   (b) Write specification of a goods item and a civil work item. **(20)**

2. (a) In order of priority, list the documents that form part of the contract. **(5)**

   (b) Suppose that as an outcome of a tender process 'X-Brothers Ltd.' has been found as the lowest responsive bidder for construction work of a residential hall at BUET. In this connection, prepare a Notification of Award on behalf of the procuring entity. **(15)**

   (c) Describe the tendering process through a flow-chart. **(15)**

3. (a) For the purpose of construction of a highway bridge over a river, tender document is to be prepared. The overall length of the bridge is 1500 m and the estimated cost is 1000 crore taka. Prepare the tender data sheet for the following items: **(20)**

   (i) Tender's experience (general and specific work)
   (ii) Tender security
   (iii) Required construction turnover
   (iv) Liquid asset or working capital required
   (v) Pre-Tender meeting

   Note that the project duration is 3 years.

   (b) Briefly describe the following terms: **(15)**

   (i) Arithmatic correction
   (ii) Contract price
   (iii) Post qualification

4. (a) State the situation where FIDIC conditions may be preferred than the conditions of contract provided in Standard Tender Document. **(5)**

   (b) Prepare a standard BoQ for concreting work in super-structure of a bridge. **(12)**

   (c) Discuss the steps for preparing effective oral presentation. **(18)**

Contd P/2

CE 301

SECTION – B

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

5. (a) Show six different types of project delivery systems in flow charts. What are the main advantages of DBB system, DB system and Multiple Prime system? **(18)**

   (b) What are the 'think twice' contract clauses (names only)? **(10)**

   (c) Who are the three key players in project development and delivery process? Who are the fourth group that co-exist with the three key players. **(7)**

6. (a) What procedures/steps should be followed while dealing with contract risk. **(10)**

   (b) Write down the names of specific concerns for professional liability insurance. **(5)**

   (c) Define Civil Engineers. Describe five basic attributes of Civil Engineering profession. **(10)**

   (d) Briefly describe Scope-Schedule-Budget triangular relationship with respect to project. **(10)**

7. (a) Describe the planning steps before a meeting and procedures during the meeting and also identify various participants' roles in a meeting. **(18)**

   (b) What are the seven C's of effective communication? Describe completeness, conciseness and concreteness. **(17)**

8. (a) Describe what the engineer is supposed to do under various circumstances according to the relevant sections of Code of Ethics for Engineers document as supplied to you.

   (i) According to Section 2, what issues of the public should the Engineer keep in mind in the performance of his professional duties? If his judgement is overruled by non-technical authority what should he do? **(3+2)**

   (ii) According to the Section 4, what should the Engineer endeavor to do and what should he protect the engineering profession from? **(4)**

   (iii) According to the Section 12, what should the Engineer not attempt to do with regards to the professional reputation, prospects of practice or employment of another engineer? **(4)**

   (iv) According to the Section 13, what kind of persons or engineers the Engineer should not become professionally associated with? **(4)**

   (b) Write short notes on:

   (i) Most common bonds. **(4)**

   (ii) Principal players in the professional liability insurance industry. **(5)**

   (iii) Three measures of project activity. **(5)**

   (iv) Fiduciary Risk. **(4)**

L-3/T-1/CE **Date : 30/07/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 315** (Design of Concrete Structures I)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) A one-way slab supported on RC beams is shown in Fig. 1. The calculated dead load on the slab is 180 psf (working) and the slab is subjected to a working live load of 80 psf. The live load can occupy any portion or any position on the slab. Calculate the critical moments and design the slab using USD method. Show the slab reinforcements with neat sketches. Given: $f'_c = 3$ ksi and $f_y = 60$ ksi. **(20)**

   (b) What do you understand by the term "serviceability" in RC design? **(6)**

   (c) Discuss why and how temperature and shrinkage reinforcement is provided in one-way slabs. What are the ACI/BNBC recommended values for such steel? **(9)**

2. (a) Design the stirrups for the beam shown in Fig. 2. Use $f'_c = 3.5$ ksi, $f_y = 60$ ksi. Calculate stirrups with 3 sets of spacing. Show the stirrups in a neat sketch. **(20)**

   (b) What are the BNBC/ACI code provisions for beam stirrups (hoops) for moderate seismic risk region e.g. Dhaka. **(9)**

   (c) What are the function of stirrups in beams? **(6)**

3. (a) Show with neat sketches cut off or bend points for bars in approximately equal spans with uniformly distributed loads. **(9)**

   (b) Discuss briefly the factors that influence development length of a reinforcing bar. **(10)**

   (c) Calculate the development length of 20 mm and 25 mm uncoated top bars in USD. Repeat the calculation for other bars also. Use $f'_c = 3$ ksi and $f_y = 60$ ksi and assume appropriate value for any missing data. **(10)**

   (d) What is the minimum length of lap for column splices as per ACI/BNBC code? **(6)**

4. (a) Describe with neat sketches five reinforced concrete floor systems commonly used in Bangladesh. **(10)**

   (b) A floor system consists of a 3 inch slab supported by continuous T-beams with 30 ft span, 50 inch on centres as shown in Fig. 3. Web dimensions as determined by negative moment requirement at the support area is $b_w = 12''$ and $d = 24''$. What tensile area is required at midspan to resist a factored moment M_u of 700 kip-ft; if $f_y = 60$ ksi and $f'_c = 3$ ksi? **(25)**

Contd P/2

CE 315

SECTION – B

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

Assume appropriate value(s) for any missing data.

The short beam of Fig. 4 cantilevers from a supporting column at the left. The beam is adequately restrained at beam-column joint and therefore can be assumed to be fixed at the column face. This structure (Fig. 4) has been selected for the students of Level-3/Term-1 to see the behaviour of reinforced concrete beam under increasing load by applying a concentrated load 'P' at the free end.

There are **FIVE** questions selected from the test, answer any **FOUR**.

5. (a) Draw the typical stress-strain curve for concrete (in compression) and steel (in tension) used in beam of Fig. 4. Also, show the different stress-strain levels (considered as design parameters) on these curves. **(9)**

   (b) (i) Determine the axial load that will stress the concrete of column of Fig. 4 to 1000 psi. **(17 ¼)**

   (ii) Determine the axial load that will produce a strain or unit shortening $\varepsilon_c = \varepsilon_s = 0.0010$ in the column of Fig. 4. Use your stress-strain curve for calculation.

   (iii) Calculate the maximum axial load that the column of Fig. 4 can carry. Consider both fast rate loading and slow rate loading for your calculation. Also, calculate the share of the total load carried by the reinforcement of column at these three stages.

6. (a) Show the distribution of stresses and strains in concrete and steel over the depth of the beam section shown in Fig. 4 under increasing load (P). **(8)**

   (b) Compute the load P, that will produce the first crack at the column face. Consider self wt. of beam for your calculation. **(9 ¼)**

   (c) Draw bending moment and shear force diagram for the cantilever beam shown in Fig. 4, when $P = 10^k$. Consider self wt of the beam for your calculation. **(9)**

7. (a) Show a typical biaxial failure surface of normal density concrete. Identify the Compression-Compression, Compression-Tension and Tension-Tension regions on the surface. Using this failure surface, explain why the cylinder and cube specimens provide different compressive strength and failure mode for same concrete? Also, show the failure points of cylinder and cube on this surface. **(13)**

   (b) Compute the load 'P' that can be applied without stressing the concrete of beam (Fig. 4) beyond 0.45 f'_c or the steel above 0.4 f_y. Consider self wt. of beam for your calculation. **(13 ¼)**

Contd P/3

CE 315

8. (a) Derive the expression for balanced steel ratio (ρ_b). Show the appropriate stress and strain distribution diagrams for your derivation. **(6)**

(b) Explain the terms 'Under reinforced', 'Over reinforced' and 'Doubly reinforced' beams. Identity the status of beam of Fig. 4 in respect of these three. **(7)**

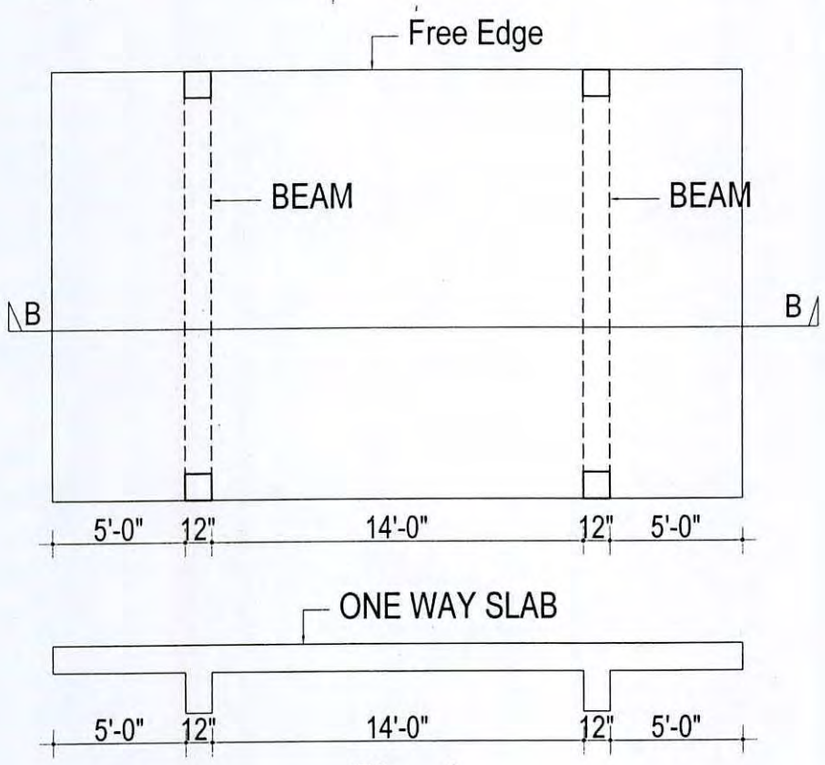
(c) Compute the design moment capacity (M_u) of the beam shown in Fig. 4. Calculate the maximum value of P which will produce such stress condition in concrete and steel of the beam. Use appropriate load factors and consider 'P' as live load. Include self wt. of the beam in your calculation. **(13 ¼)**

9. (a) If the beam of Fig. 4 carries P = 30^k (Unfactored) what part of the beam is web reinforcement required? Design the web reinforcement, basing V_c on both approximate and more elaborate equation. Also, compare the results. Consider self wt. of the beam. **(7 ¼)**

(b) What are the factors that affect the development length of rebars in tension. Check to see if adequate embedment length is available for rebars in the beam (Fig. 4) to develop f_y at the column face. If hooks are required, specify detailed dimensions. You can consider simplified equations for your calculation. **(8)**

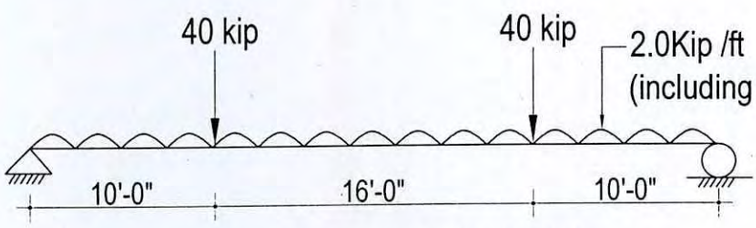
(c) Calculate the point where the centre rebar can be terminated. Check to be sure that adequate embedment length is provided for both continued and discontinued rebars. **(6)**

(d) The centre rebar of the beam needs to be spliced away from the critical section. Shear reinforcement consists of No. 3 at 4 in. spacing. All rebars are assumed to be fully stressed. Calculate the required splice length. **(5)**



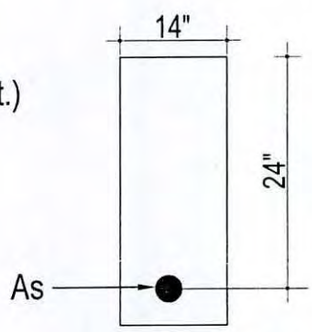
Section B-B

Fig- 1

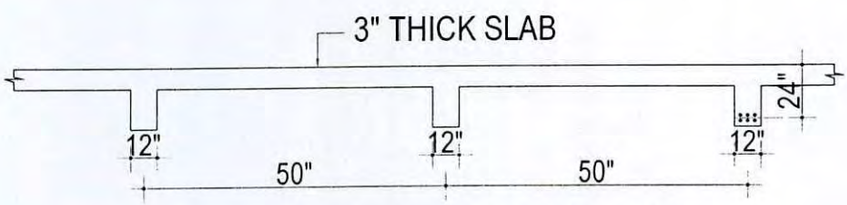


ALL LOADS ARE FACTORED

Fig- 2



BEAM SECTION

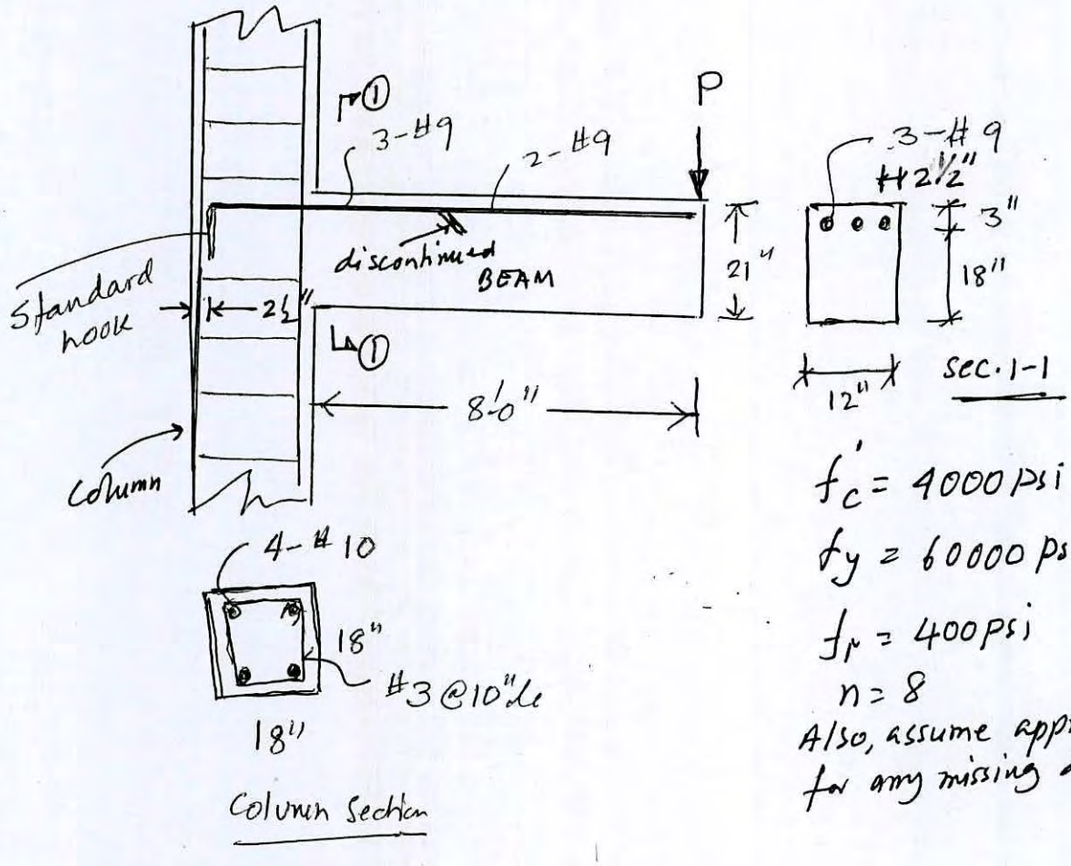


SPAN OF BEAMS = 30'-0"

Fig- 3

Given:

f'c = 3 ksi
fy = 60 ksi
Mu = 700 kip-ft



Column Section

$f'_c = 4000$ psi

$f_y = 60000$ psi

$f_r = 400$ psi

$n = 8$

Also, assume appropriate value(s) for any missing data.

Fig. 4

L-3/T-1/CE **Date : 05/07/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 311** (Structural Analysis and Design I)

The figures in the margin indicate full marks.

Full Marks : 280 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **SEVEN** questions in this section. Answer any **FIVE**.

1. Find maximum shear at quarter point of a simply supported beam of 40 ft due to the wheel load shown in Fig. 1. **(28)**

2. Calculate maximum moment at one-third point of a simply supported beam of 60 ft for the wheel load shown in Fig. 1. **(28)**

3. Determine maximum stress for member L_2U_3 of the truss shown in Fig. 2. The wheel load is given in Fig. 1. **(28)**

4. Draw shear force and bending moment diagram for the stiffening girders of the suspension bridge shown in Fig. 3. **(28)**

5. Calculate horizontal deflection at joint "D" of the truss shown in Fig. 4. Given: Cross-sectional area of all members = 5 in^2. Assume E = 30,000 ksi. **(28)**

6. Compute change in slope at "D" of the beam shown in Fig. 5. Given: E = 30,000 ksi, I_1 = 100 in^4 (Member ABC), I_2 = 200 in^4 (Member CD). **(28)**

7. Determine vertical deflection at "C" of the frame shown in Fig. 6. Given: A = 10 in^2 and I = 300 in^4 for all the members. E = 30,000 ksi. **(28)**

SECTION – B

There are **SEVEN** questions in this section. Answer any **FIVE**.

8. Find by Equivalent Static Force Method of BNBC, the vertical distribution of earthquake forces on a 30 m high 10-storied hospital building with story height 3 m each located in Khulna city. The concrete building has a square plan 40 m × 40 m and the basic structural system is developed using ordinary moment resisting frames in concrete (R = 5). **(28)**

   Given: Dead load = 6 kN/m^2 for each floor

   Partition Wall Load = 2 kN/m^2 for each floor

   Z = 0.075; I = 1.25; Site coefficient, S = 1.2;

   C_t = 0.073, C < 2.75 and C/R > 0.075

Contd P/2

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9. Using cantilever method draw shear force and bending moment diagrams for the girder EFG of the building frame shown in Fig. 7. Also draw axial force diagrams for the columns. Cross sectional areas of the columns are shown alongside them in the figure. Draw moment diagrams on compression side. **(28)**

10. The building frame shown in Fig. 8 carries a uniform vertical load of 2 kip/ft of each girder. Using approximate method draw axial force and bending moment diagrams for the column ABCDEFG. The column has constant cross section over its height. Draw moment diagrams on compression side. **(28)**

11. Using approximate method determine the bar forces in the truss shown in Fig. 9. Diagonals can not carry any compression. **(28)**

12. For the beam shown in Fig. 10, draw influence lines for (a) reaction at A (b) reaction at C (c) shear at B (d) shear just left of C (e) shear just right of C (f) moment at B and (g) moment at C. **(28)**

13. Calculate the force in the counter L_2U_3 of the truss shown in Fig. 11 due to a moving UDL of 3 kip/ft accompanied by a roving concentration of 60 kip. The dead load of the truss is 2 kip/ft. **(28)**

14. For the truss shown in Fig. 12, find stresses in members CD, BK, HK and KD. **(28)**

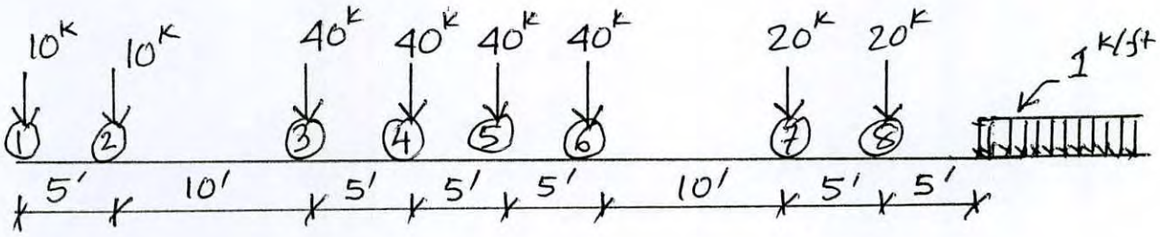

Fig. 1

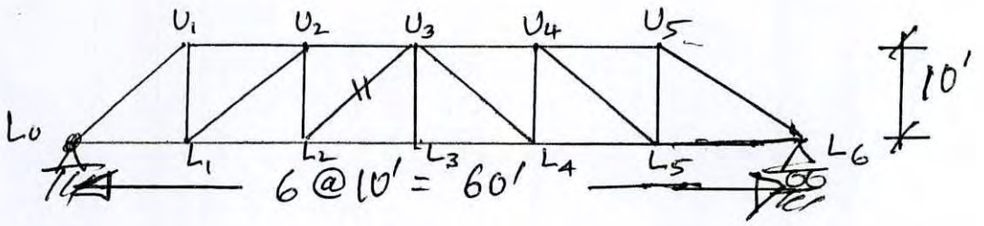

Fig. 2

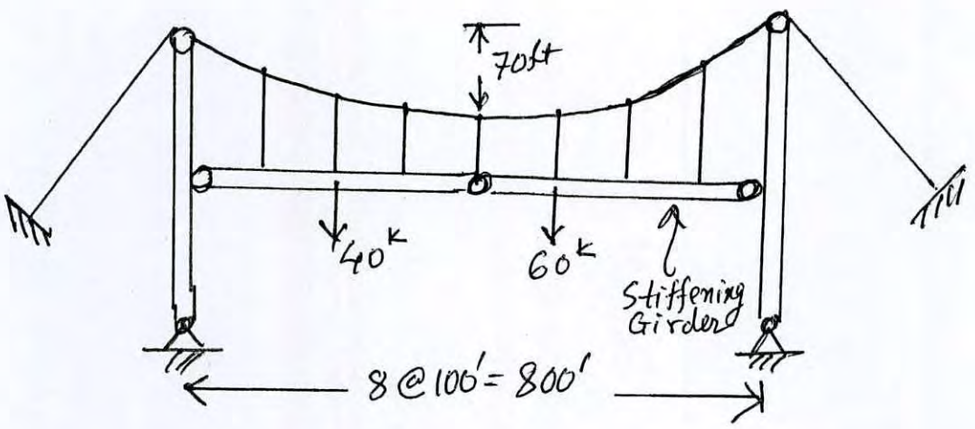

Fig. 3

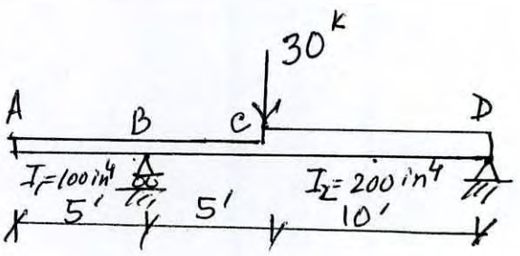

Fig. 5

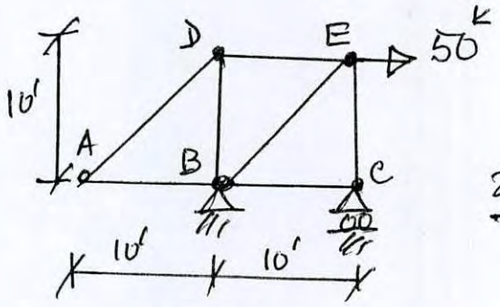

Fig. 4

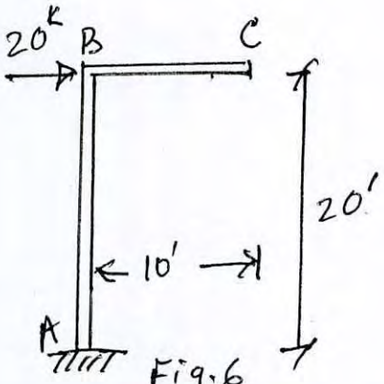

Fig. 6

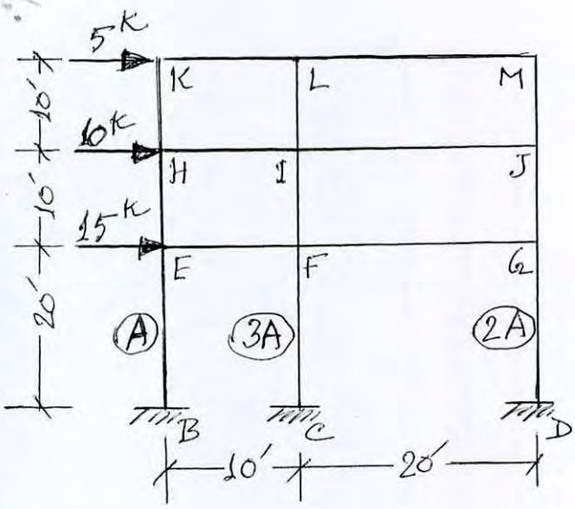

Fig. 7

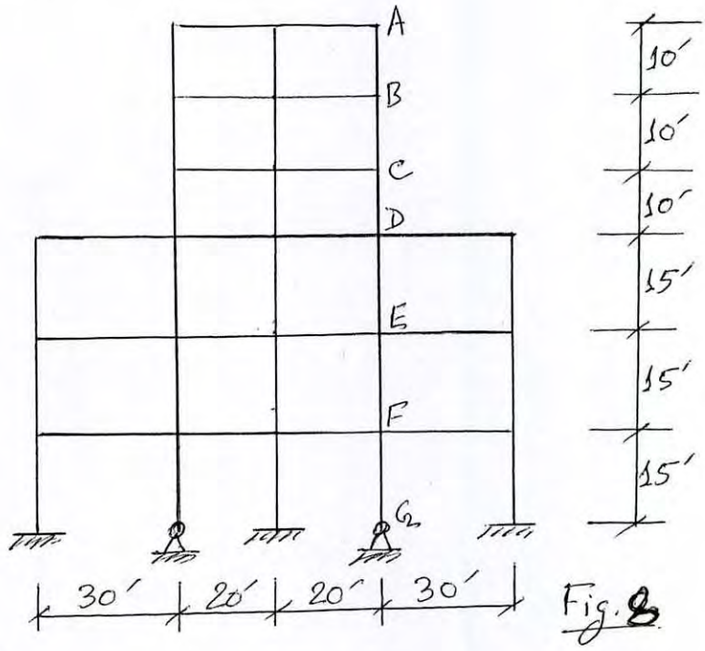

Fig. 8

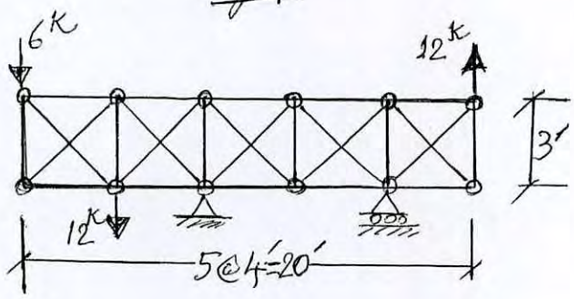

Fig. 9

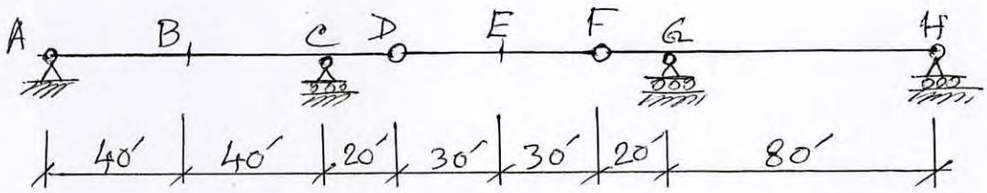

Fig - 10

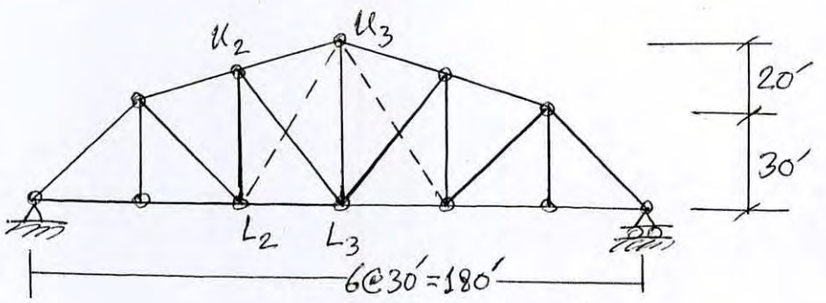

Fig - 11

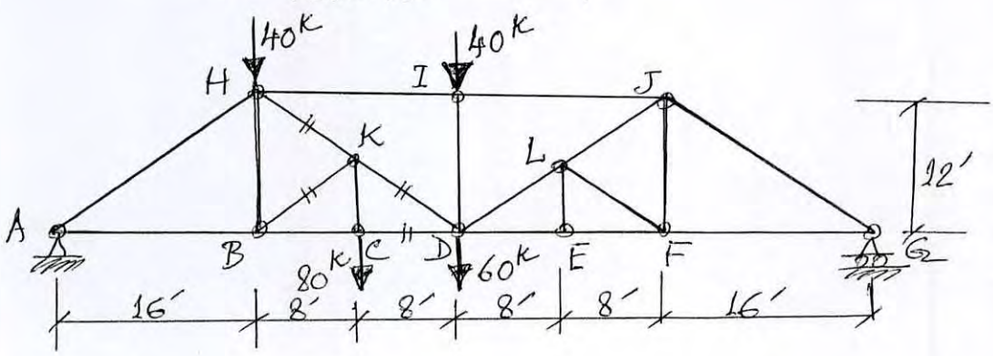

Fig. - 12

L-3/T-1/CE **Date : 28/06/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 341** (Principles of soil Mechanics)

Full Marks : 280 Time : 3 Hours

The figures in the margin indicate full marks.

Assume reasonable value(s) of any data, if missing.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **EIGHT** questions in this section. Answer any **SIX**.

1. What are the various aspects of Geotechnical Engineering? Define each of them. Show in a line diagram the classification of transported soil. **(23 ⅓)**

2. Derive an expression for passive earth pressure in a c-ϕ soil. Prove that the depth of theoretical unsupported height in a c-ϕ soil is $4c/\gamma \tan(45 + \phi/2)$. **(23 ⅓)**

3. Laboratory test on a soil sample obtained from a highway project site revealed the following data. **(23 ⅓)**

   % passing # 4 sieve = 95
   % passing # 10 sieve = 85
   % passing # 40 sieve = 75
   % passing # 200 sieve = 55
   Uniformity co-efficient = 10
   Co-efficient of curvature = 4
   Liquid limit = 36
   Plastic limit = 23
   Liquidity Index = 0.75

   Classify the soil. Comment on the stiffness of the natural soil.

4. A soil sample taken from a sand deposit is tested in a direct shear apparatus and found to have an angle of shearing resistance of 32° at a unit weight of 19.8 kN/m^3. Estimate the shear strength of the soil in a horizontal plane. A structure proposed to be built on the site will cause the vertical and shear stresses to increase by 65 and 50 kN/m^2, respectively at the same depth. Will the structure be stable against shearing if the ground water table rises from below that point to the ground surface? **(23 ⅓)**

5. A drained triaxial compression test for a normally consolidated clay specimen was conducted with σ'_3 = 100 kPa. After the test, the failure planes on the specimen were observed. The failure plane angle was measured as 55° inclined from the horizontal. Determine the effective angle of internal friction ϕ' and σ'_1 at failure. **(23 ⅓)**

Contd P/2

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6. A vertical retaining wall 10 m high supports a cohesionless soil with $\gamma = 18$ kN/m^3. The upper surface of the backfill is level with the wall top and horizontal. Determine the total active pressure by Culmann's graphical method and check the thrust obtained by Rankine's method. Take $\phi = 30°$ and $\delta = 20°$. Use normal graph paper. **(23 ⅓)**

7. The Figure below shows surcharge loads on the horizontal backfill of a retaining wall. Compute and plot the lateral earth pressure distribution against the non-yielding vertical wall at a section of distance 1.5 m (lateral distance along the wall) from the point load due to the combination of surcharge load. **(23 ⅓)**

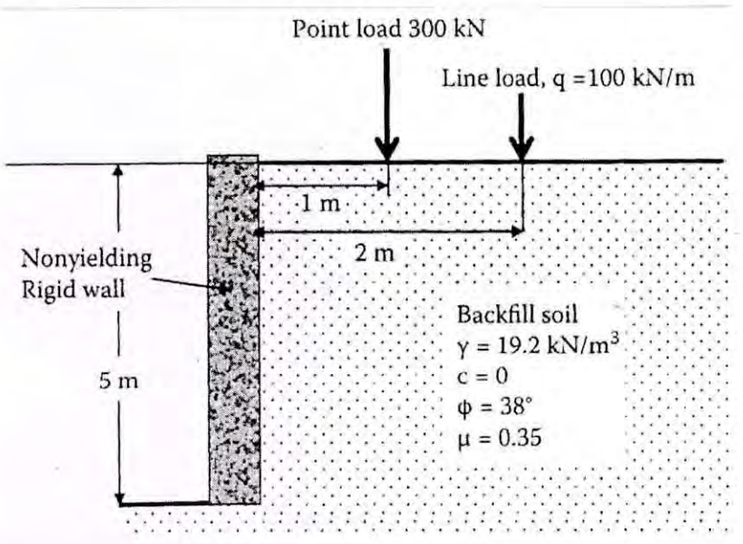

Fig. 1 for Q. no. (7)

8. For a smooth vertical wall with cohesive soil backfill as shown in Fig. 2 below, compute the lateral thrust coming against the wall, showing the distribution of pressure. Compute the point of application of the thrust. Compute only the soil pressures. **(23 ⅓)**

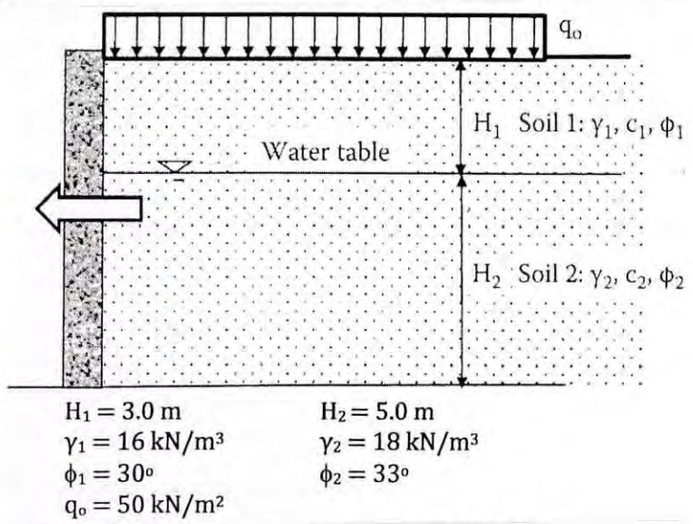

Fig. 2 for Q. no. (8)

SECTION – B

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

9. (a) The porosity and specific gravity of solids of 100% saturated soil are known. In terms of these quantities and with the aid of a block diagram, derive a formula for the moisture content of the soil. **(10 ⅔)**

Contd P/3

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Contd ... Q. No. 9

(b) How do you determine the void ratio of a soil sample? **(7)**

(c) Give the salient features of compactions curves. **(7)**

(d) How do you calculate coefficient of permeability of clayey soil and give the typical value of it for coarse sand and clay. **(7)**

(e) There are two borrow areas A and B which have soils with void ratios of 0.80 and 0.70 respectively. The in-place water content is 20% and 15% respectively. The fill at the end of construction will have a total volume of 10,00 m^3 with bulk density of 2 gm/cc and at a water content of 22%. Determine the volume of soil required to be excavated from both the areas with Gs = 2.65. **(15)**

If the cost of excavation and transportation is Tk. 5000.00 per 100 m^3 for area A and Tk. 5500.00 per 100 m^3 for area B, which of the borrow area is more economical?

10. (a) Define the term seepage pressure and derive an expression for calculating seepage force per unit volume. **(10⅔)**

(b) What is quick sand? How would you calculate the hydraulic gradient required to create quick sand condition in a cohesionless silty soil? Why this condition does not exist in clayey soil and gravel. **(10)**

(c) What is capillary rise? Write down the typical value of it for fine sand and clay. **(10)**

(d) Draw the flow net diagram for the problem shown in Fig. 3 and estimate seepage loss in six months. Given $k = 3.15 \times 10^{-5}$ m/sec. **(16)**

11. (a) Give Terzaghi's definition of consolidation. Distinguish between consolidation and compaction. **(10⅔)**

(b) Discuss the construction of field e-logp curve for normally consolidated and preloaded clay. **(10)**

(c) How would you calculate time-settlement curve for a soil subjected to consolidation? **(10)**

(d) A 3.0 m thick clay layer beneath a 10-storey building in Chittagong is overlain by a permeable stratum and is underlain by an impervious rock bed. The compression index and the coefficient of consolidation of the clay were determined in the laboratory and found to have values 0.16 and 0.025 cm^2/minute respectively. The final expected settlement for the clay layer is calculated as 8.0 cm. **(16)**

(i) How much time will it take for 80% of the total settlement?

(ii) Determine the time required for a settlement of 2.5 cm to occur.

(iii) Compute the settlement that would occur in 5 years.

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12. (a) An embankment is to be constructed with following dimensions (Fig. 4):

Top width = 8 m; height = 4 m; side slope = 1 : 1.5 (vertical : horizontal). The unit weight of soil is 21 kN/m^3 and a surcharge load of 50 kN/m^2 is acting on the road surface (QR). **(15)**

Calculate the increase in vertical stress at "A" which is at a depth of 6.0 m on the central line of the vertical plane of embankment.

(b) An overhead water tank is supported at a depth of 3.0 m by four isolated square footing of sides 2.0 m each in a square pattern with a centre-to-centre spacing of 8.0 m (Fig. 5). Compute the vertical stress at the foundation level, **(15)**

(i) at the centre of the four footing, and

(ii) at the centre of one footing. Adopt Boussinesq's point load approximation.

Assume the load on each footing is 700 kN.

(c) A foundation is constructed to take a stress of 150 kN/m^2 and is attached with another existing foundation (Fig. 6) taking a stress of 100 kN/m^2. Find the vertical stress at a depth of 2.0 m below the point D. Use Newmark's chart method. **(16 2/3)**

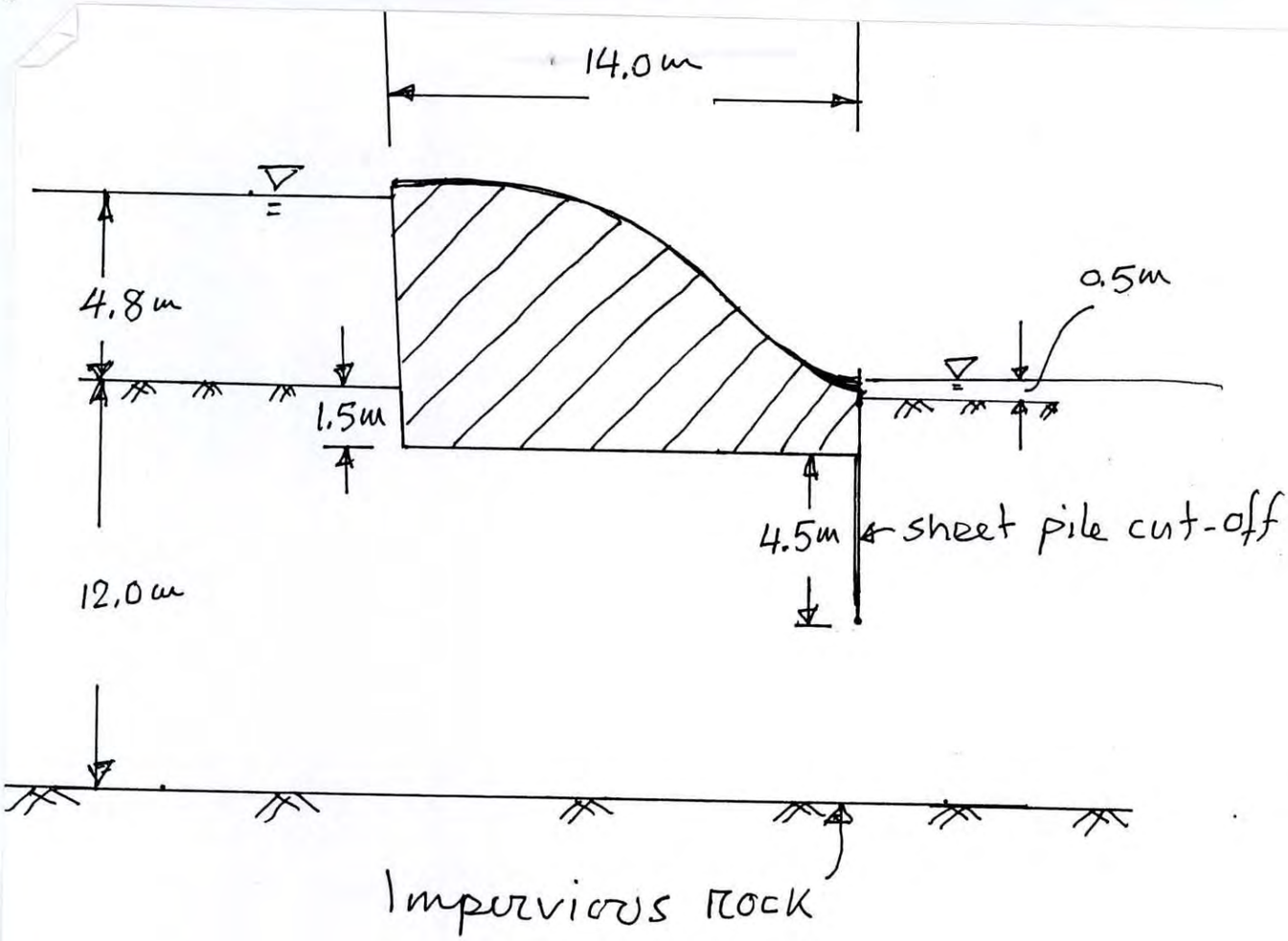

Fig.3 (for Q. no. 10(d))

P.S You may draw Flow net on this figure and attach this page with the answer script.

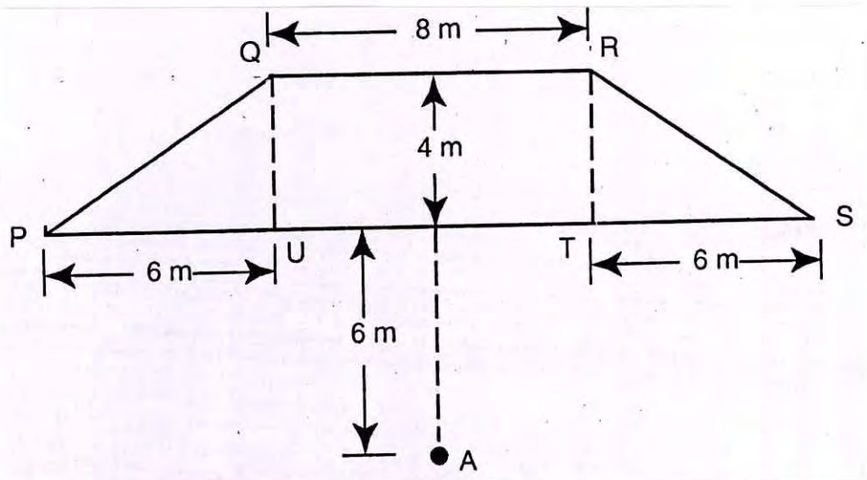

Fig. 4. (for Q. no. 12(a))

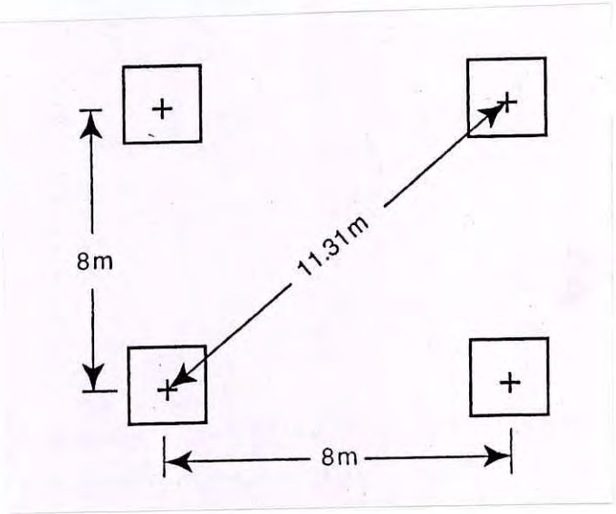

Fig. 5 (for Q. no. 12(b))

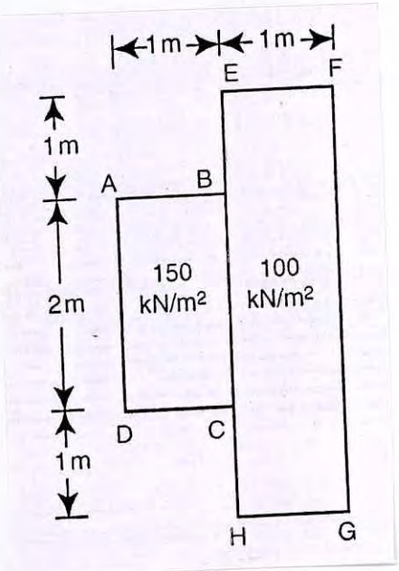

Fig. 6 (for Q. no. 12(c))