L-3/T-1/CE **Date : 15/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 311** (Structural Analysis & Design - 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 **SEVEN** questions in this Section. Answer any **FIVE**.

1. Draw the influence lines for: **(21)**
   (a) Reaction at C
   (b) Shear force at D and at the left of C
   (c) Bending Moment at D and C of the beam in Fig. 1.

2. Draw influence line for: **(21)**
   (a) Bending Moment at panel points 3 and 4, and
   (b) Shear force in Panel 3-4
   of the girder with floor beams in Fig. 2.

3. Find the maximum shear force at 30 feet away from the left support of a simply supported beam of 80 feet due to the wheel loads shown in Fig. 3. **(21)**

4. Calculate the maximum reaction of the support D of the Beam in Fig. 4 due to the wheel loads shown in Fig. 3. **(21)**

5. Draw influence line for bar force in U_3L_3, U_4U_5, U_5U_6 and L_5L_6 of the truss shown in Fig. 5. (load moves over the bottom chord) **(21)**

6. Calculate the maximum value of the shear force and bending moment at F of the beam in Fig. 4 due to the combined effect of: **(21)**
   (a) self weight = 3 kips /ft
   (b) moving uniform live load = 5 kips/ft
   (c) roving concentrated live load = 50 kips

7. Calculate the maximum bar force in U_5L_4 and L_3L_4 of the truss in Fig. 5 due to the combined effect of: **(21)**
   (a) self weight = 3 kips / ft
   (b) moving uniform live load = 5 kips /ft
   (c) roving concentrated live load = 50 kips.

Contd P/2

CE 311

SECTION – B

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

8. Draw influence lines for both shear and moment at sections a-a and b-b of the structure shown in Fig. 6. Unit load moves from A to B. **(21)**

9. Draw axial force, shear force and bending moment diagrams for the structure shown in Fig. 7. Also draw free body diagram of joint E. **(21)**

   Given : Shear at F = – 20^k.

10. Determine the bar forces in members U_2U_3, U_2M_3, M_3U_4 and M_3L_2 of the truss shown in Fig. 8. **(21)**

11. Calculate the force in the counter AD of the truss shown in Fig. 9 due to a moving UDL of 10 kip/ft accompanied by a roving concentration of 90 kip. The dead load of the truss is 2 kip/ft. **(21)**

12. State and derive the General Cable Theorem. **(21)**

13. A cable has a span of 500 ft and a sag ratio of $1/40$. The slope of the cable chord is defined by tan $\gamma = 0.7$. The load on the cable is 1 kip/horizontal. ft. Find (a) the slope of the cable at 400 ft. from the left support, (b) maximum tension in the cable, and (c) the length of the loaded cable. **(21)**

14. Draw shear force and bending moment diagrams for the stiffening girder of the suspensions bridge shown in Fig. 10. **(20)**

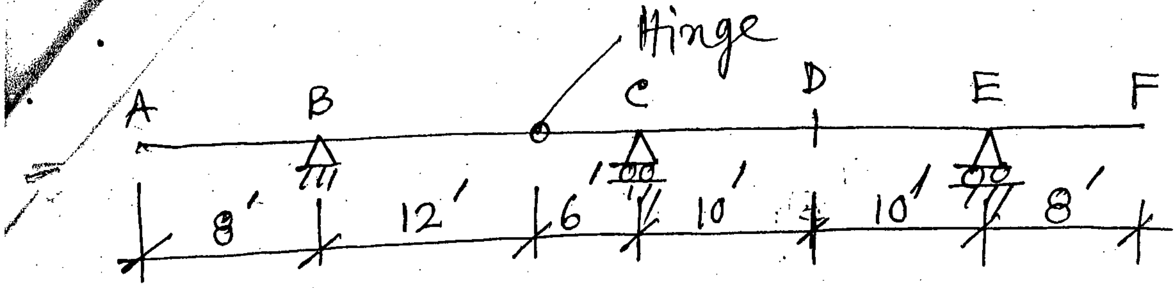

Fig. 1

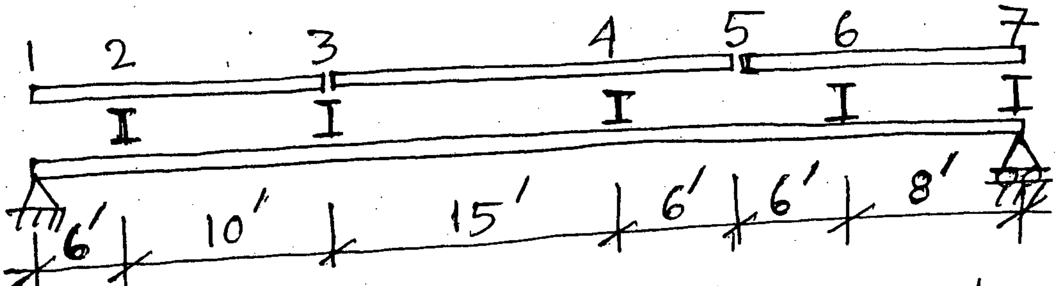

Fig. 2

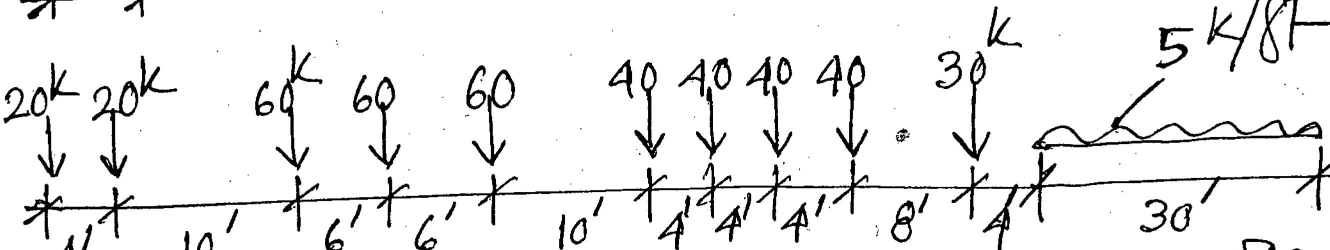

Fig. 3

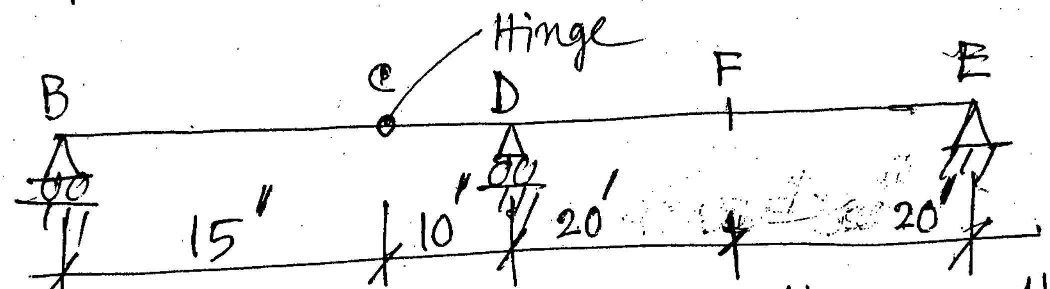

Fig. 4

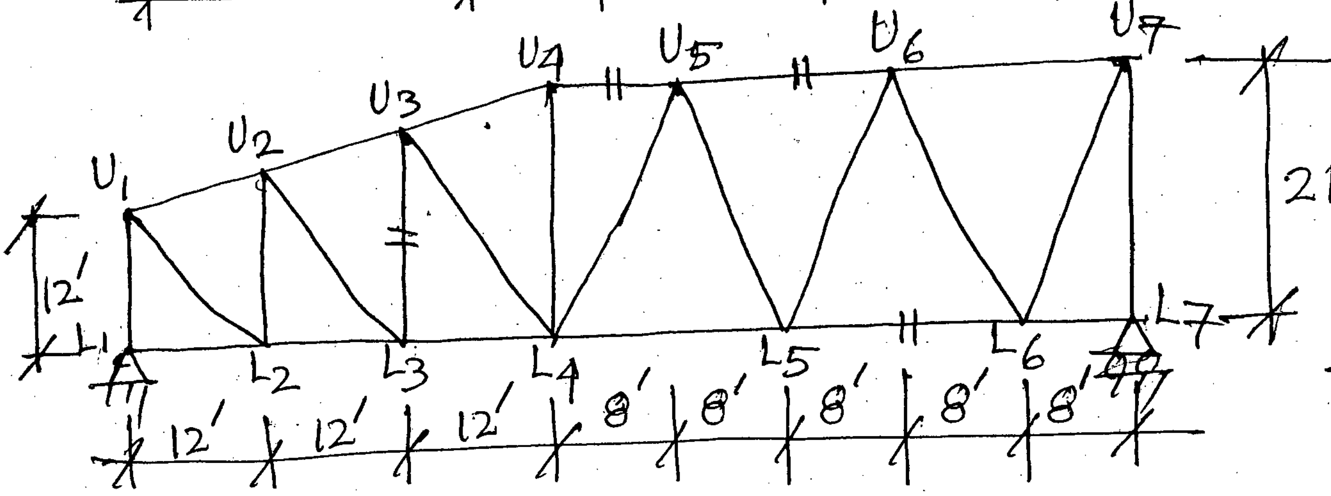

Fig. 5

A/7

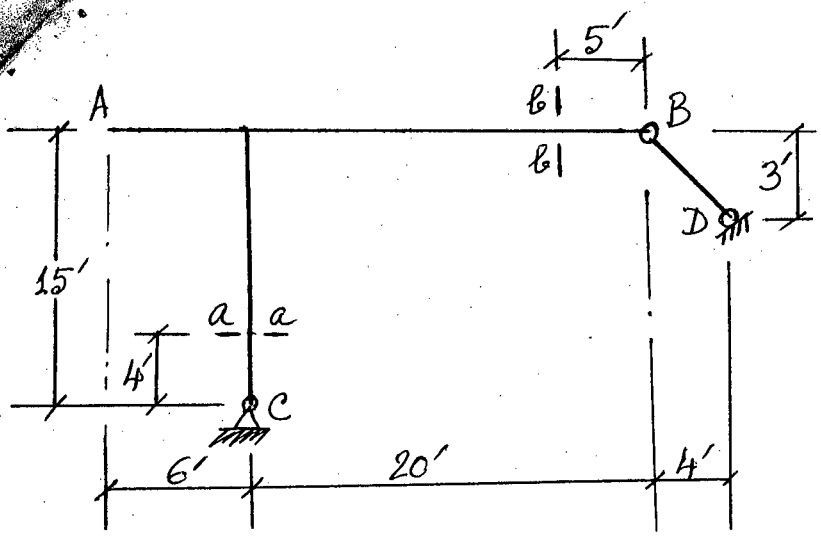

Fig. 6

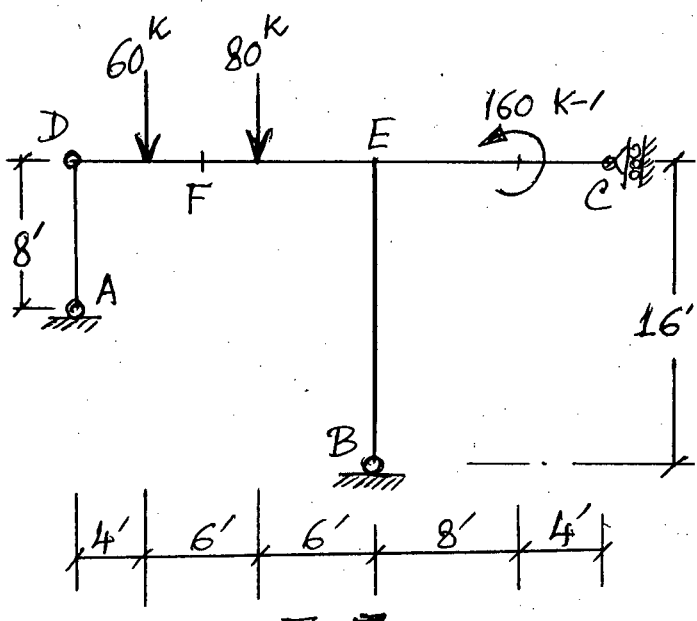

Fig. 7

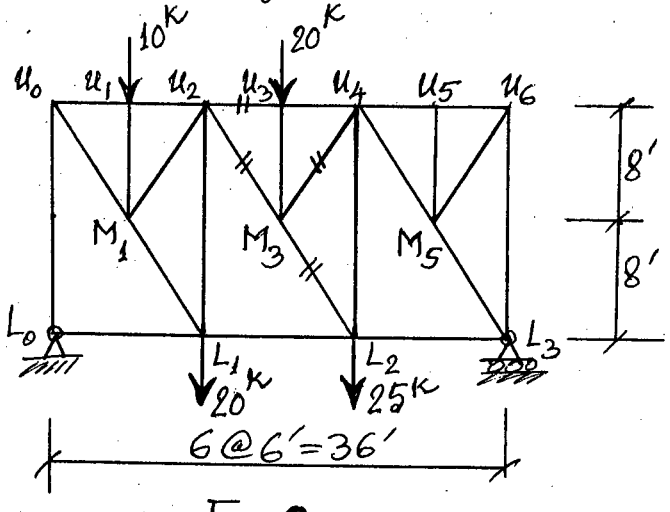

Fig. 8

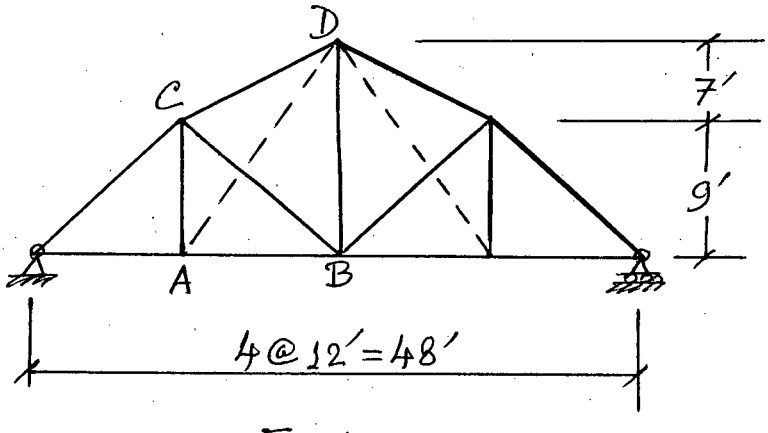

Fig. 9

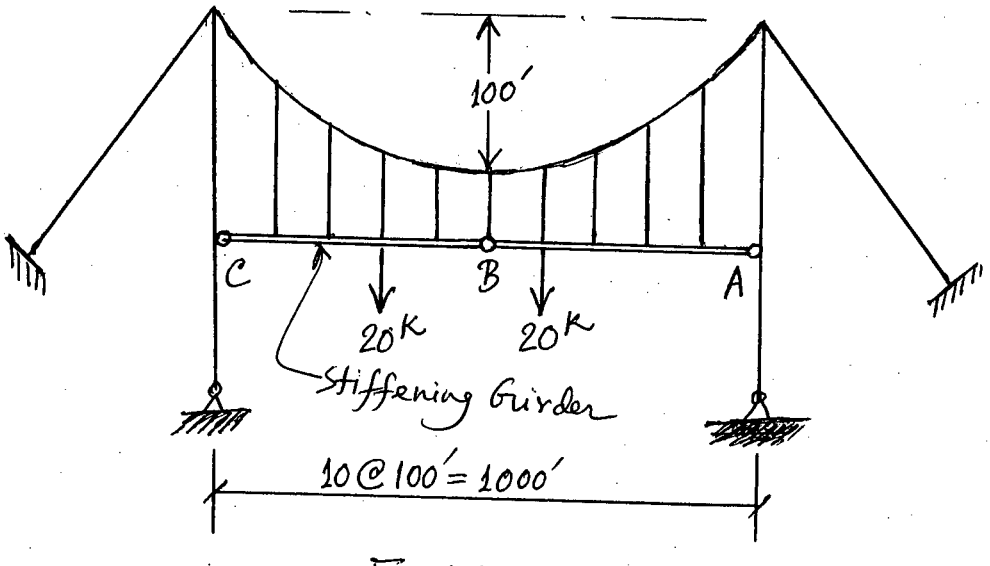

Fig. 10

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L-3/T-1/CE **Date : 29/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2010-2011

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) Discuss the behaviour of reinforced concrete rectangular beam in flexure under increasing load by drawing neat sketches for strain and stress distribution of uncracked, cracked and ultimate conditions. **(9)**

   (b) What is the difference between under-reinforced and over-reinforced beam? Which one is preferable and why? **(6)**

   (c) A singly reinforced RC beam section, as shown in Fig. 1, has a width of 12 in., effective depth of 25 in. and total depth of 28 in. The tension reinforcement consists of three No. 10 bars in one row,

   Given: $f'_c = 4$ ksi, $f_y = 60$ ksi, $f_s = 24$ ksi, $f_r = 7.5\sqrt{f'_c}$ psi, $n = 8$

   Find:

   (i) Cracking moment **(10)**

   (ii) Stresses in concrete and steel caused by a bending moment M = 100 kip-ft **(10)**

2. (a) What is the purpose of providing minimum amount of flexural steel in a beam? Write ACI code provisions for minimum reinforcement ratios. **(5)**

   (b) What is the justification of selecting strength reduction factor ϕ based on net tensile strain ε_t? Discuss the variation of ϕ with ε_t as given in ACI code. Also explain how ε_t controls maximum reinforcement ratio. **(10)**

   (c) A beam section is limited to a width b = 10 in. and total depth h = 21 in. and has to resist a factored moment M_u of 200 kip-ft. Calculate the required reinforcements. Given: $f'_c = 3$ ksi, and $f_y = 50$ ksi. **(20)**

3. (a) What are the sources of uncertainties in analysis, design and construction of RC structures? Discuss how safety is ensured against these uncertainties in USD method. **(9)**

   (b) A rectangular beam carries a service live load (unfactored) of 2.0 kip/ft and an unfactored superimposed dead load of 1.0 kip/ft (in addition to self weight of beam) on a 20 ft simple span as shown in Fig. 2. The beam will have a cross-section of 12″ × 24″ for architectural reasons. Given: $f'_c = 3$ ksi, $f_y = 60$ ksi. Design the beam for flexure using USD method. **(14)**

Contd P/2

CE 315 (CE)

Contd ... Q. No. 3

(c) A rectangular beam has width 14 in. and effective depth 28 in. as shown in Fig. 3. It is reinforced with six No. 10 bars in two rows (d = 28″, d_t = 29.5″). If f_y = 60,000 psi and f'_c = 5,000 psi, what is the nominal flexure strength M_n and what is the maximum moment ϕM_n that can be utilized in the design? **(12)**

4. (a) A floor system consists of a 3 in slab supported by continuous T-beams with 30 ft span, 50 in on centres as shown in Fig. 4. Web dimensions as determined by negative moment requirement at the support are, b_w = 12 in. and d = 24 in. 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? **(20)**

(b) A rectangular RC beam as shown in Fig. 5 measures 12 in wide and has an effective depth of 25 in. Tension steel consists of six No. 9 bars in two layers (d = 25 in, d_t = 26.5 in) and compression steel consisting of two No. 9 bars is located 2.5 in from the compression face. If f'_c = 3 ksi and f_y = 60 ksi, what is the design moment capacity of the beam according to ACI code. Check for yielding of compression steel. Use USD method of design. **(15)**

SECTION – B

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

5. (a) A simply supported rectangular beam with as span of 20 ft is limited by architectural considerations to a width of 12″ and a total depth of 18″ as shown in Fig. 6. The beam carries a service DL = 2.2 kip/ft (including self wt of beam) and LL = 1.8 kip/ft. Given f_s = 20 ksi; f'_c = 4 ksi and n = 8. What reinforcement is required for flexural design by WSD method? **(20)**

(b) A simply supported rectangular beam with a span of 18 ft supports a uniform live load of 1200 plf and a concentrated dead load of 3000 lb at the middle of the span in addition to its self-wt. With f'_c = 3000 psi and f_s = 20,000 psi, determine the required cross-section and steel area. **(15)**

6. (a) Design the stirrups for the beam shown in Fig. 7. Use f'_c = 3.5 ksi; f_y = 60 ksi. Calculate stirrups with 3 sets of spacing. Show the stirrups in a neat sketch. **(22)**

(b) Write down the ACI/BNBC code provisions for beam stirrups (hoops) for Dhaka-moderate seismic risk region. **(9)**

(c) Show with neat sketches location of critical section for shear design for different conditions of beam supports. **(9)**

Contd P/3

CE 315 (CE)

7. (a) Show with neat sketches cut off or bend points for bars in approximately equal spans with uniformly distributed loads. **(10)**

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

   (c) What is the minimum length of lap for column splices as per ACI/BNBC code? **(5)**

   (d) Calculate the development length by USD method for 16 mm and 25 mm bars when used as (i) top bars, (ii) for other bars. Given: f'_c = 3500 psi and f_y = 60,000 psi. **(10)**

8. (a) A reinforced concrete one-way slab is built integrally with its supports and consists of two equal spans, each with a clear span of 16 ft. The service live load on the slab is 120 psf. Design the slab by USD and show the reinforcements with neat sketches. Given: f'_c = 3000 psi and f_y = 60,000 psi. **(25)**

   (b) Why temperature and shrinkage reinforcements are required in one-way slab? What are the ACI/BNBC recommended ratios for such steel? **(10)**

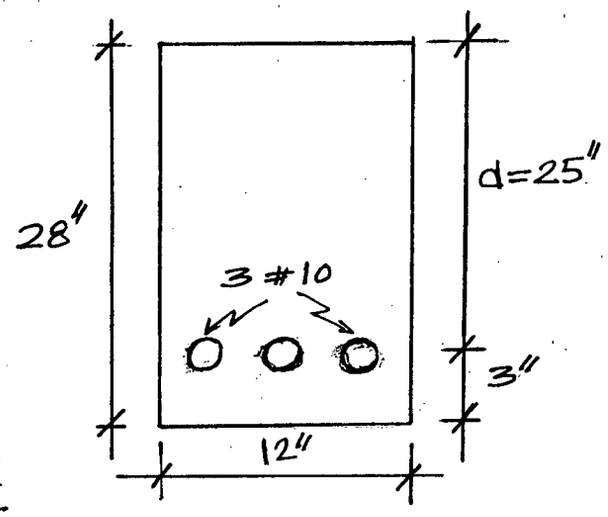


Fig. 1

Given:

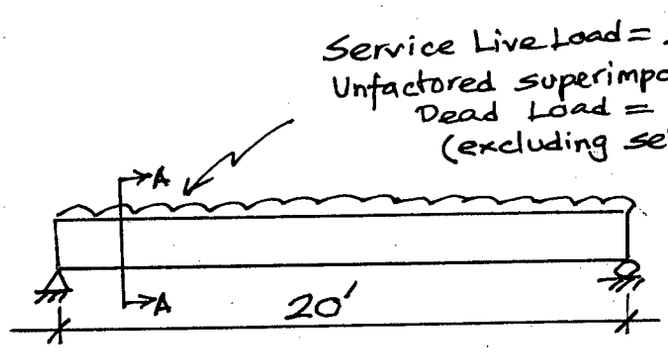
$f_c' = 4\ ksi$

$f_y = 60\ ksi$

$f_s = 24\ ksi$

$f_r = 7.5\sqrt{f_c'}\ psi$

$n = 8$

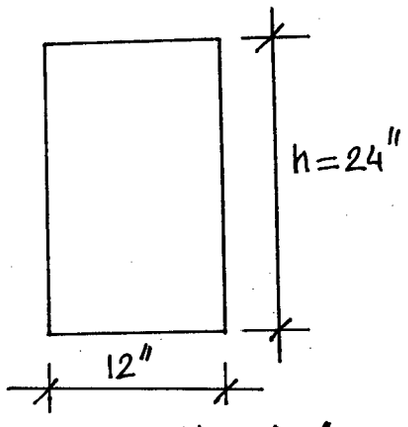


Given:

$f_c' = 3\ ksi$

$f_y = 60\ ksi$

Fig. 2



Section A-A

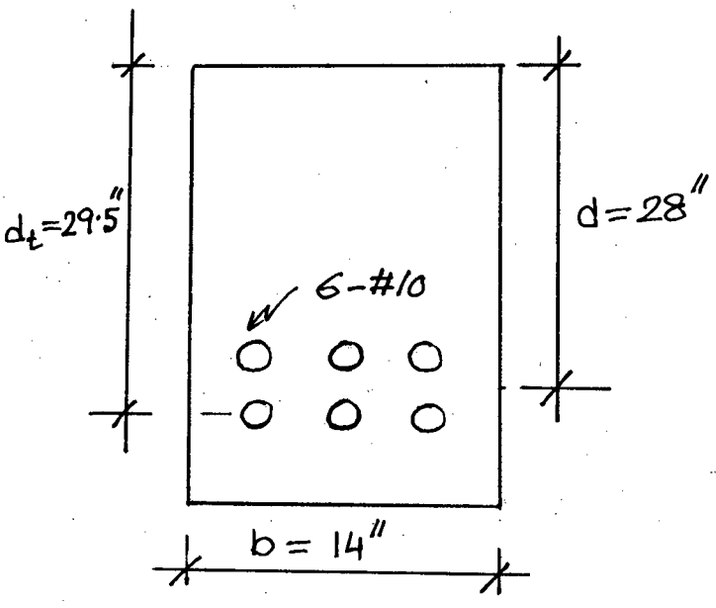
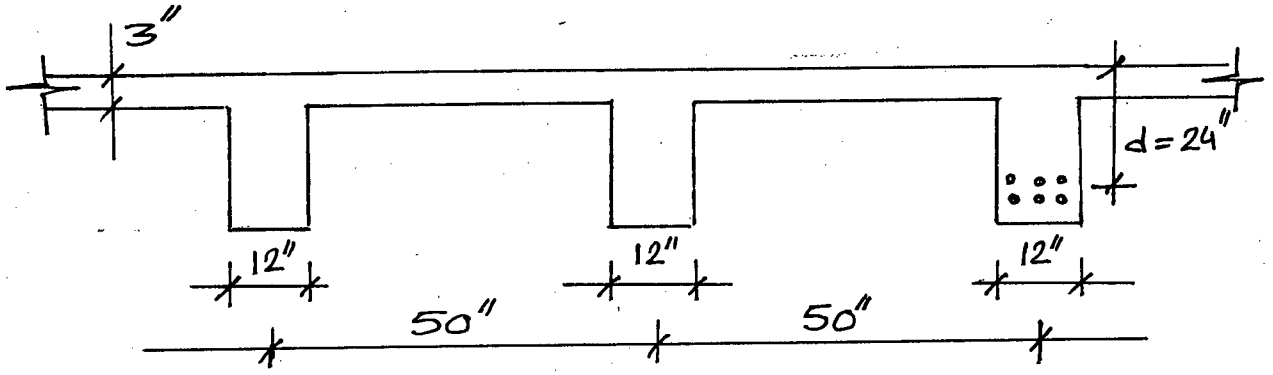


Fig. 3

Given:

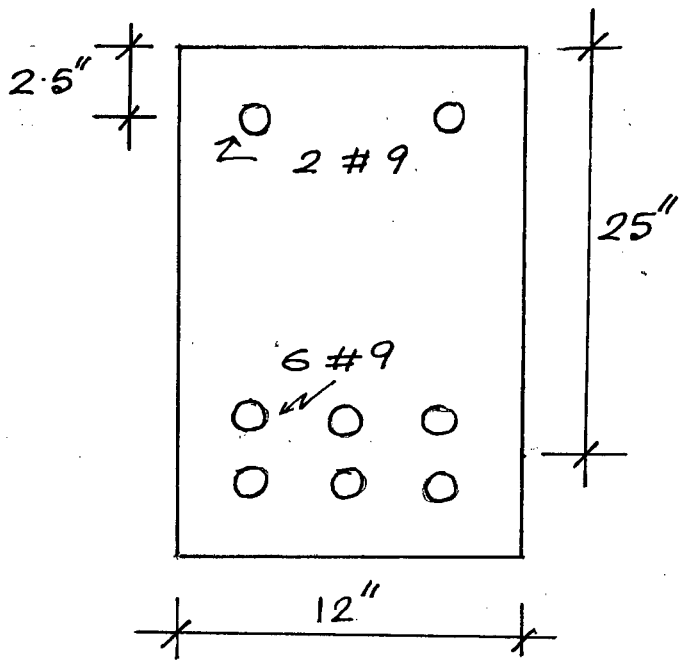
$f_c' = 5{,}000\ psi$

$f_y = 60{,}000\ psi$



Given: $f_c' = 3$ ksi, $f_y = 60$ ksi
Beam span = 30 ft
M_u = 700 kip-ft

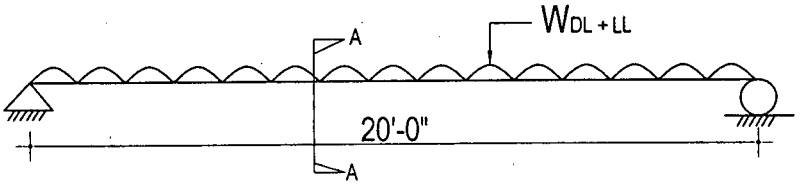
Fig. 4

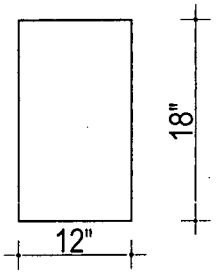


Given:
$f_c' = 3$ ksi
$f_y = 60$ ksi

Fig. 5

CE 315 for CE (Session-August 2011)

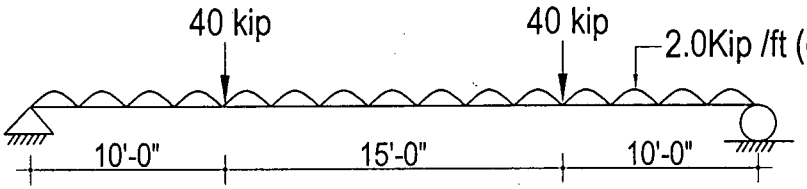




Given:

W_{DL}=2.2Kip /ft (including self-wt.)
W_{LL}=1.8Kip /ft
f'c = 4 ksi
fs = 20 ksi
n = 8

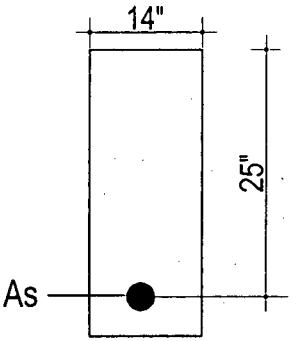
Fig- 6



ALL LOADS ARE FACTORED

Given:

f'c = 3.5 ksi
fy = 60 ksi



BEAM SECTION

Fig- 7

L-3/T-1/CE **Date : 22/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 331** (Environmental Engineering 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) Discuss briefly with flow diagram the essential elements of water supply system. **(15)**

   (b) State the methods of making a population estimate with qualitative population curves. Which one of the methods, do your think best and why? **(12)**

   (c) According to Kuichling, how many fire streams may be called into use at the same time in a city with a population of 164000? **(8)**

2. (a) State the factors to be considered in selecting the design period of a water supply system. **(10)**

   (b) Discuss briefly, how the following factors affect the percapita water consumption? **(12)**

   (i) size of the city, (ii) characteristics of people, (iii) water rates and metering and (iv) climatic condition.

   (c) Describe the various Layouts of distribution network in a water supply system and state their advantages and disadvantages. **(13)**

3. (a) "A continuous method of water supply is always better than the intermittent method." — Justify the statement. **(12)**

   (b) What are the options of ionization / dissociations of Arsenic compounds in water? What are the three alternative Methods of Arsenic removal from low iron content ground water through co-precipitation processes? Explain with flow diagrams. **(16)**

   (c)Show the variation of Carbonic Acid species (Natural acidity, Bicarbonate, Carbonate etc.) With pH value **(7)**

4. (a) Briefly mention the adverse physiological effects on human health of any three common ground water impurities in Bangladesh. **(6)**

   (b) Water are the advantages of "inclined parallel plates separator'' over single storied "plain setting tank"? Show with diagram. **(12)**

   (c) Explain briefly the three disinfection mechanisms (hypothesis) with diagram. **(10)**

   (d) What are the different methods of aeration of water and which method is comparatively most efficient in achieving the objectives of aeration? **(7)**

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CE 331

SECTION – B

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

5. (a) List down the names of the impurities responsible for turbidity, color, odor and taste in a water supply system **(8)**

   (b) What are the mechanisms for the removal of turbidity and microorganisms from water through granular media filtration process? Explain very briefly with diagram. **(12)**

   (c) How do pH value and alkalinity affect "Precipitation softening process"? **(8)**

   (d) What are the alternative methods of "Desalination" of water and what are their limitations? **(7)**

6. (a) Explain briefly the mechanisms of removal of Manganese through Catalytic Contact Oxidation and Sorption processes with equations. **(10)**

   (b) What are the sanitary significances of presence of "Indicator Organisms" in a domestic water supply system? **(6)**

   (c) What are the main problems of groundwater development in Bangladesh? **(7)**

   (d) Explain with diagrams the mechanism of saltwater intrusion in wells in coastal regions. What technological options can be adopted to prevent pumping saltwater? **(12)**

7. (a) What are the describe qualities of pressure pipes? Which type of pipes would you choose in a corrosive environment? **(7)**

   (b) What is the main operating principle of an air-lift pump? What are its main advantages and disadvantages? **(9)**

   (c) What are the difference between the working principles of a tara handpump tubewell and that of a No. 6 handpump tubewell? **(6)**

   (d) A fully penetrating well of diameter 0.4 m is abstracting water from a 2.5 m thick confined aquifer. The steady-state drawdowns at 8 m and 50 m distances were observed to be 2.5 m and 0.6 m, respectively. Compute the steady-state discharge from the well. The coefficient of permeability is 10^{-3} m/s. **(13)**

8. (a) Describe the sludger method of sinking tubewell. **(8)**

   (b) What is the mechanism of pipe corrosion by microbial action? **(7)**

   (c) Write short notes on **(20)**

   (i) Galvanic corrosion

   (ii) Pump curve and system curve

   (iii) Gravity springs

   (iv) Hydraulic conductivity of an aquifer

   (v) Well maintenance

L-3/T-1/CE **Date : 01/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B.Sc. Engineering Examinations 2010-2011

Sub : **CE 341** (Geotechnical Engineering-I)

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

1. (a) In a liquid limit test by one point method, a soil sample showed water content of 45% against number of blow of 28. The plastic limit of the soil was 18.2% and the natural moisture content was 40%. What was the state of consistency of the soil? What is the shrinkage limit of the soil, if the void ratio at the shrinkage limit is 0.40. Given that, Degree of saturation, $Sr = \frac{WG}{e}$. Assume G = 2.70. Also calculate the linear shrinkage of the soil. **(23 ⅓)**

   (b) Derive an expression for achieve earth pressure at a depth h in a $c - \phi$ soil. Also find the magnitude of active thrust coming to a retaining wall having height H, due to this backfill soil. Use Rankine's method. **(23 ⅓)**

2. (a) A consolidated undrained test was conducted on a saturated clay specimen. The cell pressure was 50 kPa and the failure σ_1 was 86.2 kPa. If the similar specimen, which is first, consolidated under 50 kPa cell pressure and then it is tested in an unconfined compression device, what will be the unconfined compression strength, q_a? **(23 ⅓)**

   (b) The following data were obtained from a laboratory test on a soil: **(23 ⅓)**

   Percentage of particles finer than 4.75 mm = 100

   Percentage of particles finer than 75 μm = 96.9

   Uniformly co-efficient = 1.40

   Co-efficient of curvature = 1.03

   Liquid limit = 20

   Plasticity index = 6

   Classify the soil as per both USCS and AASHTO.

3. (a) A vertical wall 10 m high retains two horizontal layers of saturated cohesive backfill with a level surface. The top 4 m of the backfill has an undrained cohesion of 18 kPa and a bulk unit weight of 18.6 kN/m^3. The bottom clay layer has a bulk unit weight and an undrained cohesion of 20 kN/m^3 and 24 kPa respectively. Estimate the likely depth of the tension zone behind the wall. Draw the pressure distribution diagram and calculate total active force if tension crack develops. Also, locate the point of application of the resultant lateral force. **(23 ⅓)**

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Contd ... Q. No. 3

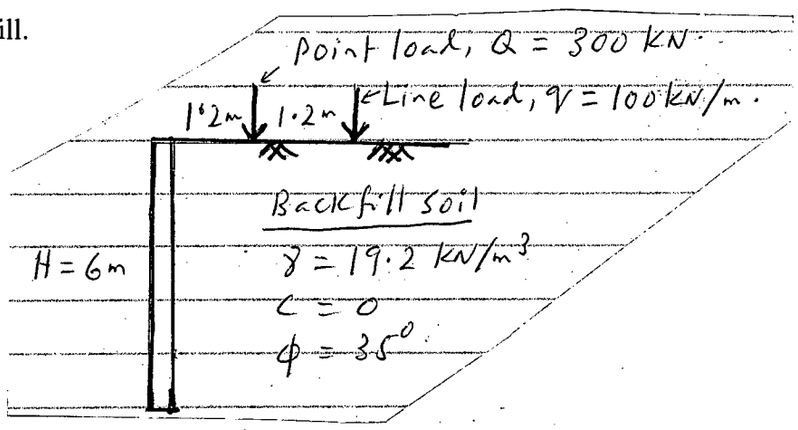
(b) A retaining wall of height 6 m retains backfill soil with a surface slope of 18°. The soil has the following Properties: **(23 ⅓)**

$c = 0$, $\phi = 33°$ $\gamma = 18$ kN/m^3 and OCR = 3. Draw the lateral pressure distribution diagram and calculate the magnitude of horizontal thrust coming to the wall for the following conditions.

(i) The wall is restricted from any movement.

(ii) The wall has yielded sufficiently to allow the backfill soil moving tendency in the outward and downward directions.

4. (a) The figure below shows surcharge loads (a point load and a line load) on the horizontal back fill. **(23 ⅓)**



Compute the Plot the induced lateral pressure distribution against the vertical wall due to the combination of the surcharge loads. Compute it along the nearest wall face of the point load.

(b) In a consolidated drained triaxial test, a specimen of saturated sand fails under an additional axial stress of 250 kN/m^2, when the cell pressure is 100 kN/m^2. Draw the Mohr's circle diagram for the stress conditions. Determine shear strength parameter and the theoretical inclination of the failure plane to the horizontal. What is the shear stress on the failure plane and the maximum shear stress that developed? What is the orientation of the plane of maximum shear stress? **(23 ⅓)**

SECTION – B

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

5. (a) What is a compaction curve? Give its salient features. What is a zero-air void line? **(16)**

(b) Distinguish between compaction and consolidation. What are the factors that affect compaction? Discuss in brief. **(10⅔)**

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Contd ... Q. No. 5

(c) There are two borrow areas 'A' and 'B' which have soils with void ratios of 0.80 and 0.70 respectively. The inplace water contents are 20% and 15% respectively. The fill at the end of construction will have a total volume of 10,000 m^3 with bulk density of 2 ton/m^3 at a moisture content of 22%. Determine the volume of the soil required to be excavated from both areas. Assume G_s = 2.65. If the cost of excavation of soil and transportation is Tk. 2000/- per 100 m^3 for area 'A' and Tk. 2200/- per 100 m^3 for area B, which of the borrow area is more economical? Also calculate the additional quantity of water to make 100 m^3 of fully saturated borrow soil at 'A'. **(20)**

6. (a) What are the different causes of preconsolidation in soils? What is the effect of preconsolodation on the settlement? **(10⅔)**

(b) What is the time factor? How it is related to the average degree of consolidation? Prove that $S^2 \alpha t$ for u <60%, where 'S' is the settlement achieved in time t and U is the average degree of consolidation. **(16)**

(c) A clay layer 4 m thick is subjected to a pressure of 55 kN/m^2. If the layers has a double drainage condition and undergoes 5% consolidation, determine the settlement in one year. Given, K = 0.020 m/yr. How much time it will take to reach 429 mm settlement? **(20)**

7. (a) "The results of permeability tests on cohesionless materials are often misleading" explain. **(8)**

(b) How do you determine the coefficient of permeability of clay? **(8)**

(c) What is effect of the seepage pressure on the effective stress? Give examples. **(10⅔)**

(d) Draw the flow net diagram for the problem shown in Fig. 1. Also calculate seepage loss in 6 months and factor of safety against heaving using Terzaghis criteria. Give K = 2.5×10^{-5} m/sec and γ_{sat} = 21.5 kN/m^3. **(20)**

8. (a) What do you understand by contact pressure? What are the factors that affect the contact pressure distribution? Draw the contact pressure distribution diagrams for flexible and rigid foilings. **(10⅔)**

(b) A rectangular area 2 m × 4 m carries a uniform pressure of 8 ton/m^2 at the ground surface. Find the vertical stress at 5 m below the centre and the corner of the loaded area. **(18)**

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(c) For a normally consolidated clay layer with organic content in the field the following data are given: **(18)**

- The Thickness of the clay layer = 8.5 ft.
- Initial void ratio = 0.80
- Compression index = 0.28
- Effective overburden pressure at the mid-depth of the clay layer = 2650 lb/ft^2
- Increase in effective pressure at mid-depth due to super imposed load = 970 lb/ft^2
- Secondary compression index = 0.02

What is the total settlement of the clay layer five years after the completion of the primary consolidation settlement? Given, time for completion of primary settlement = 1.5 years.

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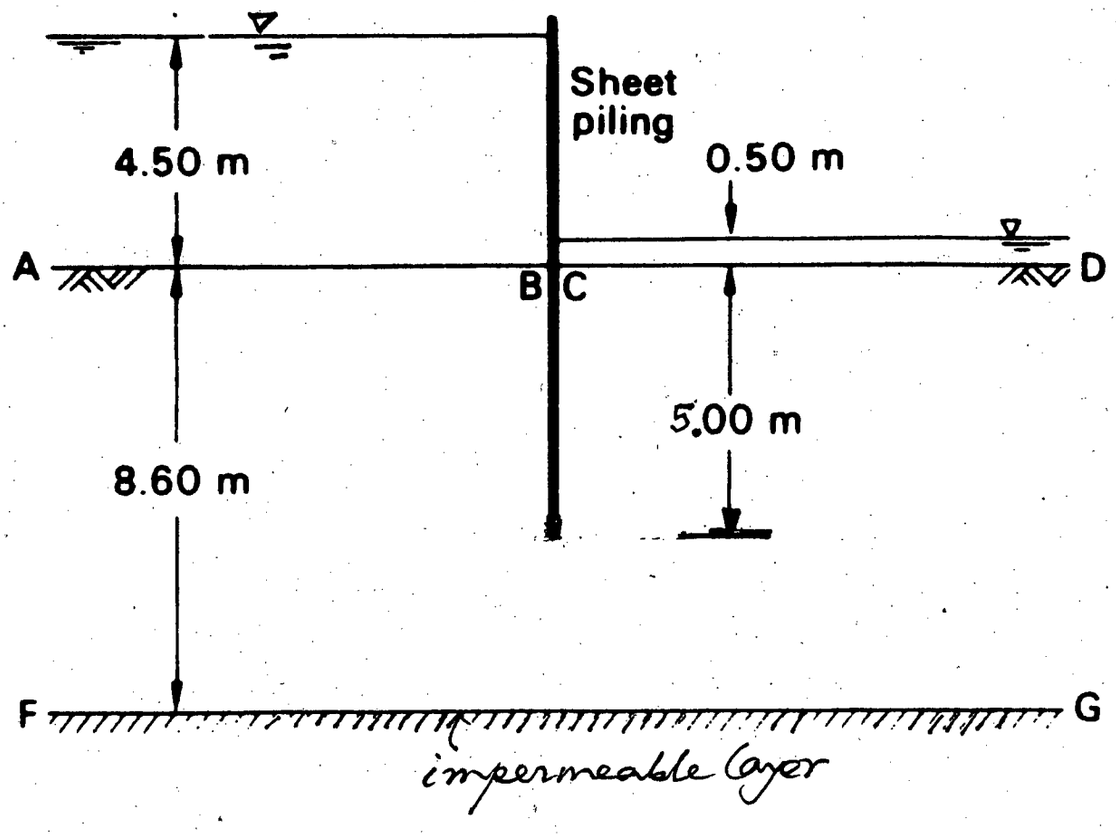

Fig 1

P.S You may draw flow net diagram on this page and attach this with the ~~main script~~ answer script.